City of Washougal

Water Use Efficiency Goals

November 2007

WALLIS ENGINEERING

WE #889P

City of Washougal
Water Use Efficiency Goals

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CITY OF WASHOUGAL

WATER USE EFFICIENCY GOALS

BACKGROUND

The Washington State Legislature passed the Municipal Water Law in 2003 to address the increasing demand on the state's water resources. This law requires all municipal water suppliers to enact measures to ensure the efficient use of this critical resource in exchange for water right certainty and flexibility to meet future demands.

The Legislature directed the Washington State Department of Health (DOH) to adopt a rule that establishes water use efficiency (WUE) requirements for all municipal suppliers. This rule includes the following key elements:

- *Water Use Efficiency Planning* – This element of the rule requires the collection of water production and consumption data, forecast of future water demands, evaluation of system leakage, evaluation of water rate structures and the implementation of water use efficiency measures. This plan is a required element of all Water System Plans prepared after January 2008.

- *Distribution Leakage Standard* – Municipal water suppliers are required to satisfy a distribution leakage standard equal to less than 10 percent of total production by July 2010.

- *Water Use Efficiency Goal-Setting and Performance Reporting* – Municipal water suppliers are required to set water use efficiency goals through a public process and report annually on their performance to customers and DOH. The deadline for establishing system goals is January 22, 2008. The first annual performance report will be completed by July 1, 2008.

The purpose of this document is to provide information necessary to satisfy the January 2008 WUE Goal-Setting deadline in accordance with *WAC 246-290-810* and the DOH *Water Use Efficiency Guidebook*. The development of WUE goals, including the evaluation and implementation of water use efficiency measures, is outlined in the following discussion. A complete Water Use Efficiency Program will be completed in conjunction with the next Water System Plan Update.

PROPOSED WATER USE EFFICIENCY GOAL AND ADOPTION PROCESS

The City of Washougal is adopting a Water Use Efficiency Goal to guide the City in achieving higher standards for the efficient use of water. Enacting this goal will result in improved system performance during peak water demand periods, and delay the cost of future infrastructure investment to serve new growth. The goal proposed by Public Works Staff for the consideration of the public and City Council follows:

Reduce residential peak day demand by 5% over a 6-year period.

The proposed Water Use Efficiency Goal will be achieved through the implementation of water use efficiency measures as presented in this document. A public forum for City leaders and staff to receive customer input will be held, following which the goal will be adopted by City Council.

CURRENT WATER CONSERVATION PROGRAM

The current water conservation program was developed in conjunction with the *Water System Plan Update* completed in 2004 (*2004 WSP*). The *2004 WSP* addressed conservation planning elements in accordance with the DOH *Conservation Planning Requirements* document which has been replaced by the July 2007 DOH *Water Use Efficiency Guidebook*. The City has implemented multiple measures to improve water use efficiency, including the following:

- Public Education. During the spring and summer months, water conservation signs are posted at the 17th & E Street and 32nd & Addy Street entrances to the City.

- Program Promotion. Water Department staff participate in public events with an outreach program complete with display boards and interactive promotions to deliver the water conservation message. Conservation reminders are also included in the annual Consumer Confidence Report.

- Technical Measures. The City completes distribution system leakage surveys on a 3-year schedule and annual commercial water meter calibration. Each leak detection survey covers approximately 50% of the distribution system. The most recent effort completed in 2003 and 2006 resulted in the repair of 23 leaks estimated to be responsible for nearly 77,000 gallons per day (gpd) of water loss.

- Customer Assistance. The City will assist residential, commercial and industrial customers as requested to provide conservation guidance and assist with leak detection.

The implementation of the current water conservation program has resulted in significant water savings, particularly through the identification and repair of distribution system leaks. Over the past six years, water savings are estimated at approximately 80,000 gpd. In conjunction with the *2004 WSP*, a system wide goal of reducing water demand by 2% through conservation was adopted.

WATER USE EFFICIENCY MEASURE EVALUATION AND IMPLEMENTATION

DOH requires the adoption of specific mandatory water use efficiency measures as evaluated below. Additional water use efficiency measures must be evaluated and a minimum number adopted based on the number of connections served. With a current active service connection total of approximately 4,560 combined residential, commercial and industrial water users, the City of Washougal is required to implement a minimum of 6 water use efficiency measures.

MANDATORY WATER USE EFFICIENCY MEASURES. DOH mandatory efficiency measures include the following. All measures include an action status. Noted cost estimates are preliminary, and will be finalized during the budget process with the scope of implementation adjusted accordingly.

Water Meters

Water systems must install meters for all production sources and customer services. All City of Washougal well sources and water system customers are currently metered.

Recent source metering improvements include the replacement of Well #5, #6, and #7 positive displacement meters with new magnetic flow meters in 2006. The new magnetic flow meters provide improved accuracy.

Individual customer service meters are currently inspected during each reading. In the event the meter appears damaged or unusual readings are recorded, the meter is scheduled for replacement. Nearly 85% of customer meters are less than 10 years old. In addition, all meters 3-inch and larger are flow tested on an annual basis to ensure accuracy.

The City of Washougal has two emergency interties with the City of Camas. These interties are not metered as allowed by DOH. The interties will operate only under emergency conditions.

WUE Measure Cost Estimate: N/A (System Currently Metered)
Estimated Water Savings: N/A (System Currently Metered)
WUE Measure Action Status: Currently Implemented

Customer Education

In addition to the current conservation program public outreach efforts previously discussed, the Water Department will begin coordinating with the Accounting Department the inclusion of water conservation education flyers with monthly bills. These flyers will be included on a seasonal basis to educate customers regarding indoor / outdoor water conservation, irrigation efficiency, etc.

WUE Measure Cost Estimate: $500
Estimated Water Savings: Seasonal – 2% Reduction In Peak Day Consumption
WUE Measure Action Status: To Be Implemented In 2008

ADDITIONAL WATER USE EFFICIENCY MEASURE EVALUATION AND IMPLEMENTATION. The following evaluation is provided for water use efficiency measures required (6 minimum) in addition to the mandatory measures described above. All measures include an action status. Noted cost estimates are preliminary, and will be finalized during the budget process with the scope of implementation adjusted accordingly.

Conservation Rate Structure

The City currently has a declining water rate structure for usage in excess of the allowance provided under the base monthly charge. A water and wastewater utility rate review is scheduled for early 2008. This evaluation will examine multiple rate options including rate schedules by customer class, adjustment of billing structure to reduce standard allowable usage, and implementation of a rising block excess use rate.

