SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

I. WATER RESOURCES

APPENDIX A
OFFICIAL YIELD ESTIMATE AND LONG-RANGE WATER DEMAND FORECAST

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May 2006
Official Yield Estimate and
Long-Range Water Demand Forecast

Inputs and Assumptions for the Firm Yield Estimate

Firm yield of the water supply system is estimated using a simulation model developed by Seattle Public Utilities called the Conjunctive Use Evaluation (CUE) model. Additional details of the model and inputs are documented in the final report titled *Firm Yield of Seattle's Existing and Alternative Water Supply Sources*, April 2006, prepared by Seattle Public Utilities.

Model Inputs and Assumptions

⇨ Firm yield is based on the **98% reliability standard**—one shortfall occurs in the 76 years of historic record.

⇨ **Historic weekly inflows** reconstructed for water year 1929 through 2004 are used.

⇨ **Total system demand** is shaped on a monthly demand pattern based on the average of actual deliveries from calendar year 1994 to 2000.

⇨ **Sources of supply are operated conjunctively as a single system.**

⇨ **Operational assumptions include:**

- Cedar River System:
  Meet Cedar River Habitat Conservation Plan instream flow commitments below Landsburg, assuming flashboards in place on Overflow Dike.
  Fixed rule curve of Chester Morse Lake 1550'/Masonry Pool 1546' for November-February; 1560' both for May-August.
  Minimum levels for Chester Morse Lake: 1532'; Masonry Pool: 1510'

- South Fork Tolt System:
  Meet instream flows from 1988 Tolt Settlement Agreement (with treatment project).
  Fixed rule curve 1754' for October-January; 1765' for March-August.
  Minimum level for South Fork Tolt Reservoir: 1710'
  Treatment/Transmission capacity: 120 MGD

- Seattle Well Fields:
  10 MGD withdrawn for 14 weeks as needed from July-December.
  5 MGD recharged for 14 weeks from January-March.

Results

Based on the above, **the system-wide firm yield is 171 million gallons per day**.

Inputs and Assumptions for the Water Demand Forecast Model

Seattle Public Utilities has developed a new water demand forecast model for the water system planning process now underway. Following a literature review of demand forecast models used by other utilities, SPU settled on a "Variable Flow Factor" approach. As with simpler fixed flow factor models, current water demand flow factors are calculated by sector (single and multi-family residential, non-residential) for Seattle and each individual wholesale customer. However, like an econometric model, the Variable Flow Factor model reflects the impacts of variables such as price, income, and conservation on water flow factors for each sector over time. This approach takes advantage of past econometric analysis to provide estimates of how some of the variables (price and income) affect demand. SPU's Conservation Potential Assessment (CPA) Model is then used to estimate the impacts of code and programmatic conservation on the flow factors over time. The structure of the model is summarized in the flow chart on the next page while the model inputs and assumptions are outlined, below.

Model Inputs and Assumptions

⇨ **Weather adjusted base year consumption:**

By sector
- single family residential
- multifamily residential
- manufacturing non-residential
- non-manufacturing non-residential

By service area
- Seattle-inside city limits
- Seattle-outside city limits
- Individual wholesale customers

Base Year
- Retail: 2004
- Wholesale: 2003

Sources: SPU billing data, Annual Purveyor Surveys, NOAA

⇨ **Demographics: Historical and projected single- and multi-family households and employment:** The model uses Puget Sound Regional Council (PSRC) 2004 TAZ-level forecasts of population, households and employment to 2030 apportioned to Seattle and individual wholesale service areas. (These are the most recent forecasts available though PSRC is expected to release a new forecast in 2006.) A straight line extrapolation of average annual growth between 2010 and 2030 is used to forecast beyond 2030.

In the first table below is displayed PSRC's forecast of population, households, and employment in King County. The tables that follow contain these forecasts as they have been apportioned into water service areas. Separate tables are provided for SPU's entire service area, the retail service area and the wholesale service area. The last two tables further split the wholesale service area between those wholesale customers with block contracts and those without.

PSRC Forecasts of Population, Households, and Employment

King County

	Population	Households: Single Family	Multifamily	Total	Employment
2000	1,737,034	453,437	257,479	710,916	1,188,577
2010	1,869,479	475,497	306,573	782,070	1,351,220
2020	2,039,480	503,483	365,957	869,440	1,516,898
2030	2,202,366	522,084	437,423	959,507	1,670,793
2000-2030					
Growth	465,332	68,647	179,944	248,591	482,216
% Change	27%	15%	70%	35%	41%
Annual %	0.8%	0.5%	1.8%	1.0%	1.1%

As Apportioned to SPU's Retail and Wholesale* Service Area

	Population	Household: Single Family	Multifamily	Total	Employment
2000	1,238,645	318,628	206,184	524,812	952,618
2010	1,323,892	326,829	247,924	574,752	1,075,996
2020	1,443,404	341,413	298,168	639,581	1,204,694
2030	1,565,848	350,809	359,322	710,131	1,321,282
2000-2030					
Growth	327,203	32,181	153,138	185,319	368,664
% Change	26%	10%	74%	35%	39%
Annual %	0.8%	0.3%	1.9%	1.0%	1.1%

As Apportioned to SPU's Retail Service Area

	Population	Household: Single Family	Multifamily	Total	Employment
2000	618,323	151,070	128,604	279,674	557,005
2010	655,391	151,746	152,082	303,828	624,648
2020	711,171	154,352	182,669	337,021	682,243
2030	780,336	157,758	221,071	378,829	730,053
2000-2030					
Growth	162,013	6,688	92,467	99,155	173,048
% Change	26%	4%	72%	35%	31%
Annual %	0.8%	0.1%	1.8%	1.0%	0.9%

As Apportioned to SPU's Wholesale* Service Area

	Population	Household Single Family	Multifamily	Total	Employment
2000	620,322	167,558	77,580	245,139	395,614
2010	668,501	175,083	95,841	270,924	451,349
2020	732,233	187,061	115,499	302,560	522,452
2030	785,512	193,051	138,252	331,303	591,229
2000-2030					
Growth	165,190	25,492	60,672	86,164	195,616
% Change	27%	15%	78%	35%	49%
Annual %	0.8%	0.5%	1.9%	1.0%	1.3%

As Apportioned to SPU's Wholesale Service Area WITH Block Contracts

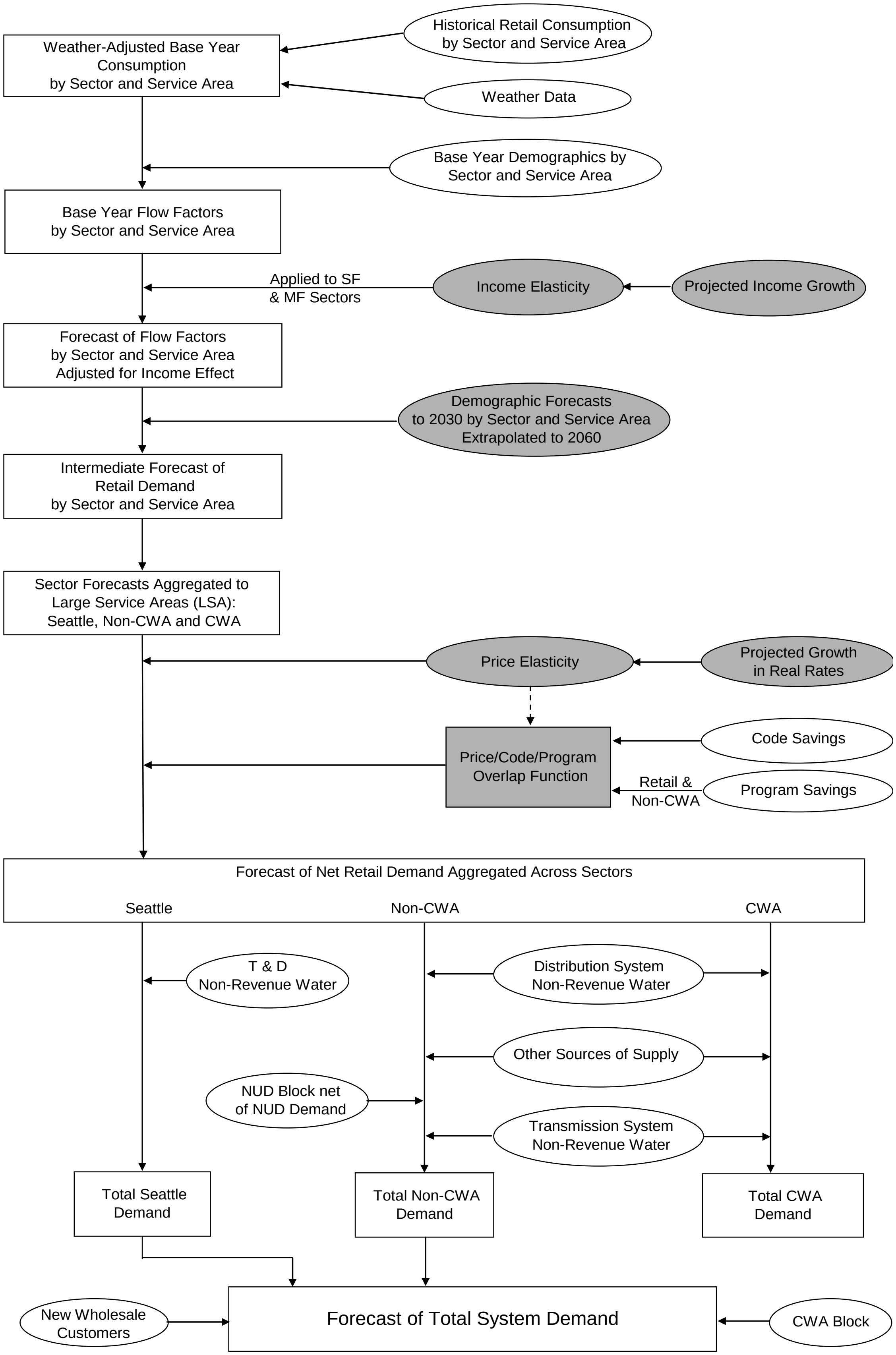
	Population	Household Single Family	Multifamily	Total	Employment
2000	270,823	71,372	41,073	112,444	272,184
2010	302,791	77,016	52,127	129,143	317,344
2020	333,075	81,504	64,079	145,583	368,456
2030	360,462	83,391	78,500	161,890	414,488
2000-2030					
Growth	89,639	12,019	37,427	49,446	142,304
% Change	33%	17%	91%	44%	52%
Annual %	1.0%	0.5%	2.2%	1.2%	1.4%