WUE Measure Cost Estimate: Cost Neutral. Additional revenue anticipated with the increasing block rate structure is conservatively expected to be negated by reduced consumption.
Estimated Water Savings: Seasonal – 2% Reduction In Peak Day Consumption
WUE Measure Action Status: To Be Implemented In 2008 Following Rate Evaluation

Reclaimed Water Opportunities

In conjunction with long-term wastewater planning efforts in 2004, an evaluation of wastewater treatment plant effluent reuse was completed as included in Appendix A. This evaluation examined the facilities necessary to produce reuse quality water, potential beneficial use sites within the City and associated costs.

WUE Measure Cost Estimate: $1.7M to supply Class A reuse water to industrial area (2004 $).
Estimated Water Savings: 500,000 gpd assuming industry demand would warrant investment.
WUE Measure Action Status: No Action - Not Cost Effective At This Time

Indoor Water Conservation Kits

New residential home and commercial building construction is required to satisfy the current Building Code that requires the installation of low flow water fixtures. A significant portion of existing residential development was constructed prior to the adoption of the existing Code water efficiency requirements. This measure would provide for the distribution of indoor water conservation kits during public events and by customer request. Kits include low flow showerheads, faucet aerators, water heater temperature gauge, faucet drip gauge and toilet leak tablets.

WUE Measure Cost Estimate: $5,000
Estimated Water Savings: 1,125,000 gallons per year (gpy)
WUE Measure Action Status: To Be Implemented In 2008

Outdoor Water Conservation Kits

The inefficient use of water during the summer months results in excessive consumption during peak demand periods. To promote the efficient use of water outdoors, the City will distribute outdoor water conservation kits during public events and by customer request. Kits include a spray nozzle, rain gauge, soil moisture gauge and hose repair kit.

WUE Measure Cost Estimate: $ 5,000
Estimated Water Savings: Seasonal - 2% Reduction In Peak Day Consumption
WUE Measure Action Status: To Be Implemented In 2008

Water Bill Showing Consumption History

The City Accounting Department is currently implementing new utility billing software that is scheduled for operation by January 2008. This software will provide customers with a history of past consumption on bimonthly billing statements. Providing historical consumption information encourages customers to conserve water and establishes benchmarks from which to track individual conservation efforts. Implementation of this measure will count as two implanted measures as it will be provided for both residential and industrial/commercial customers.

WUE Measure Cost Estimate: No Cost
Estimated Water Savings: 1% Reduction In Annual / Peak Day Consumption
WUE Measure Action Status: To Be Implemented In 2008 (Counts as 2 Measures)

Displays At Public Events

As previously discussed, Water Department staff currently participate in public events with a public outreach program complete with display boards and interactive promotions to deliver the water conservation message. In the last year, this program was presented during the "Taking City Hall To the Streets" and "Downtown Revitalization Project Dedication" events. Promotional materials provided to citizens at no cost included water bottles, indoor conservation kits and outdoor conservation kits.

WUE Measure Cost Estimate: $ 1,000
Estimated Water Savings: See Individual WUE Measure Discussion Above
WUE Measure Action Status: Currently Implemented

CUSTOMER EDUCATION

The City will expand the current customer education program. The following is a summary of measures currently adopted and proposed for implementation:

- Conservation Flyers: The inclusion of water conservation education flyers with monthly bills on a seasonal basis.

- Displays at Public Events: Display boards and interactive promotions to deliver the water conservation message.

- Water Bill Consumption History: Provide water consumption history on individual customer bills.

- Water Conservation Signs: In addition to the signs posted at 17th & E Street and 32nd & Addy Street, additional locations will be evaluated for the placement of conservation signs during the peak use summer months.

ESTIMATED WATER SAVINGS FROM WUE MEASURES

Implementation of the proposed WUE measures is anticipated to satisfy the water saving benchmarks outlined in the Water Use Efficiency Goal. Meeting the proposed goal of reducing residential peak day demand by 5% will result in water savings of approximately 165,000 gpd.

WATER USE EFFICIENCY PROGRAM EFFECTIVENESS EVALUATION

The WUE rule requires the completion of annual performance reporting to system customers and DOH. The City will use the preparation of the annual performance report as an opportunity to review the effectiveness of the WUE measures and determine if established goals require revision or if new goals and/or conservation measures need to be implemented. The annual effectiveness evaluation and DOH report will include the following elements:

- Calculation of distribution system leakage in terms of volume and percent of total production.
- Identification of WUE goals.
- Evaluation of established WUE goals, including estimating water savings achieved through implemented measures and progress towards satisfying goals.

The City will distribute the performance report to customers in conjunction with the annual Consumer Confidence Report by July 1st. In addition, the report will be available at City Hall, Public Works office and the City's website.

DISTRIBUTION SYSTEM LEAKAGE EVALUATION

The distribution system leakage standard is a significant element of the WUE requirements. This standard requires that all water systems track authorized consumption – the volume of water authorized for use by the water system. All water that cannot be tracked under this definition is considered distribution system leakage. Distribution system leakage includes both apparent losses (water theft, meter inaccuracies, etc) and real losses (leaking water mains, reservoir overflow, etc). The WUE requirements mandate that water systems maintain distribution system leakage at 10% or less of total production based on a three year running average.

The primary method for tracking authorized consumption is through the installation of meters on all customer services. Additional authorized uses that may not be metered, but are estimated and recorded, include hydrant use for fire fighting and water distribution system flushing.

As previously discussed, all customer services and well production sources are metered. Well production meter readings are recorded daily. Customer service meters are read every other month. The two emergency interties with the City of Camas are not currently metered, but are only activated in an emergency situation. City water production and consumption data collection is completed in accordance with WUE guidelines.

A review of historical consumption and production meter data indicates distribution system leakage in the range of 15-20%. Exact figures are not available, however, due to uncertainties with data accuracy. Proposed activities to improve water use accounting include billing software updates as discussed earlier, and improved documentation of unmetered uses such as distribution system flushing, hydrant testing, construction use and fire fighting.

The City will have until 2010 to satisfy the 10% leakage requirement. If this standard is not satisfied, a Water Loss Action Plan will be required. The initial requirement under the Water Loss Action Plan for systems with leakage between 10-20% is an assessment of data accuracy, collection methods and errors. The City will work to satisfy these requirements prior to the 2010 implementation date.

WATER SUPPLY CHARACTERISTICS

The City of Washougal produces drinking water from five existing wells with a maximum firm capacity currently adequate to meet existing demands. All of the City's wells produce water from a shallow aquifer referred to as the Pleistocene Alluvial Aquifer, with groundwater flowing generally in a southwesterly direction within this aquifer. Wells # 5, 6, 7 and 11 are located in the City's Westside Wellfield, while Well # 1 is located in the City's Hathaway Park Wellfield.

The Pleistocene Alluvial Aquifer is a shallow water table aquifer that occurs within the Pleistocene alluvial deposits. The deposits are approximately 100 feet thick in the vicinity of the City's Westside Wellfield. The aquifer is very permeable and serves as a source of supply to most of the industrial wells owned by Georgia Pacific as well as many of the municipal wells

owned by the City of Camas. Depth to the water table ranges from 38-46 feet at the Westside Wellfield and 55 to 81 feet at the Hathaway Park Wellfield. Well capacities typically exceed 1,000 gpm and well specific capacities typically range between 250 and 500 gallons per minute per foot.

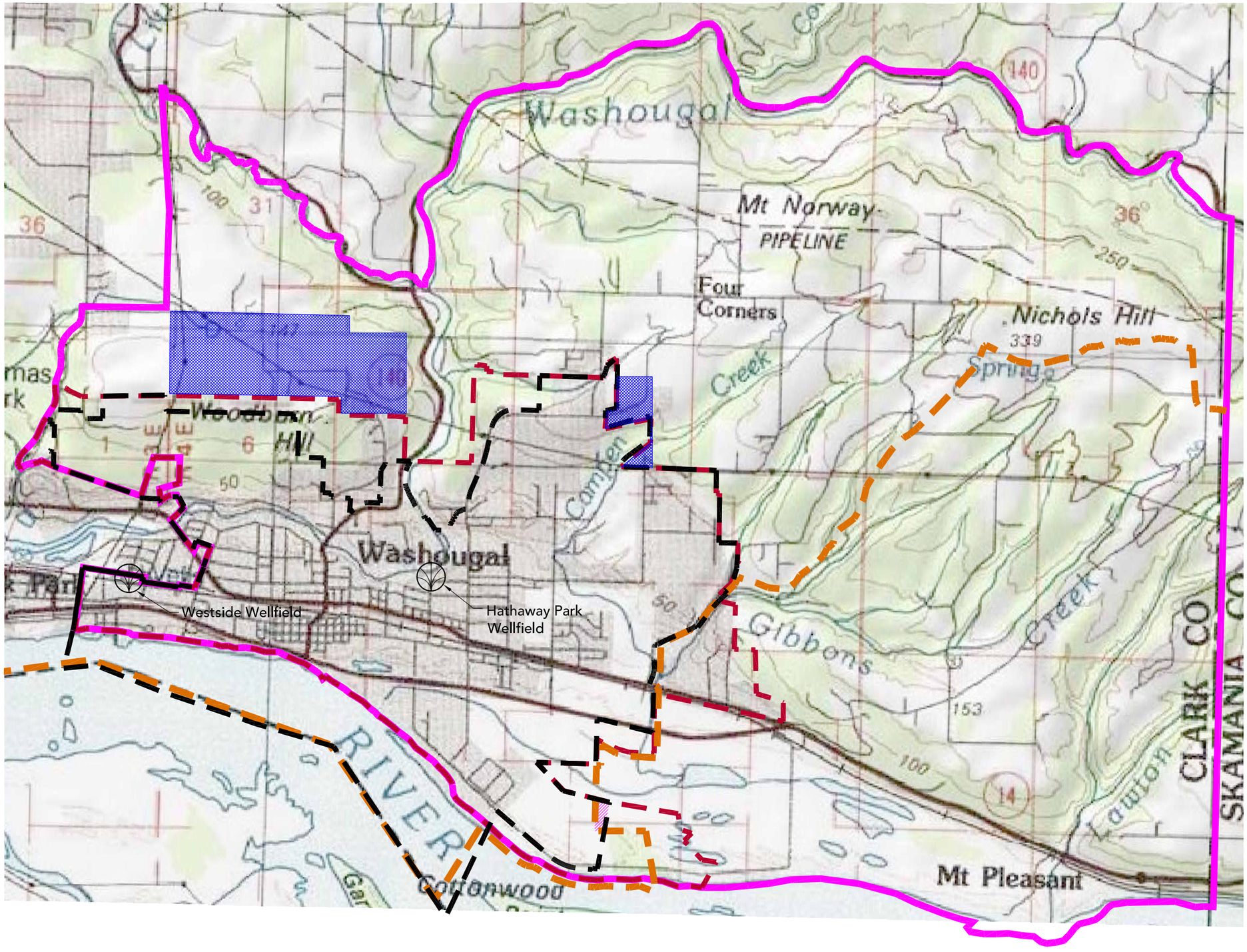
Washougal well capacities are summarized in Table 1 below. See also Figure 1 for the locations of the Westside and Hathaway Park Wellfields.

Table 1
WELL CAPACITY SUMMARY

Well Number	Single Operation	Combined Operation	Installed HP
1	925 GPM		75
5	635 GPM		50
6	630 GPM		50
7	635 GPM		75
11	960 GPM		75
5 & 6		1,150 GPM	
5 & 7		1,325 GPM	
6 & 7		1,350 GPM	
5, 6, & 7		1,775 GPM	
5, 6, 7, & 11		2,380 GPM (estimated)	
1, 5, 6, & 7		2,820 GPM (estimated)	

All City water rights are for municipal supply purposes. All wells have a place of use corresponding with the Washougal Water Service Area as outlined in Figure 1. There are no known time of use limitations with any of the certificates or claims. There is a limiting condition associated with one certificate that states "The total annual water allocation for the City of Washougal shall be limited to 3,786 acre-feet per year for municipal use from all rights." There are no known legal constraints which could limit the City's ability to utilize the full water right. A copy of the water rights self-assessment as completed in conjunction with the *2004 WSP* ("Table 4-2 Existing Water Rights(s) Status") is included as Figure 2. Based on water demands developed in the *2004 WSP*, this allocation is adequate to satisfy 20-year demand projections.

Chemical tests performed on water samples from both wellfields reveal good water quality in terms of specific chemical and physical constituents. Critical elements are less than the maximum contamination levels mandated by federal and state regulations. However, the naturally low water pH results in the corrosion of copper pipes (service lines and customer piping) such that excessive levels of copper were recorded in past water sampling. A chemical treatment facility located at the Westside Wellfield provides for the addition of sodium hydroxide to increase pH, which has resulted in copper levels consistently below federal standards.