As Apportioned to SPU's Wholesale* Service Area WITHOUT Block Contracts

	Population	Household Single Family	Multifamily	Total	Employment
2000	349,498	96,187	36,507	132,694	123,429
2010	365,709	98,066	43,715	141,781	134,005
2020	399,158	105,557	51,420	156,977	153,995
2030	425,050	109,660	59,752	169,412	176,741
2000-2030					
Growth	75,551	13,473	23,245	36,718	53,312
% Change	22%	14%	64%	28%	43%
Annual %	0.7%	0.4%	1.7%	0.8%	1.2%

* Note that for demand forecasting purposes, the wholesale service area does not include Edmonds, Lake Forecast Park, or Renton.

WATER DEMAND FORECAST MODEL STRUCTURE



- **Base Year Flow Factors:** Base year flow factors are obtained by dividing the weather-adjusted base year consumption for each sector (e.g. single family residential) and service area (e.g. Bothell) by the corresponding number of households or employees in the base year.

- **Elasticity of residential demand to changes in real (inflation adjusted) household income:** Household income is generally expected to have a positive effect on water demand. A review of the literature revealed a range of estimated income elasticities. An elasticity value of **0.27**, representing the middle of this range, was chosen. (This means that a 10% increase in household income would be expected to cause a 2.7% rise in residential demand.)

  Source: Results of literature review

- **Forecast of annual growth in real mean household income:** A growth rate of **1.7%** was chosen based on national and local time series data on mean household income between 1960 and 2004.

  Sources: U.S. Bureau of Economic Analysis, Dick Conway & Associates.

- **Elasticity of demand to changes in real water prices:** A considerable body of literature has developed concerning the effect of price upon water demand and the inverse relationship predicted by economic theory is now well established. However, a number of complications summarized in the literature review (complex rate structures, conservation impacts, etc.) have made it difficult to estimate price elasticity with much confidence. As a result, there's a wide range of estimates in the literature but as with the income elasticity, values towards the middle of the range have been chosen for this model. These are shown below. (The value of -0.20 for single family households means that given a 10% increase in water prices, demand would be expected to decline by 2%.)

	Single Family	Multifamily	Non-Residential
Price Elasticity	**-0.20**	**-0.10**	**-0.225**

  Sources: Results of literature review, Seattle's 1992 econometric model.

- **Forecast of annual growth in real water prices**: Seattle and its wholesale customers have different water rates and different rate structures. Most customers face different marginal rates depending on whether they're residential or non-residential, what consumption block they fall in and what season it is. There is no single price of water. However, the model abstracts from all these complexities by using the system average price of water, i.e., total annual system revenue requirements (net of CWA's share) divided by annual retail and non-CWA billed consumption.

  The model assumes that the average system price increases by **1%** per year in real terms. This is less than the average historical rate of growth of about 2% since 1950 but is based on the assumption that revenue requirements double by 2060 adjusting for inflation. The growth rate for prices used in the demand model is slightly higher than that implied by the financial model through 2030. The financial model predicts that inflation-adjusted (real) rates will increase at about 1% annually through 2020 and then begin to decline so that by 2030, the average annual growth rate over the entire period is 0.3%. (This is the rate path for capital expenditures that includes "unanticipated needs" as described in Part II, Chapter

2.) The impact of this difference on demand is small and well within the uncertainties discussed below.

Sources: SPU revenue requirements forecast model and demand forecast model.

- **Conservation - Reductions in Water Use due to Code Savings:** Some conservation savings occur each year without SPU intervention due to federal and state plumbing codes that require that only low volume showerheads, toilets and aerators be sold or installed. As old fixtures are replaced with new ones in existing buildings and new fixtures are installed in new construction, water use efficiency improves and conservation savings accrue. The Conservation Potential Assessment (CPA) model was used to estimate these savings through 2030. These estimates are based on the assumption that showerheads, aerators and toilets are, on average, replaced every 15, 25 and 28 years, respectively. Code savings are expressed as percent reductions in the unadjusted[1] forecasts of consumption by sector and are shown in the table, below. Beyond 2030, cumulative code savings are assumed to continue growing but at a rapidly decreasing rate.

	Single Family	Multifamily	Non-Residential
2010	**-3.5%**	**-5.1%**	**-3.7%**
2020	**-7.4%**	**-10.9%**	**-7.1%**
2030	**-9.4%**	**-13.9%**	**-8.7%**

Source: Conservation Potential Assessment (CPA) model.

- **Conservation - Reductions in Water Use due to Programmatic Savings:** It is assumed that the remainder of the programmatic MGD targets is met by 2010. This along with the "Everyone Can Save" program and accelerated I-63 savings amounts to **6.8** mgd of programmatic savings from 2005 to 2010. Based on the January 2006 decision by the Seattle Regional Water System Operating Board, the forecast assumes **15** mgd of combined price-induced and programmatic conservation savings between 2011 and 2030, by reducing demand by 0.75 mgd each year in the 20-year period. These conservation savings are only applied to Seattle's retail and current non-CWA wholesale customers. There is assumed to be no additional programmatic conservation after 2030.

- **Price/Code/Programmatic Conservation Overlap:** Total conservation savings is adjusted downwards to account for the overlap between the different types of conservation. It is assumed that half of the price effect overlaps with code and programmatic savings as long as the total amount of overlap represents less than half of total code and programmatic conservation (as is the case over the forecast period). However, if the price effect exceeds combined code and programmatic conservation, the amount of overlap is capped at 50%.

- **Non-Revenue Water:** Combined transmission and Seattle distribution system non-revenue water is assumed to decrease from **12** mgd to **9** mgd between 2000 and 2015 as in-city reservoirs are covered. From that point on however, non-revenue water is projected to gradually increase, reaching **15.5** mgd by 2060. This increase is expected to be caused by the growing number of leaks that will probably occur as the distribution system ages. SPU's Waverider optimal pipe repair/replacement model was used to estimate pipeline leakage rates over the forecast period.

[1] i.e., prior to adjusting demand for the impacts of income growth, price increases, and programmatic conservation.

⇨ **Wholesale Customer Demands:**

- Wholesale customer distribution system non-revenue water is assumed to be a constant **6%** of retail water demand in the wholesale service area over the forecast period. This is added to the forecast of wholesale customers' retail demand.

  Source: Annual Surveys of Wholesale Customers, 1994-2004.

- Water that wholesale customers expect to obtain from other sources of supply is subtracted from their demand from the SPU system. This amount is currently about **5** mgd (which is split about evenly between CWA and Non-CWA customers) and is projected to reach **8** mgd by 2030.

  Sources: 2004 Survey of Wholesale Customers, direct communication with individual wholesale customers.

- Contract with the Cascade Water Alliance (CWA). Under the CWA contract, Seattle will provide a fixed block of **30.3** mgd to CWA through 2023. The block will be reduced by **5** mgd in 2024 and by another 5 mgd in 2030. Additional 5 mgd reductions will occur every 5 years thereafter through 2045, leaving a final block of **5.3** mgd. This has been incorporated into the forecast by subtracting the projected demand of CWA members that are currently Seattle wholesale customers, and adding the CWA block. The following cities and districts are members of CWA:

  - Bellevue
  - Covington
  - Kirkland
  - Issaquah
  - Redmond
  - Sammamish Plateau
  - Skyway
  - Tukwila

- Block contract with Northshore Utility District (NUD). Under a new contract with NUD, Seattle will reserve a fixed block of **8.6** mgd for NUD through the contract period which terminates in 2060. This has been incorporated into the forecast by subtracting NUD's projected demand and adding the NUD block. Note that current NUD demand is about 3 mgd less than its block. By 2060, actual NUD demand is expected to be approximately equal to its block.

- Forecasts of demand from potential new wholesale customers are based on data provided by them on their projected demand and existing supplies. Potential new wholesale customers included in the forecast are:

  - Ames Lake
  - North Bend
  - Sallal

  …with total demand ramping up to **1.4** mgd by 2040.

  Source: direct communication with Executive Director of East King County Regional Water Association (EKCRWA).

- It is assumed that Edmonds will continue to buy all its water from Alderwood.

⇨ **Environmental Block:** Unlike the 2004 official demand forecast, the set-aside for the Environmental Block is not included as a component of water demand in the current forecast because this requirement will be met through other mechanisms. The Environmental Block, as defined in the I-63 Settlement Ordinance, is water dedicated to environmental benefits for salmon that increases over time from 2 MGD in 2001 to as much as 12 MGD in 2015. That commitment is now intended to be met through the 2006 agreement with the Muckleshoot Indian Tribe, in which the City agrees to leave 20 MGD of its perfected water right in the Cedar River.

⇨ **Weather-Induced Demand Variability:** Because the base year flow factors are calculated from weather-adjusted consumption data, the forecast represents demand under average weather conditions. However, in any one year, actual demand may be higher or lower than forecast due to variation in summer weather. Analysis of daily consumption data back to 1982 shows a maximum variability of about plus or minus 5%. In other words, an extremely hot dry summer would be expected to increase annual consumption *in that year* by up to 5% above the average trend.

Results

Given the assumptions described above, the water demand forecast is considerably lower than the last official forecast and remains considerably below SPU's current firm yield of 171 mgd until well after 2060. Total demand is forecast to decline from **140** mgd in 2005 to **129** mgd in 2030. Additional reductions in the CWA block is expected to keep demand relatively flat over the following 15 years. Once the CWA block has been reduced to its minimum level in 2045, water demand is forecast to begin rising again, finally reaching current levels by about 2050 and **159** mgd by 2060.

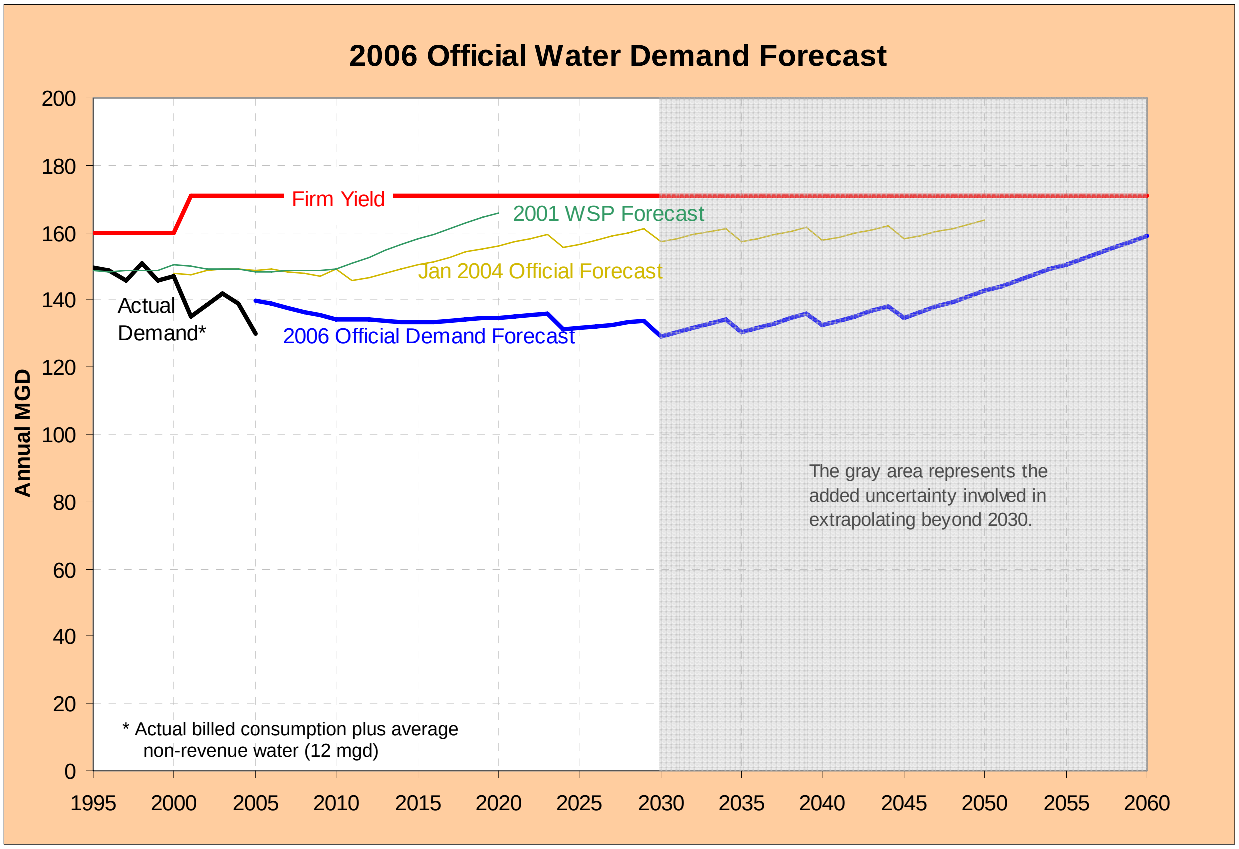
The first graph on the following page shows the forecast of demand and supply out to 2060. The gray area between 2030 and 2060 represents the additional uncertainty involved in forecasting out more than 25 years. The previous official forecast is also shown.

Although the methodology used in the current forecast is very different than that used in earlier versions, the primary reason the new forecast is so much lower than the previous official forecast has to do with changes in planned programmatic conservation. The old forecast assumed the 1% Conservation Program would keep demand flat from 2000 through 2010 and very little programmatic conservation would occur after 2010. The new forecast reflects a planned 6.8 mgd of additional 1% program savings from now through 2010 and another 15 mgd of programmatic and price-induced conservation between 2011 and 2030. The table below and the second graph on the next page show the components of actual and forecast water demand.

Components of Actual and Forecast Water Demand
All figures in millions of gallons per day (MGD)

	Year	Billed Demand								Non-Revenue Water	Total System Demand	
		Seattle Retail				Wholesale					Annual Average[4]	Peak Day[5]
		SF Res	MF Res	Non-Res	Subtotal	Non-CWA[1]	CWA[2]	New[3]	Subtotal			
A	2000	26.9	14.5	27.7	69.0	40.5	25.9	-	66.4	12.8	148.2	241.9
C	2001	24.0	13.6	24.6	62.2	36.8	24.1	-	60.9	11.5	134.6	204.0
T	2002	24.8	13.4	24.6	62.8	38.5	25.4	-	63.8	9.9	136.5	222.6
U	2003	24.9	12.8	24.6	62.3	41.4	26.9	-	68.3	9.3	139.9	250.2
A	2004	24.2	12.5	24.6	61.3	39.0	27.4	-	66.4	14.0	141.7	246.8
L	2005	22.6	12.1	23.4	58.1	35.4	25.5	-	60.9	7.7	126.7	210.4
	2005	23.4	12.2	23.5	59.1	39.5	30.3	0.0	69.8	11.0	139.9	229.2
	2006	23.0	12.3	23.2	58.5	39.2	30.3	0.0	69.5	10.8	138.7	227.3
	2007	22.7	12.3	22.9	57.9	38.8	30.3	0.0	69.1	10.6	137.6	225.5
	2008	22.3	12.3	22.6	57.3	38.0	30.3	0.5	68.8	10.4	136.5	223.7
	2009	22.0	12.4	22.3	56.7	37.7	30.3	0.5	68.6	10.2	135.4	221.9
F	2010	21.6	12.4	22.0	56.1	37.4	30.3	0.6	68.3	10.0	134.3	220.1
O	2011	21.5	12.6	22.0	56.1	37.4	30.3	0.6	68.3	9.8	134.2	219.9
R	2012	21.4	12.8	22.0	56.1	37.3	30.3	0.7	68.3	9.6	134.0	219.6
E	2015	21.0	13.2	21.8	56.0	37.1	30.3	0.8	68.2	9.0	133.2	218.2
C	2020	20.5	14.2	21.7	56.4	37.5	30.3	1.0	68.8	9.5	134.7	220.7
A	2025	20.1	15.3	21.7	57.1	38.2	25.3	1.1	64.6	10.0	131.7	215.8
S	2030	19.9	16.5	21.7	58.1	39.0	20.3	1.2	60.5	10.6	129.2	211.6
T	2035	20.4	18.3	22.5	61.2	41.3	15.3	1.3	57.8	11.3	130.3	213.6
	2040	21.1	20.4	23.4	64.9	43.8	10.3	1.4	55.4	12.0	132.3	216.8
	2045	21.8	22.6	24.4	68.8	46.5	5.3	1.4	53.1	12.8	134.7	220.8
	2050	22.5	25.0	25.4	72.9	49.3	5.3	1.4	56.0	13.7	142.5	233.6
	2055	23.3	27.5	26.3	77.1	52.3	5.3	1.4	58.9	14.6	150.6	246.7
	2060	24.1	30.0	27.3	81.4	55.3	5.3	1.4	61.9	15.5	158.8	260.2