NORTH

0 1500 3000

SCALE IN FEET

Legend

- City Limits (2007)
- Urban Growth Boundary (2003 Comp Plan)
- Water Service Area Boundary (Clark County WSP - 1997)
- Columbia River Gorge National Scenic Area Boundary (CRGNSA)
- Washougal Urban Reserve (2003 Comp Plan)
- Wellfield

Figure 1
City of Washougal Water Service Area & Wellfield Locations

Washougal Water Use Efficiency Goals
November 2007

P:\8\889\889P Water Eff Goals\Water Efficiency Goals Report\Figure 1 Wellhead Locations.dwg, Ledger, 11/27/2007 3:05:32 PM

Table 4-2 Existing Water Right(s) Status

Permit Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Existing Consumption		Current Water Right Satus (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Permits/ Certificates										
1. G2-25796	Washougal	February 3, 1981	Well Nos. 6 & 7	Primary	1,100 gpm	1,419.5 ac-ft/yr	1,343 gpm	866 ac-ft/yr	(243 gpm)	916.5 ac-ft/yr
2.										
3.										
4.										
Claims										
1. G2-000773	Washougal	1931	Well No. 1	Primary	1,100 gpm	1,777.75 ac-ft/yr	925 gpm	595 ac-ft/yr	175 gpm	1,182.75 ac-ft/yr
2. G2-000777	Washougal	September 1942	Well No. 5	Primary	1,200 gpm	1,936 ac-ft/yr	549 gpm	343 ac-ft/yr	651 gpm	1,593 ac-ft/yr
3. G2-000774	Washougal	1925	Well No. 11	Supplemental	850 gpm	1,371 ac-ft/yr			850 gpm	1,371 ac-ft/yr
4.										
5.										
TOTAL	**********	********	********	**********	4,250 gpm	6,504.25 ac-ft/yr	2,817 gpm	1,802 ac-ft/yr	1,433 gpm	5,063.25 ac-ft/yr

Intertie Name/Identifier	Name of Purveyor Providing Water	Existing Limits on Intertie Water Use		Existing Consumption Through Intertie		Current Intertie Supply Status (Excess/Deficiency)	
		Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1.							
2.							
3.							
TOTAL	**********						

Pending Water Right Application	Name on Permit	Date Submitted	Primary or Supplemental	Pending Water Rights	
				Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. G2-30192	Washougal	April 30, 2004	Primary	1,000 gpm	645 ac-ft/yr
2.					
3.					
4.					

Figure 2 – City of Washougal Water Rights Summary

City staff has observed under past recurrent drought conditions that the Hathaway Park Wellfield Well No. 1 cannot be operated on a 24-hour basis under certain circumstances. Dropping water tables in the aquifer during summer and early fall pose the problem of the pump running out of water. The pump must be operated on a manual basis with close observation of the well drawdown. The Westside Wellfield has not been as severely impacted with lowering water table. The record low water table for the Westside Wellfield was recorded in fall 1994. This problem is again attributed to the drought condition affecting an otherwise excellent aquifer with a history of high production with little pump drawdown effects.

The Wellhead Protection Plan prepared by Pacific Groundwater Group in June 2001 rated the aquifer as highly susceptible and highly vulnerable to potential contamination. The high susceptibility rating is based on the aquifer composition (permeable sand, gravel and cobbles) and lack of an extensive confining layer above the shallow water table. Vulnerability is also considered high because of known and potential contaminant sources identified within the wellfield capture zone. The Wellhead Protection Plan is the basis of City efforts to protect this valuable resource through the implementation of public education, contaminant source management, water quality monitoring and land use and regulatory controls.

The City is currently developing a new well in the Westside Wellfield – Well #12. In conjunction with the development of this new source, aquifer testing was completed by GSI Water Solutions, Inc. Tests included step-drawdown and constant-rate testing to evaluate the long-term pumping rate for Well #12. Additional wells were operated during the tests to reveal potential interference from the operation of multiple sources. Tests revealed minimal drawdown at the 1,500 gpm recommended Well #12 design capacity, which will satisfy projected 20-year demands. This new source is anticipated to be fully operational in Spring 2008.

WATER DEMAND FORECAST

Water demand forecasting identifies how much water the system will need to satisfy future demands. The primary factors examined in calculating future water supply requirements include historic water production/consumption, future population trends, and land use planning. The *2004 WSP* included a comprehensive analysis of these factors in developing a 20-year water demand forecast.

For the purpose of setting WUE goals, the *2004 WSP* water demand forecast will be utilized as presented in the following Table 2. A summary of the planning criteria follows:

- Water demand projections are based on equivalent residential units (ERUs). An ERU service unit is defined as the amount of water consumed by a typical full-time single-family residence. Multi-family, commercial and industrial customers typically have demand patterns that vary from that of a single-family residence. This system of capacity analysis allows all customers to be compared on the basis of an average single-family residence.

- Existing water consumption for all customer classes was examined to determine year 2003 equivalent ERU values. Future 6 and 20-year ERU totals were then calculated based on growth assumptions as presented in the City of Washougal *February 2003 Comprehensive Plan Update*. Total ERU projections are divided into respective pressure zones.

- Table 2 future water demand projections for Average Day Demand (ADD) and Maximum Day Demand (MDD) conditions are based on historical source production trends. An average daily demand of 280 gal/ERU and 525 gal/ERU maximum daily demand were utilized.

- A second annual demand total was included in the *2004 WSP* based on the successful implementation of conservation plan measures. The anticipated water use reduction to be realized from this program was estimated at 2%. For the purpose of this WUE document, this assumption remains unchanged.