1. The forecast of non-CWA demand includes the Northshore Utility District (NUD) block while the historical consumption data contains NUD's actual demand. NUD's block exceeded its actual demand by 3.4 mgd in 2005.
2. The forecast of Cascade Water Alliance (CWA) demand is equal to its block while the historical consumption data reflects water actual purchased from SPU by CWA members. The CWA block exceeded the actual consumption of CWA members by 4.8 mgd in 2005.
3. Potential new wholesale customers.
4. The forecast of Total System Demand includes the NUD and CWA blocks while the historical consumption data reflects SPU water actually purchased by NUD and CWA.
5. The forecast of peak day demand is based on a peak day factor of 1.64, the average ratio of peak day to average annual demand for the period 1999 through 2005.


2006 Official Water Demand Forecast
Annual MGD
Firm Yield
2001 WSP Forecast
Jan 2004 Official Forecast
Actual
Demand*
2006 Official Demand Forecast
The gray area represents the
added uncertainty involved in
extrapolating beyond 2030.
* Actual billed consumption plus average
non-revenue water (12 mgd)
0
20
40
60
80
100
120
140
160
180
200
1995
2000
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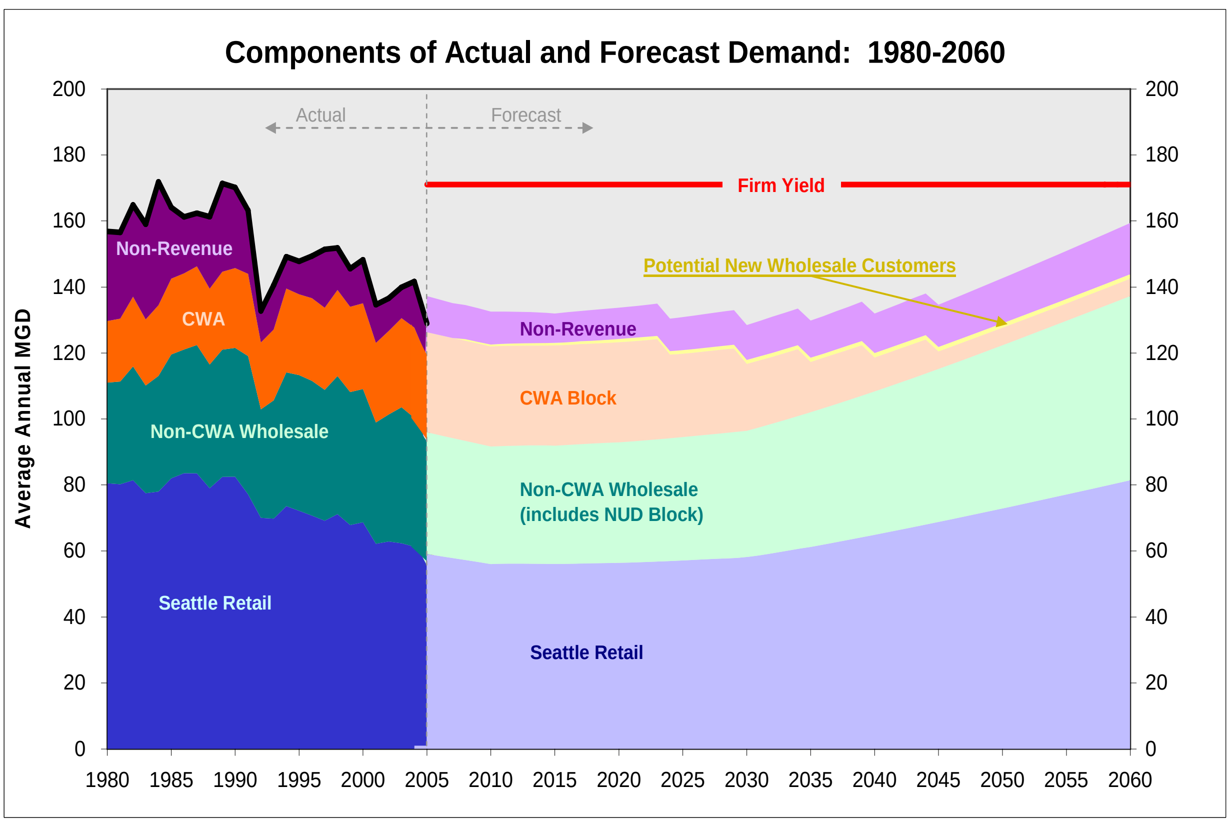

Components of Actual and Forecast Demand: 1980-2060
Average Annual MGD
Actual
Forecast
Firm Yield
Non-Revenue
CWA
Non-CWA Wholesale
Seattle Retail
Potential New Wholesale Customers
Non-Revenue
CWA Block
Non-CWA Wholesale
(includes NUD Block)
Seattle Retail
0
20
40
60
80
100
120
140
160
180
200
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060

Forecast Uncertainty

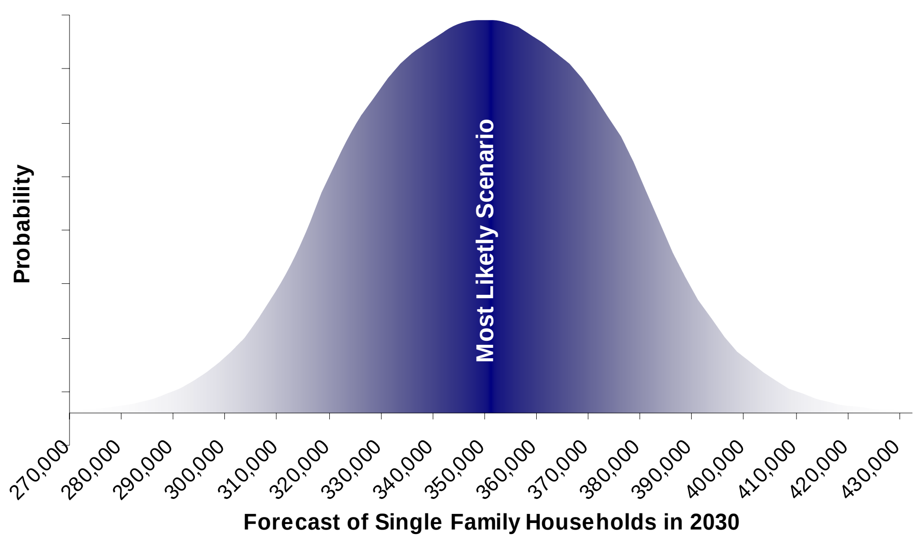
What is most certain about a forecast out to 2060 is that it will be wrong. Actual demand in 2040 or 2060 is highly unlikely to be exactly what was forecast back in 2006. The official water demand forecast is itself based on forecasts of income, water prices, households and employment – all subject to uncertainty. Additional uncertainty surrounds the forecast model's assumptions about price and income elasticities, future conservation, wholesale customers' other sources of supply, and whether SPU will gain new customers and/or lose existing customers.

The Official Demand Forecast represents both SPU's policy intentions and its expectations of the future. However, it is prudent, especially in long-term planning, to consider the many uncertainties that could cause demand to be different from what's projected in the official forecast. These uncertainties fall into two categories – discrete and continuous – and are handled in two different ways.