Table 2
WATER DEMAND PROJECTIONS BY PRESSURE ZONE

Year	Pressure Zone	ERUs	ADD		MDD		Annual Production (MG)	
			mgd	gpm	mgd	gpm	Total Base Demand	With Conservation
2003	Zone 1	5,025	1.36	945	2.76	1,914	496.71	
	Zone 2	736	0.20	138	0.40	280	72.75	
	Zone 3	116	0.03	22	0.06	44	11.47	
	Zone 4	66	0.02	12	0.04	25	6.52	
Total		5,943	1.61	1,118	3.26	2,264	587.45	575
2011	Zone 1	5,630	1.58	1,095	2.96	2,053	575.39	
	Zone 2	909	0.25	177	0.48	331	92.90	
	Zone 3	902	0.25	175	0.47	329	92.18	
	Zone 4	365	0.10	71	0.19	133	37.30	
Total		7,806	2.19	1,518	4.10	2,846	797.77	782
2025	Zone 1	6,773	1.90	1,317	3.56	2,469	692.20	
	Zone 2	1,276	0.36	248	0.67	456	130.41	
	Zone 3	2,020	0.57	393	1.06	736	206.44	
	Zone 4	967	0.27	188	0.51	353	98.83	
Total		11,036	3.09	2,146	5.79	4,024	1,127.88	1,105

Appendix A

November 2004 WWTP Effluent Reuse Evaluation

WALLIS
ENGINEERING

TECHNICAL MEMORANDUM

DATE: November 19, 2004

TO: Mr. Doug McKenzie
City of Washougal

FROM: Brent Gruber, P.E.

RE: Washougal WWTP Effluent Reuse Evaluation
Job No. 1159A

Wastewater reuse has received significant attention over the last several years as communities struggle to satisfy the water needs of a growing population. This technical memorandum has been completed in conjunction with the current wastewater treatment plant long-term planning effort to provide a general overview of the regulations associated with water reclamation, the potential impact of these regulations on the City wastewater treatment facility operations, identify potential beneficial use applications within the City, and the facilities necessary to produce reclaimed water.

BACKGROUND

The Reclaimed Water Act, Chapter 90.46 of the Revised Code of Washington (RCW), was created in order to gain public acceptance and support for reclaimed water use. The Departments of Health and Ecology were directed by the legislature to jointly develop reclaimed water standards for the reuse of wastewater from municipal treatment plants. This act encouraged using reclaimed water for land application, industrial and commercial uses and treating wastewater as a potential for reuse. The basic premise for reclamation is that the water must be used for direct, beneficial purposes.

TYPICAL APPLICATIONS

The driving force behind reuse often falls into three categories:

Receiving Water Limitations

Tightening water quality regulations, including the implementation of Total Maximum Daily Loads (TMDLs) for many waterways, have resulted in reduced effluent pollutant loadings on receiving waters. These limitations are often seasonal. Reuse is often selected as the preferred alternative for reducing the effluent discharge volume during critical water quality periods to satisfy these requirements.

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telephone (360) 695-7041 fax (360) 694-1043

Community Driven "Green" Approach

Many communities are taking a pro-active approach in implementing environmentally friendly public works activities. Effluent reuse for the irrigation of park lands, golf courses or agricultural lands is often driven by this motivation.

Reduce Potable Water System Demands

The recently enacted Municipal Water Law, intended to reform the state's water laws, provides for coordination between the Departments of Health and Ecology on water planning issues. This legislation amended Chapter 90.46 to require public water systems serving 1000 or more connections to evaluate opportunities for reclaimed water when completing a water system plan. This effort is intended to identify potential uses for reclaimed water which could replace potable water in non-potable water applications. The ultimate goal is the conservation of existing potable water sources and extending the capacity of existing water supply sources and water rights.

REUSE CLASSIFICATIONS

The Department of Ecology has established four classifications for reclaimed water: Class A, B, C, and D. Reclaimed water suitable for reuse requires varying levels of treatment and disinfection beyond that provided by conventional wastewater treatment facilities as outlined in the following Table 1:

Table 1
Reclaimed Water Treatment Requirements

	Reclaimed Water Classification			
Treatment Criteria	**Class A**	**Class B**	**Class C**	**Class D**
Oxidized	X	X	X	X
Coagulation w/ Filtration	X			
Disinfection				
Average Total Coliform (per 100 mL)	2.2	2.2	23	240
Maximum Total Coliform (per 100 mL - Single Sample)	23	23	240	N/A

As outlined in Table 1, all reuse water must be oxidized. Oxidized wastewater is that in which organic matter has been stabilized, with a biochemical oxygen demand (BOD) less than 30 mg/L, total suspended solids (TSS) less than 30 mg/L, is nonputrescible, and contains dissolved oxygen. Class A reclaimed water must satisfy the most stringent treatment requirements which includes coagulation and filtration to a

turbidity level which does not exceed an average monthly operating turbidity of 2 NTU and maximum 5 NTU at any time. Classes B, C, and D differ in the allowable average and maximum total coliform counts.

The Washougal Wastewater Treatment Plant utilizes an activated sludge secondary treatment process to produce effluent with typical BOD and TSS levels of 5 mg/L and 7 mg/L respectively. These concentrations will likely increase with time as loadings increase. Ultraviolet disinfection results in average fecal coliform counts of 4 per 100 mL and maximum counts of 6 per 100 mL. While the NPDES discharge permit is based on fecal coliform counts, the reclaimed water standards measure disinfection performance based on total coliform. Though the treatment plant does not regularly test for total coliform, it is assumed the existing UV disinfection would satisfy Class C disinfection requirements at a minimum, and possibly Class A and B standards without additional treatment.

The reclaimed water classifications address a limited range of water quality parameters. Nitrogen compounds, for instance, are not specifically addressed in the classifications, though the quantity of nitrogen in reclaimed water is important when used for irrigation applications. Metals, organic and inorganic compounds, and dissolved gases are also constituents which require evaluation for potential effects depending on the particular beneficial use.

POTENTIAL USES FOR RECLAIMED WATER

Reclaimed water can be utilized for a variety of beneficial uses including irrigation, wetland enhancement, ground water recharge, and various commercial and industrial uses to name a few. The level of treatment is dependant on each specific application and is typically determined by the likelihood of human contact. Descriptions of reclaimed water uses and associated treatment requirements from the DOH Water Reclamation and Reuse Standards are included in Appendix A. The following is a brief summary of general wastewater reuse categories and applications:

Urban Reuse

Urban applications include the irrigation of public parks, golf courses, highway medians, and ornamental and residential landscape, as well as for fire protection and toilet and urinal flushing in commercial buildings. Class A reclaimed water is required for applications where the public has unrestricted access and the risk of exposure. In areas with restricted access limiting the possibility of exposure, reclaimed water must satisfy Class C standards.

Agricultural Reuse

Agricultural uses include the irrigation of crops, commercial nurseries, and pasture lands. Reclaimed water must satisfy Class D standards for the irrigation of trees, fiber and seed crops, and Class C for sod, commercial nursery stock and pasture for milking cows. Food crops may be irrigated with Class B reclaimed water, however, in cases of contact with the edible portion of the crop Class A requirements must be satisfied.