The first category refers to those uncertainties that result from discrete events that produce significant and sometimes abrupt changes in customer demand. Discrete uncertainties represent occurrences that either happen or don't. They're on or off, yes or no (though there can be more than two conditions). An example of a discrete uncertainty is whether or not the Weyerhaeuser water right is developed. If it isn't, SPU continues to serve Woodinville and Northshore. If the project is developed, Woodinville and Northshore have a new supply source and demand from SPU is reduced by 12 to 13 mgd. This and other discrete uncertainties are thought to be best handled by running individual "what-if scenarios" through the demand forecast model.

The second category consists of the continuous uncertainty that surrounds the various inputs to the model. An example would be the forecast of household growth. Actual growth over the forecast period could turn out to be lower or higher than forecast. These types of uncertainties can be represented by a continuous probability distribution around a mean or most likely value as illustrated below.

Probability Distribution
Surrounding a Most Likely Forecast



Modeling Continuous Uncertainty

A number of model inputs were identified as being subject to continuous uncertainty. (These are shown in the model structure flowchart on page 2 shaded in gray.) They include forecasts of single and multi-family households and employment; average annual growth rates for water prices and household income; price and income elasticities; and the extent to which price-induced conservation overlaps with code and programmatic conservation. Each uncertainty was modeled by specifying a probability distribution around the mean value of each variable. Many sources were consulted to define the range of uncertainty[2] and the shape of the distributions. The sources and assumptions used to characterize continuous uncertainties are outlined below.

Forecasts of Households and Employment: Two different sources were consulted to establish uncertainty ranges around the forecasts of long term demographic growth. The Washington State Office of Financial Management (OFM) produced high and low forecasts of population by county based on historical variability in net migration rates. Dick Conway and Associates developed high and low alternatives around the PSRC long term regional forecasts of population and employment (but not households) based on optimistic and pessimistic scenarios for the local and national economies[3]. The greater geographical specificity of the OFM forecasts was combined with the more rigorous methodology and wider range between low and high provided by Dick Conway's analysis. The ranges of uncertainty around the projections of households, employment and population used in the demand forecast model are shown in the table, below. The forecast number of multifamily households in 2060, for example, is 35% less than the baseline forecast in the low growth scenario and 54% higher in the high growth scenario.

Uncertainty Ranges Around Mean Values
Associated with High and Low Demographic Growth Scenarios

	2030		2060	
	Low	High	Low	High
Single Family Households	-8%	12%	-15%	24%
Multifamily Households	-24%	37%	-35%	54%
Employment	-12%	19%	-20%	30%
Population*	-14%	22%	-25%	38%

* The number of single and multi-family households rather than population is used in the demand forecast model.

The ranges around single and multi-family households were derived from the reported high and low population values and the assumption that variability around the single family forecast is less than for the forecast of multifamily households. Note that the potential variation from forecast values is expected to be greater on the high side than on the low side.

Growth in the Price of Water: System water rates are obtained by dividing each year's projected revenue requirement by projected demand. Uncertainty about future water prices derives from variability in both of these terms. The baseline assumption is that revenue requirements will double in real (inflation-adjusted) terms between now and 2060. This combined with the baseline water demand forecast implies increases in real water prices of about 1% per year over the forecast period. The range of uncertainty around this is

[2] Each range is characterized by a high and low value representing two standard deviations from the mean.
[3] Scenarios developed by DRI-WEFA (now known as Global Insights, Inc.)

assumed to be **plus or minus 80%** resulting in projected annual growth rates in real prices of between **0.2%** and **1.8%**. This range corresponds to the assumption that real revenue requirements could grow by as little as 25% by 2060 or triple by that time.

The model handles the impact on price of different levels of projected demand in a different way. Given the same set of revenue requirements, lower demand results in higher water prices and vice versa. That means that price effects would be expected to amplify swings in demand. For example, higher-than-projected demographic growth would cause demand to be higher than the official forecast, resulting in reduced prices and an additional boost in demand. The amount of the boost is determined by the price elasticity of demand and the amount by which prices fall. Incorporating this demand-price-demand-etc. feedback loop explicitly into the model isn't feasible because, as is explained in more detail below, the uncertainty analysis involves running 10,000 iterations of the demand model. However, the feedback loop has been approximated by widening the range of uncertainty around growth in households and employment. The amounts by which the ranges have been increased are **4.9%** on the high side and **6.4%** on the low side[4].

Price Elasticity: The uncertainty ranges around price elasticity represent a synthesis of the various estimates of price elasticity reported in the literature review. These are **plus or minus 50%** for single and multi-family elasticities and **plus or minus 33%** around the non-residential elasticity.

Uncertainty Ranges Around Mean Price Elasticities

	Single Family	Multi-Family	Non-Residential
Low	-0.10	-0.05	-0.15
Mean	-0.20	-0.10	-0.225
High	-0.30	-0.15	-0.30

Growth in Real Household Income: Historical income data at both national and local levels revealed very little variation in real income growth when averaged over long (30 year) periods of time. Therefore, a relatively narrow uncertainty band of **plus or minus 18%** was placed around the projected 1.7% annual rate of income growth resulting in annual growth rates between **1.4%** and **2.0%**.

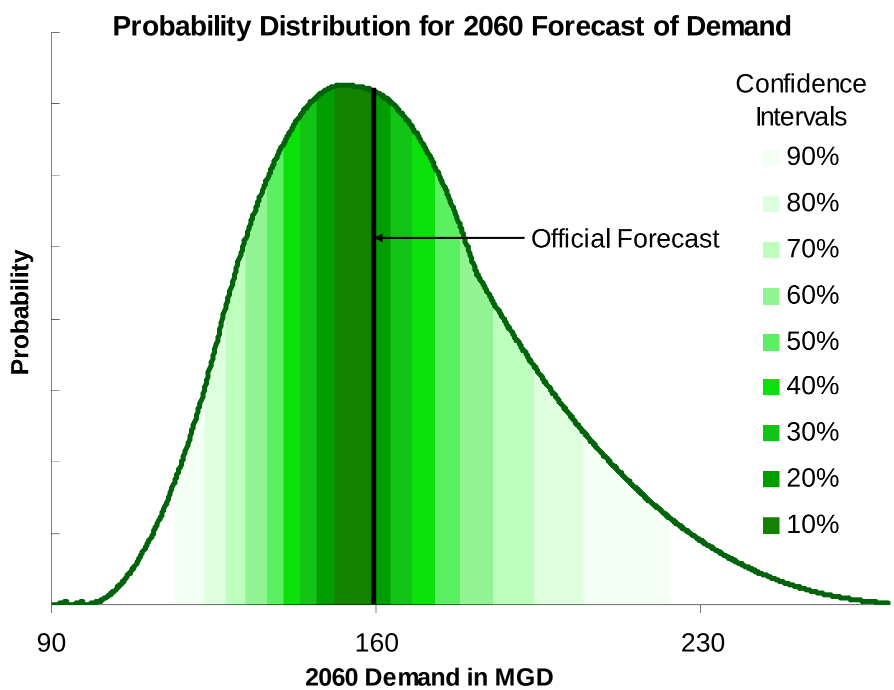
Income Elasticity: As with price elasticity, the uncertainty band around income elasticity was derived from the various estimates of income elasticity in the literature review. A range of income elasticities from **0.19** to **0.35** (i.e., **plus or minus 30%**) around the mean value of 0.27 was chosen.

Conservation Savings: The price/code/programmatic conservation overlap function is used to introduce an element of uncertainty to overall conservation savings. The baseline assumption is that 50% of the price effect overlaps with code and programmatic conservation. Assuming a higher level of overlap produces a smaller amount of total conservation savings, and vice versa. A range of conservation savings are obtained in the model by varying the overlap parameters between **25%** and **75%**.

[4] These percents were obtained by calculating the percent changes in 2060 water prices that would result from the high and low growth scenarios relative to the baseline scenario and multiplying them by the average price elasticity.

Modeling Uncertainty with @Risk: The uncertainty ranges described above are assumed to have normal or log-normal distributions,[5] with the endpoint values representing two standard deviations from the mean. These probability distributions become inputs to an aggregate uncertainty model using @Risk software (an add-in to Excel) which employs Monte Carlo simulation to characterize uncertainty around the official demand forecast. During each individual run of the Monte Carlo simulation, a value is randomly selected for each input variable based on the probability density function specified for that variable[6]. Then, the complete set of input values for that iteration is used to produce a water demand forecast. The simulation procedure performs a large number (10,000) of independent iterations, each generating a separate demand forecast. These forecasts are then pooled to obtain a probability distribution of forecast water demand through 2060.

The results of the Monte Carlo simulation are displayed in the graph on the next page. The green bands indicate the range of uncertainty around the official forecast with each band representing a 5% change in probability. For example, the bottom of the lowest band represents the 5th percentile. That means it's estimated there's a 5% chance actual demand will be below that point (and, thus, a 95% chance it will be above). The top band is the 95th percentile which corresponds to an estimated 95% probability that actual demand will be below that point. Taking a cross-section of the graph at 2060 produces the probability distribution around the official forecast shown below.