Environmental Reuse

The enhancement of natural wetlands, creation of artificial wetlands and stream flow augmentation are all applications for reuse. The water quality criteria for these applications is often regulated to a higher standard than that outlined in Table 1. In addition to lower concentration limits and total loading rates for BOD and TSS, limits on nitrogen, phosphorus, ammonia and metals are often applied.

Commercial and Industrial Reuse

Reclaimed water can be used for a wide variety of commercial and industrial applications including boiler feed, cooling and process water. The quality of water is dependant on use. For a closed system such as boiler feed, Class C or better is required. For cooling or process water where aerosols or worker exposure is possible, Class A water must be provided.

UNIT TREATMENT PROCESSES

The treatment processes discussed in this section are those required in addition to the existing secondary treatment facilities to satisfy the various reclaimed water class requirements. The existing process schematic is illustrated in the following Figure 1.

To ensure the reclaimed water product is safe, state regulations require the water be continuously and reliably treated. In order to comply with this requirement, redundant facilities are required in the treatment process. This is one of the primary differences between a wastewater treatment facility and a water reclamation facility. For every unit treatment process, a water reclamation facility requires a fully operational and functional backup component. The standards also require automated alarms, redundancy of treatment units, emergency storage, and stringent operator training and certification to meet the development criteria.

Coagulation and Filtration

Coagulation and filtration are required to satisfy Class A reclaimed water standards. Coagulation is the process of blending or mixing coagulating chemicals into a secondary waste stream to improve the removal of particulate and colloidal matter in a subsequent filtration step. Coagulants must be thoroughly mixed with the secondary effluent prior to filtration.

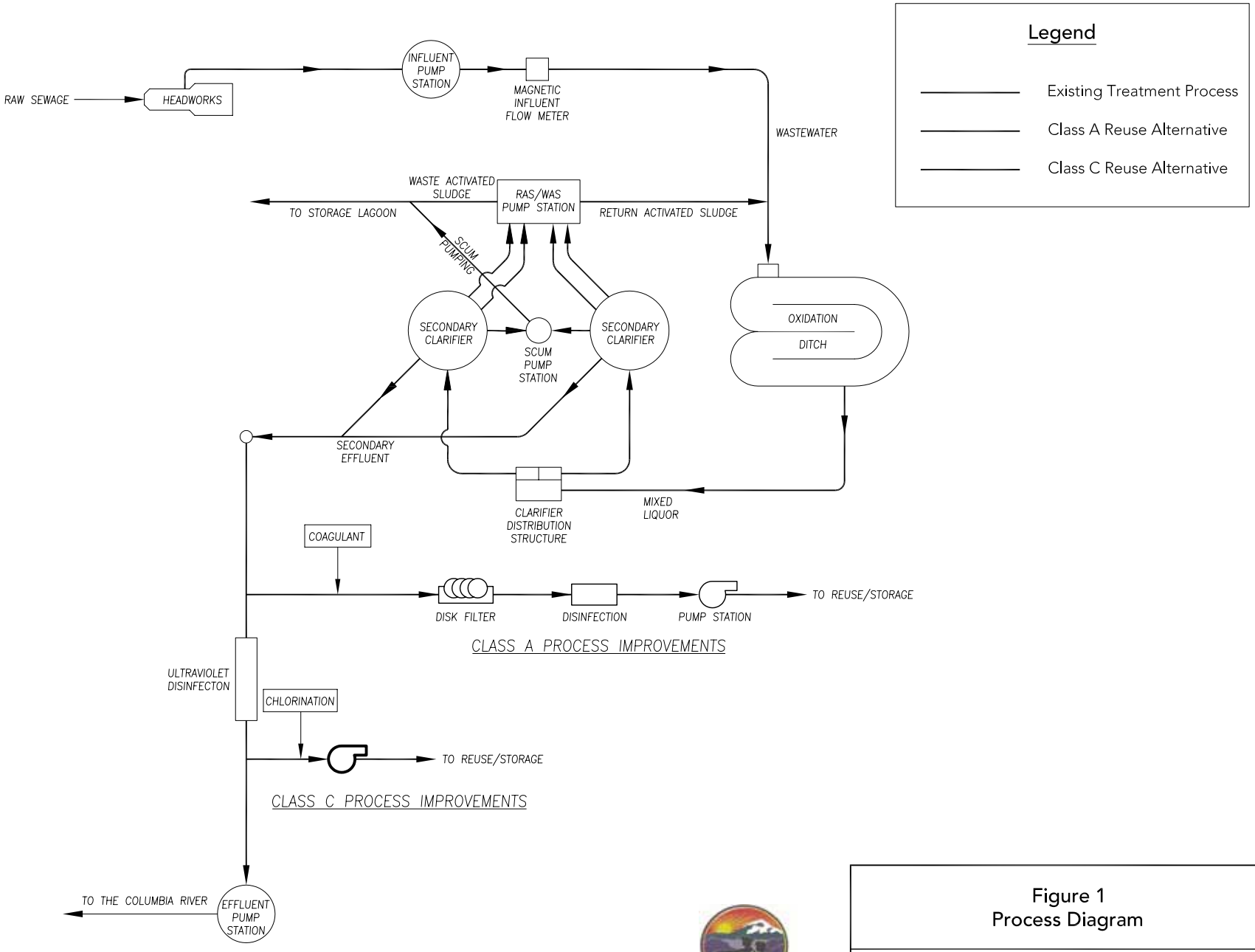

Figure 1
Process Diagram

City of Washougal
Effluent Reuse Evaluation

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Coagulated secondary effluent must be filtered to achieve a maximum average turbidity of 2 NTU. Many filtering techniques are available that are capable of providing this level of turbidity. Upflow sand media, continuous backflow upflow sand media and disk fabric filters are commonly used in Washington water reclamation facilities. From a capital and operating cost perspective, the disk fabric filter is very competitive and proven effective with limited required operator attention, and maintenance can be performed without significant downtime. This equipment is comprised of a rotating filter device consisting of a series of disks covered in a fine mesh fabric. Alum chemical facilities to achieve coagulation and a disk filter will provide the basis of estimating capital costs to produce a Class A effluent. These facilities are shown in Figure 1.

Disinfection

Disinfection is considered the most important step in the production of reclaimed water. The various classes of reclaimed water are largely differentiated by the respective levels of disinfection required as outlined in Table 1.

The City currently utilizes ultraviolet disinfection as previously discussed to achieve average fecal coliform counts of 4 per 100 mL. For the purpose of this evaluation, it is assumed that the existing UV treatment will achieve a Class C equivalent effluent. To satisfy Class A reuse requirements, filtration will take place prior to disinfection. Disinfection with UV or chlorine assuming adequate contact time are both options.