The uncertainty model represents a significant refinement over simply compounding all the high or all the low assumptions to create extreme high and extreme low scenarios. In the extreme high scenario, everything that could possibly cause demand to be higher than forecast is assumed to happen at the same time. The extreme low scenario is just the opposite with all low side assumptions applied simultaneously. These extreme scenarios overstate the actual

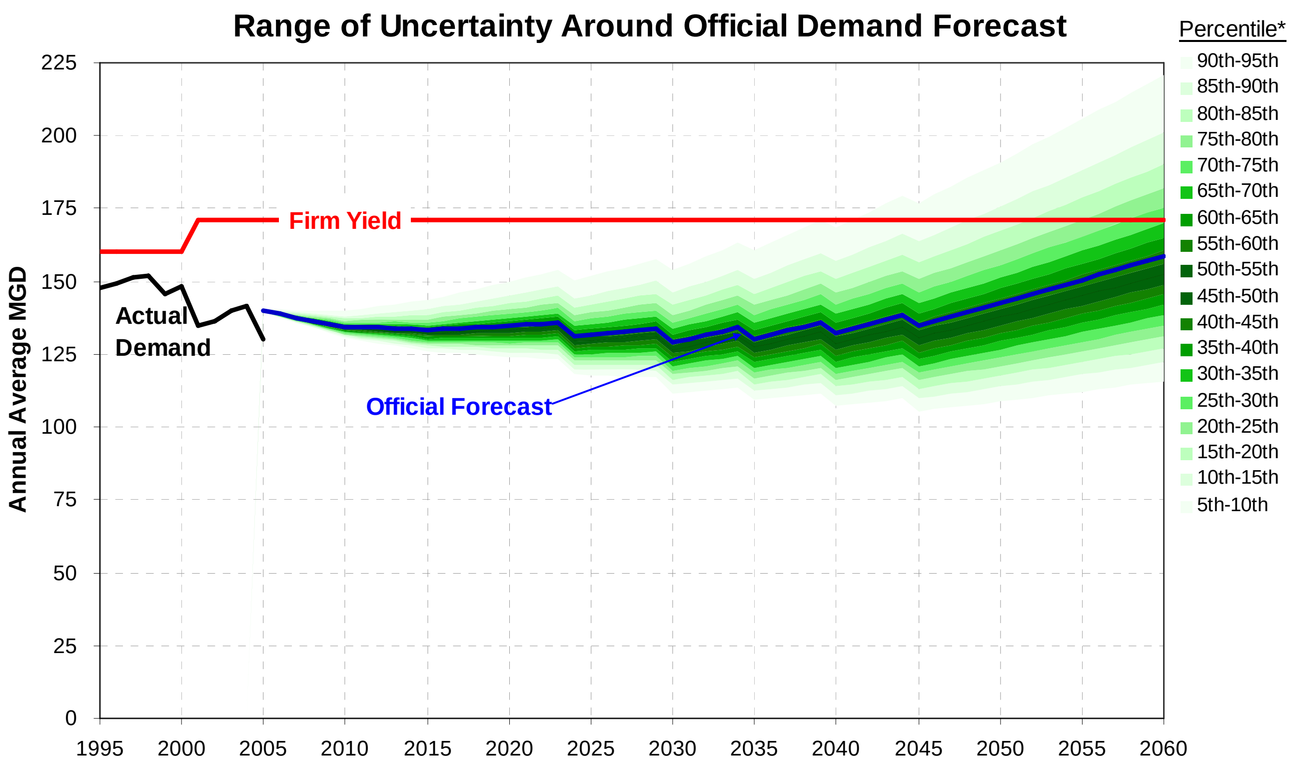
---

5 Log normal distributions are used for the uncertainty around household and employment growth because the high and low ranges exhibit positive skewness (i.e., the highs are higher than the lows are low).

6 All variables with uncertainty are assumed to be independent except for growth in households and employment. These are linked in the model because they would be expected to move together.

uncertainty surrounding demand because they represent two highly unlikely combinations of events with essentially zero probability of occurring. The Monte Carlo simulation provides narrower bands of uncertainty and information about their estimated probabilities.

Implications: Given the current firm yield estimate for SPU's existing supply resources and the official demand forecast, a new source of supply will not be needed until well after 2060. Taking demand uncertainty into consideration, there's still more than a 70% probability that a new source will not be necessary before 2060. At an even higher level of confidence, the uncertainty analysis implies a 90% probability that existing sources will be sufficient to meet demand through at least 2048. This analysis does not explicitly calculate the possible impact of the "discrete" category of uncertainties mentioned in the introduction. However, none of the discrete uncertainties that have been identified (development of Weyerhaeuser water right, changes in the CWA contract, new federal standards for washing machines, etc.) would shift the forecast of demand beyond the range calculated for continuous uncertainties and shown in the graph, below.



* Percentiles represent the probability that demand is less than the value shown. Ranges reflect uncertainty in projected household, employment, price and income growth; price and income elasticities; and conservation. Note that the Official Forecast is at about the 57th percentile.

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

I. WATER RESOURCES

APPENDIX B
WATER CONSERVATION PLAN 2007 - 2012

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Seattle Public Utilities
Water Conservation Plan 2007-2012
Technical Appendix
July 2006

Water conservation is integral to how Seattle Public Utilities (SPU) is preparing for the uncertainty of climate change, managing its water resources for people and fish, and helping customers reduce their bills.

SPU and its regional partners – building on two decades of experience and achievement – have made a commitment to water conservation through the year 2030. Significant water savings will be realized from a combination of water rates, the plumbing code, system efficiencies, and programmatic efforts.

The six-year water conservation goal articulated in this plan is expected to reduce demand by over 13 million gallons a day (mgd) of average annual savings from 2007-2012. Key components include:

- Continuation of the regional 1% Conservation Program and the Seattle-only I-63 Settlement Ordinance Program through 2010; and
- Regional baseline conservation program commitment from 2011-2030.

This appendix details the analysis and approach that support SPU's conservation plan.

Evaluation of Cost-Effective Conservation

In order to evaluate conservation for its *2007-2012 Water Conservation Plan*, SPU updated its *1998 Conservation Potential Assessment* (CPA) in 2004 and revised it in 2006. The *2006 Conservation Potential Assessment (2006 CPA)* is included as an attachment to this appendix and contains details of the assessment.

The *2006 CPA* calculates and reports on water savings and levelized costs[1] for both average annual demand and peak season demand for 135 conservation measures. The CPA analysis also calculates other benefits obtained by the conservation measures including savings from reductions in demand for electricity, stormwater and wastewater. The CPA incorporates efficiencies expected from the State Building Code relative to plumbing fixtures. The code savings are used to calculate the savings in Exhibit 2, below, and are also incorporated into SPU's water demand forecast.

Cost-effectiveness for the 1% Program intended to operate through 2010 is based on the marginal cost of new supply – described as "avoided cost." This was used because conservation was being implemented as a source of supply that could be compared to other sources of supply that might be constructed to bring new water into the system. Because the current demand forecast does not indicate that a new source of supply is needed until sometime after 2060, and much can change prior to when a new source is developed, no single alternative was selected as the next preferred source for which to compare baseline conservation costs. Without a set level of avoided cost, this was not used as a measure of cost-effectiveness for selecting conservation measures beyond 2010.

[1] Levelized cost is the discounted cost per unit of water saved or produced over the lifetime of a measure.

In 2006, SPU completed an analysis using its new water supply planning model[2] . This model evaluates the unit costs of new future water supply alternatives, including additional conservation programs, along with a "value score" that captures the non-monetary benefits of each alternative. Preferred alternatives are selected based on costs and value-added, and not costs alone. Alternative selection is based on providing the highest value at the lowest cost, with recognition that tradeoffs in value and costs are policy decisions.

The *2006 CPA* ranks all of the conservation measures according to the marginal cost of achieving a unit of water savings. The *2006 CPA* analysis was used to:

- Incorporate CPA findings into the regional 1% Water Conservation Program (1% Program) to fine-tune the measures for the 2007-2010 portion of the Conservation Goal;
- Package groups of measures for the *Conservation Drivers Analysis* to evaluate eight program alternatives of varying intensity to set the level for the 2011-2012 portion of the Conservation Goal termed "Regional Baseline Conservation 2011-2030"; and
- Analyze three "Technical Potential" packages for the *SPU Water Supply Planning Model*. They were selected for use in analyzing future water supply alternatives to represent options for a new source of supply that achieves a high volume of savings, and does so at an acceptable annual and marginal cost.