When chlorine is used as the disinfectant, a total chlorine residual of at least 1.0 mg/L after a contact time of at least 30 minutes is required. In addition, a minimum residual chlorine concentration of 0.5 mg/L must be maintained in the conveyance system to the reuse area. The maintenance of a chlorine residual is not required in reclaimed water storage ponds, and at the discretion of DOH, may not be required in the reclaimed water distribution from storage ponds.

Reclaimed Water Pump Station / Storage

A pump station to deliver reclaimed water to the point of use will be required. The need for storage will depend on the use to be served. Individual on-site storage in the form of a pond or area wide storage with a reservoir are two possible alternatives.

POSSIBLE WASHOUGAL WATER REUSE OPPORTUNITIES

The process of identifying potential beneficial uses for Washougal WWTP reclaimed water included the following:

Review of Water Billing Records

Water billing records were reviewed to identify existing large water users. This review identified several industrial customers who account for a significant portion of total City water production. Followup telephone conversations identified the uses for this water and minimum water quality requirements.

Review of Area Water Rights

Water rights for the Washougal area, as identified in the recent *Groundwater Supply Expansion* report, were reviewed to identify active non-City wells. This review identified the Orchards Hills Golf Course and several small industrial wells as possible candidates for the substitution of reclaimed water for existing groundwater withdrawals.

Review of Park, School and Open Space Lands

Maps were examined to identify potential sites for possible reclaimed water irrigation including parks, school fields and other open space parcels.

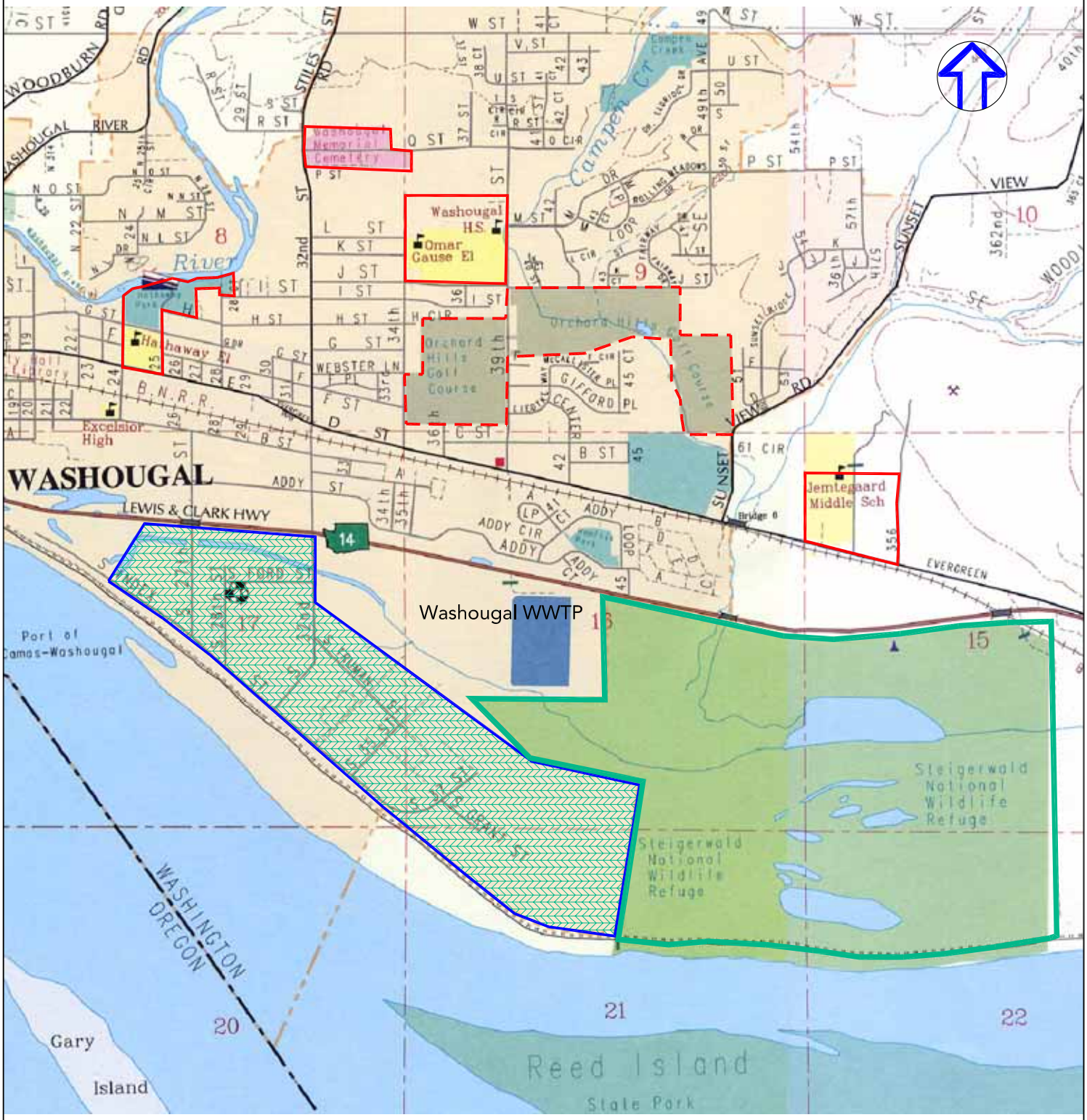
Based on the above analysis, three potential reclaimed water application centers were identified: the Port Industrial Area, Steigerwald Wildlife Refuge, and the Orchard Hills Golf Course/Schools as highlighted in Figure 2. These areas are discussed in further detail and considered as to their potential for future reclaimed water utilization.

Port Industrial Area

Currently, combined commercial and industrial water use in Washougal exceeds 42% of total water system consumption (*2004 Water Master Plan*). The largest industrial consumers of City water are Pendleton Woolen Mills (240,000 gpd), Kemira Chemical (20,000-200,000 gpd), and Saint-Gobain Crystals (40,000 gpd). Exterior Wood (20,000-30,000 gpd) is also a large consumer of private well water in the industrial park.