<u>Regional 1% Water Conservation Program (2007-2010)</u>

The regional Water Conservation Program (1% Program) will generate the majority of savings in the 2007-2012 Conservation Plan. The 1% Program was created in 1999 and expanded to include the entire SPU service region in 2000, however, Cascade Water Alliance (CWA) member utilities no longer participate in this conservation program. The program will operate through 2010.

The 1% Program is sponsored by the Saving Water Partnership that includes SPU and a group of 17 utilities purchasing wholesale water from SPU. SPU administers the 1% Program in collaboration with these utilities, under the terms of long-term water supply contracts.

In 1999, as noted previously, impetus for the 1% Program was a demand forecast that illustrated the need for a new source of supply by 2013 without conservation. The long-term goal was to keep water demand by the end of 2010 at the same level as it was in 1999, despite growth in population and economic activity.

Two performance targets were set for the 1% Program from 2000-2010:

- Reduce annual per capita consumption 1% per year; and
- Achieve a programmatic conservation savings of 14.5 million gallons a day (mgd) peak season savings (11.0 mgd annual average)[3].

[2] CH2M Hill, *SPU Water Supply Planning Model*, April 2006.
[3] 2004 target and years thereafter adjusted down from the original 18 mgd peak season savings target to reflect withdrawal of Cascade Water Alliance utilities from the 1% Program.

The conservation savings target roughly corresponded to the forecasted growth in water demand in the service region over this same time period.

Program design, conservation measures and performance by sector, consumption analysis, and projects and technologies by water provider is provided in the *2002 Ten Year Conservation Program Plan* and the *Saving Water Partnership Regional 1% Water Conservation Program, 2004 Annual Report.* Both of these documents are provided as attachments to this appendix. As a routine part of operating the 1% Program, SPU adds and deletes measures based on market advances, customer preferences, collaboration opportunities with energy utilities and other agencies, and savings achieved. The measures implemented in the 1% Program are based on the evaluation in the *1998 CPA*, the *2004 CPA Update*, and the *2006 CPA*. The most recent assessment indicates diminishing opportunities over time with hardware-related measures (e.g., rebates for low-flow toilets) and an opportunity to increase savings from customer behavioral changes (e.g., landscape watering).

A listing of recently implemented conservation projects and technologies is located in the *Regional 1% Water Conservation Program, 2004 Annual Report* Chapter 5 "Rebate Program Activity by Water Provider." This report is provided as part of this appendix.

Seattle Ordinance 120532 (I-63 SO) (2007-2010)

In 2001, the City of Seattle adopted Ordinance No. 120532, sometimes referred to as the Initiative 63 Settlement Ordinance (I-63 SO). The I-63 SO commits the City of Seattle to pursue conservation beyond the 1% Program in the SPU direct service area. As shown in Exhibit 2, below, depending on cost effectiveness and other considerations, savings in 2007-2010 from implementation of the I-63 SO conservation provisions will come from:

- Retrofit of low-income housing through the "Everyone Can Conserve Program;"
- Reclaimed water projects;
- Reservoir covering and other system efficiencies; and
- Conservation investments in City of Seattle facilities and system operations.

Pursuant to the requirements of Ordinance 120532, SPU revised its conservation program plan to include I-63 SO provisions. The Mayor and City Council approved the City of Seattle Supplement to the Ten Year Conservation Program Plan in 2003 (Resolution 30584). The Seattle City Council directed SPU to complete a next phase implementation strategy for the "Everyone Can Conserve Program" in 2004.

Through the "Everyone Can Conserve Program" nearly 14,500 low-income housing units have been upgraded with high efficiency toilets, showerheads, faucet aerators, and common area laundry facilities since 2002. SPU's goal will be to retrofit 50 percent of the remaining, eligible, low-income housing units by 2010 targeting non-subsidized low-income housing and self-certified recruitment of low-income single family households.

Regional Baseline Conservation (2011-2012)

The 2011-2012 portion of the 2007-2012 conservation goal is based on SPU's regional baseline conservation 2011-2030 target.

As the demand forecast illustrates, SPU is not projected to need a new source of supply until sometime beyond 2060. Since conservation is not currently needed as a source of supply, SPU has undertaken two efforts to determine the appropriate regional water conservation target from 2011-2030. They included:

- Conservation Drivers Analysis: A qualitative review and rating of risks related to future water conservation alternative goals; and
- *2006 Conservation Potential Assessment* (described above).

Two questions the efforts set out to answer included:

- What are the reasons to provide water conservation programs from 2011-2030 if not to offset the need for new supply?
- How much savings might be needed to meet those objectives and what would the cost be?

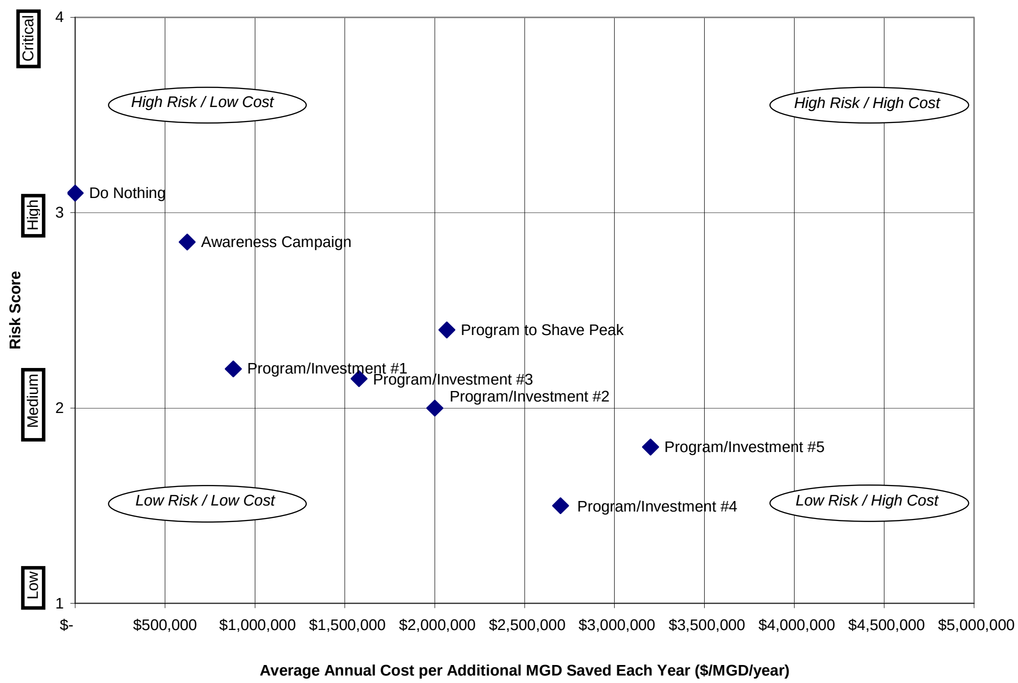
To answer the first question, risks were analyzed including public trust concerns, regulatory issues, asset and service reliability, legal concerns, environmental issues, financial ramifications, workforce issues, social and public health concerns. These risks were ranked relative to eight conservation alternatives of varying intensity. The results are shown in Attachment 1, "Assessment by Risk Categories."

To answer the second question, the Seattle Water Supply System Operating Board (Operating Board) reviewed eight alternative baseline strategies including "Do Nothing," "Awareness Campaign," "Program to Shave Peak," and "Variable Intensity Options" that ranged from efforts less intensive than the current 1% Program to greater intensity than the 1% Program. Five alternatives were selected to represent a reasonable range of future conservation investments for the "Variable Intensity Options;" other possible alternatives were not selected because of the very high marginal cost of additional supply (see Table 9 in the *2006 CPA*). For each of the eight alternatives, calculations of water savings and costs were defined based on the CPA analysis. Attachment 2 provides a summary matrix of program options, costs and risk ratings.

The *Risk Score vs. Average Cost per Annual Savings* analysis, shown by the graph in Exhibit 1 below, indicates that a 2011-2030 conservation goal of 15 mgd of cumulative average annual savings (Program/Investment #1/#2) has the lowest risk and lowest cost while serving all customer classes. This level of conservation was adopted by the Operating Board as the Regional Baseline Conservation program from 2011-2030.

SPU will participate in the 2011 - 2030 Program along with most of its wholesale customers. The 2011-2030 Program will include both public education and customer incentives for water efficient equipment (hardware) that targets both indoor and outdoor conservation measures. It will serve all customer classes and offer a broad array of measures based on the CPA, customer research, market advances, and staff expertise. In comparison to the 1% Program, there will be increased savings from customer behavioral changes (e.g., landscape watering, shorter showers, elimination of partial loads in dishwashers and clothes washers, etc.). SPU is also exploring the interaction of its conservation programs and price induced water savings.