Two options are proposed for supplying reclaimed water to the industrial area. The first assumes the need for Class A water to meet existing industrial process requirements. Providing Class A water would provide the greatest flexibility to address the wide range of potential industrial uses and assure that aerosol and worker exposure risks are minimized. Transmission system improvements are based on delivering water to Pendleton Woolen Mills, a distance of almost 6,000 ft from the wastewater treatment plant. Based on an assumed 0.5 MGD demand, the following improvements and costs are estimated for Class A treatment improvements and distribution system to serve the Industrial Area:

Industrial Area Class A Reuse	
Coagulation and Disk Filter Improvements	$600,000
Disinfection Improvements	$150,000
100,000 gal Reservoir Storage and Pump Station	$250,000
6,000 lf Non-Potable Water Distribution System	$300,000
Ecology Permitting	$50,000
Engineering, Surveying, Contingency @ 25%	$325,000
TOTAL	$1,675,000



Legend

- Port Industrial Area
- Steigerwald Wildlife Refuge
- School/City Owned Properties
- Golf Course

Figure 2
Potential Reclaimed Water Users

City of Washougal
Effluent Reuse Evaluation

The second option would assume the siting of an industry requiring a large quantity of water for boiler feed or steam generation. Under this scenario, treatment to Class C standards is assumed. Past inquires regarding vacant Port properties for new industries have included requests for "impure" water at volumes approaching 0.8 MGD. Based on an assumed 0.5 MGD demand, the following improvements and costs are assumed:

Industrial Area Class C Reuse	
Chlorine Disinfection Improvements	$ 70,000
Pump Station	$150,000
6,000 lf Non-Potable Water Distribution System	$300,000
Ecology Permitting	$50,000
Engineering, Surveying, Contingency @ 25%	$130,000
TOTAL	$700,000

Steigerwald Wildlife Refuge

The approximately 1,000 acre Steigerwald Wildlife Refuge borders the Washougal Wastewater Treatment Plant site to the south and east. The refuge consists of historic riverine flood plain habitat, semi-permanent wetlands, cottonwood riparian corridors, and pastures. Discussions with refuge staff centered on two possible uses for reclaimed water. The first application would provide periodic flooding necessary for extending the zone of willows. The second use would be a constructed wetland. The first option would require only seasonal water usage, while the second may provide for a continuous water use.

It should be stressed that both of these options were discussed on a very conceptual basis and doubts were expressed concerning the feasibility of either. The regulatory barriers to such a project, as well challenges in obtaining state and federal funding, eliminate this option from further consideration at this time.

Orchard Hills Golf Course / School Irrigation

In determining possible reclaimed water irrigation options within the City of Washougal, current irrigation use was examined. Irrigated land areas within the City of Washougal utilizing public water and private wells are identified below:

Schools	Municipal	Private
Hathaway Elementary	Washougal Memorial Cemetery	Orchard Hills Golf Course
Washougal High School	Elizabeth Park	
Omar Gause Elementary	Hathway Park	
Jemtegaard Middle School	Campen Creek	
	Hamilik Park	

Figure 2 illustrates the location of the above sites. After examining the proximity of these sites to the Wastewater Treatment Plant, it was concluded that the Orchard Hills Golf Course, Washougal High School, Omar Gause Elementary, and Washougal Memorial Cemetery present the greatest potential for

reclaimed water irrigation. These sites lie approximately a half mile north of the Washougal WWTP and are clustered in relatively close proximity to one another.

Washougal High School and Omar Gause Elementary School irrigation is currently served by the Washougal water system. A review of monthly water billings estimates that irrigation water usage is approximately 6,500 gpd between the two schools.

The Orchard Hills Golf Course currently utilizes Camp Creek and two wells for irrigation water. These sources are combined together in an on-site irrigation pond. Golf course irrigation is seasonal, with summer (late May through September) irrigation rates up to 250,000 gpd.

The Washougal Memorial Cemetery is located northeast of the schools and golf course. Summer irrigation can reach up to 13,000 gpd in the summer.

Class A reclaimed water would be required for irrigation purposes in these areas due to the potential for human exposure. Improvements will be divided into two phases. The first phase would include the treatment upgrades to produce a Class A effluent (assumed 0.5 MGD demand) and transmission system to deliver the water to the existing Orchards Hills Golf Course irrigation pond. Providing irrigation to the school properties and Cemetery would require an additional pump station, chlorination and transmission lines under Phase 2. This alternative assumes the golf course would allow the use of the existing irrigation pond to be utilized for City uses also.

Phase 1 - Golf Course Class A Reuse	
Coagulation and Disk Filter Improvements	$600,000
Disinfection Improvements	$150,000
Pump Station	$150,000
2,500 lf Non-Potable Water Transmission Main	$125,000
Ecology Permitting	$50,000
Engineering, Surveying, Contingency @ 25%	$250,000
TOTAL	$1,325,000
Phase 2 - School/Cemetery Irrigation Extension	
Pump Station	$150,000
Chlorine Disinfection Improvements	$ 70,000
2,500 lf Non-Potable Water Distribution System	$125,000
Engineering, Surveying, Contingency @ 25%	$85,000
TOTAL	$430,000

CONCLUSIONS

1) Additional investigation into the need for water reclamation to satisfy future wastewater treatment plant NPDES permit requirements is not warranted at this time. It is not anticipated that the City will face

effluent discharge restrictions on the Columbia River which would require the examination of water reclamation as an option to meet stringent pollutant loading limits.

2) The construction of new water reclamation facilities to produce a Class A reuse quality water to offset existing industrial potable water use and delay the development of new ground water sources is not cost effective at this time. The estimated cost to produce a Class A effluent of approximately 0.5 MGD is nearly $1.7 million dollars. Estimates to develop a new 1.0 MGD groundwater source is approximately $1.2 million dollars (*2004 Water Master Plan*).

3) The future siting of an industry with the need for a large quantity of Class C or D non-potable water would warrant additional consideration. Development of a Class C or D resource may be cost effective compared to the equivalent development of potable water sources.

4) The Orchard Hills Golf Course, schools and cemetery provide an excellent opportunity for effluent reuse which eliminates the need for the golf course well and the use of potable water for school and Cemetery irrigation. These irrigation demands, however, currently have a minimal impact on the potable water system and the seasonal nature of the demand would provide for only seasonal operation.

RECOMMENDATION

The preliminary evaluation of beneficial reuse opportunities in the City of Washougal does not support a more detailed evaluation at this time. While reuse opportunities may exist, the cost of permitting and construction of necessary treatment facilities are cost prohibitive. It is recommended that this issue be revisited during the completion of the next Sewer Capital Facility Plan update in conjunction with the 6-year comprehensive planning cycle.

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