Exhibit 1
Risk Score vs. Average Cost per Annual Savings



Measures to be included in the 2011-2030 Program will be selected based on cost and benefit as the time draws nearer to implementation. The CPA will be updated next in 2008. Exhibit 2 provides estimates of how savings will be achieved to meet the conservation goal.

Exhibit 2
Water Conservation Goals and Other Savings
Average Annual Savings in Millions of Gallons Per Day (MGD)

	2007	2008	2009	2010	2011	2012
Conservation Goals						
Regional 1% Program	1.12	1.12	1.12	1.12	--	--
Seattle Ordinance 120532 (I-63 SO)*	0.63	0.63	0.63	0.63	--	--
Regional Baseline Conservation 2011-2030	--	--	--	--	0.75	0.75
Total Conservation Goal	**1.75**	**1.75**	**1.75**	**1.75**	**0.75**	**0.75**
Other Savings						
Plumbing Code	0.69	0.66	0.64	0.62	0.60	0.58
Price Savings**	0.20	0.20	0.20	0.20	--	--
Total Other Conservation	**0.89**	**0.86**	**0.84**	**0.82**	**0.60**	**0.58**
TOTAL SAVINGS	**2.63**	**2.61**	**2.59**	**2.57**	**1.35**	**1.33**

* Savings are from SPU's direct service area and include the "Everyone Can Conserve" program, reclaimed water projects, reservoir covering and other system efficiencies, and conservation investments in City of Seattle facilities.

** After 2010, included in Baseline Conservation.

Exhibit 3 below provides details on the water savings targets, schedule from 2007 - 2012 and funding for the implementation of the 1% Program and as well as the conservation efforts that are occurring just within the City of Seattle.

Exhibit 3
Water Saving Partnership (1% Program) and Seattle Only* Implementation Targets, Schedule and Funding (in mgd and million $)

Water Savings Sector	2007	2008	2009	2010	2011	2012
Landscape	0.16	0.2	0.1	0.16	0.1	0.1
Commercial, Industrial, Institutional	0.35	0.4	0.5	0.5	0.25	0.25
Residential Domestic	0.50	0.5	0.5	0.44	0.4	0.4
Total Ave Annual Savings	1.1	1.1	1.1	1.1	0.75	0.75
Regional Funding	$4.06	$4.16	$4.51	$4.36	$1.30	$1.30

Note: Table includes Baseline Regional Conservation after 2010.

Seattle Only* Savings	0.63	0.63	0.63	0.63	none	none
	0.69	0.66	0.64			
Seattle Only* Funding	$1.84	$2.0	$1.84	$1.84	none	none

* "Seattle Only" refers to programs under the Seattle Ordinance 120532 (I-63 SO)

Other Savings

As shown in Exhibit 2, SPU anticipates water savings beyond its own conservation programs, as described below.

Plumbing Code (2007-2012)

Efficiencies are expected from implementation of the State Building Code as the result of installation of new plumbing fixtures. These code savings are displayed in Exhibit 2 and incorporated into the demand forecast.

Price Savings (2007-2012)

Savings related to SPU's rate structure and price signals are also anticipated. Rate related savings from price elasticity parameters in Exhibit 2 were calculated using *SPU's Demand Forecast Model*.

Municipal Water Law Conservation Checklist

As part of the Municipal Water Law water utilities are being asked to complete a conservation checklist. SPU has completed the checklist and it is provided below.

Water Conservation Program Requirements Checklist

Required Conservation Measures[4]	Measure Included	
1. Program Promotion	Yes __√___	No _____
2. Install Source Meters	Yes __√___	No _____

All recommended measures listed below must be evaluated for implementation in the conservation plan to meet the minimum requirements in the Conservation Planning Requirements.

Recommended Conservation Measures	Measure Evaluated	
3. School Outreach	Yes _√____	No _____
4. Speakers Bureau	Yes _√____	No _____
5. Theme Shows and Fairs	Yes _√____	No _____
6. Purveyor Assistance	Yes _√____	No _____
7. Customer Assistance	Yes _√____	No _____
8. Conduct Technical Studies	Yes _√____	No _____
9. Utilize Bill Showing Consumption History	Yes _√____	No _____
10. Install Service Meters	Yes _√____	No _____
11. Develop Unaccounted Water/Leak Detection Program	Yes _√____	No _____
12. Single-Family/Multi-Family Kit Distribution Program	Yes _√____	No _____
13. Development of Nurseries/Agricultural Conservation Program	Yes _√____	No _____
14. Development of Landscape Management/Xeriscaping Program	Yes __√___	No _____
15. Conservation Pricing	Yes __√___	No _____
16. Utility Financed Retrofit	Yes __√___	No _____
17. Seasonal Demand Management	Yes __√___	No _____
18. Water Recycling/Reuse	Yes __√*__	No _____

* SPU currently does not provide reclaimed water to any of our customers, but many of our customers recycle or reuse water within their facilities.

Other Requirements Contained In the Conservation Planning Requirements

In addition to developing a conservation plan as delineated above, the state's Conservation Planning Requirements also require that all public water systems preparing a water system plan identify existing rate schedules (include schedules for various customers classes if they are different), and inventory major potential sources and uses for reclaimed water. The demand forecast section of the body of the *2007 Water System Plan* discusses issues regarding customer rates. As noted below, SPU has completed an inventory of sources and uses for reclaimed water as part of the *2007 Water System Plan.*

Other Requirements	Information Included	
1. Inventory of Sources and Uses for Reclaimed Water.[5]	Yes __√___	No _____

---

[4] Program promotion is required to be implemented for all public water systems. Source metering is required to be implemented by all systems prior to receiving additional water rights. If additional water rights are not being sought, this measure must be evaluated and implemented if cost effective. If unaccounted for water is greater than 20 percent, a leak detection program must be initiated.

[5] A list of potential sources and uses of reclaimed water is contained in the Conservation Planning Requirements. Only those systems with more than 25,000 service connections will be required to evaluate water reuse as a conservation measure.

ASSESSMENT BY RISK CATEGORIES
Water Conservation Drivers Analysis
Baseline Water Conservation: 2011-2030

Public Trust
1. Utilities' reputation as credible managers of the resource
2. Utilities' reputation as credible financial managers
3. Perception that the Utilities are responsive to public needs for reducing bills
4. Relationship and credibility with the In-stream Flow Commission
5. Ally and partner with other utilities and private sector contractors regarding conservation programs

Regulatory
1. FERC determination of Tolt water rights during 2025 re-licensing
2. Compliance with WA State Dept. of Health water conservation regulations
3. Consistent with Cedar River Habitat Conservation Plan
4. Compliance with I-63 Settlement Ordinance requiring SPU implement all cost-effective conservation
5. Bills considered by WA State legislature
6. Federal Clean Water Act regulations

Asset and Service Reliability
1. Uncertainty of climate patterns
2. Certainty of customer behavioral changes to conserve water (vs. investment in hardware related conservation)
3. Risk of curtailment and rate surcharges
4. Loss of "risk free" way of adding supply = savings account for growth, tribal issues, and climate disruption
5. Insurance if CWA seeks more water from SPU

Legal
1. Lawsuits filed by environmental groups or tribes
2. Initiatives filed by citizens

Environmental
1. In-stream flows for fish, animals, and plants (aquatic and riparian habitat)
2. Amount of pesticide run-off from irrigation
3. Leverage for recycling, energy conservation, and reductions in storm water and wastewater flows

Financial
1. Revenue stability related to conservation savings
2. Amount of surplus water to sell

Work Force
1. Cost of ramping up conservation expertise
2. Availability of conservation experts during droughts and emergencies

Social
1. Impact on requirements for customer behavior changes

Public Health
1. Improper use of gray and recycled water by customers and employees
2. Improper sanitation due to less frequent toilet flushing

Note: This risk assessment document was created on 12/21/05.

Attachment 2

WATER CONSERVATION DRIVERS ANALYSIS: 2011-2030

Risk Assessment for Water Conservation Baseline Strategies

Purpose: Set 2011-2030 baseline water conservation level for 2007 Water System Plan Update and Demand Forecast

Alternative Conservation Baseline Strategies	Program Description	20 Year Savings (Cumulative) Annual MGD Savings by 2030	20 Year Savings (Cumulative) Peak Season MGD Savings by 2030	Total Annual Budget O&M+ CIP= TOTAL '000 of $ per Year	Public Trust Concerns (20%)	Regulatory Concerns (10%)	Asset and Service Reliability Concerns (15%)	Legal Concerns (10%)	Environmental Concerns (10%)	Financial Concerns (15%)	Workforce Concerns (5%)	Social Concerns (10%)	Public Health Concerns (5%)	Key Points
Do Nothing	* No messaging or incentives	0	0	0	Critical	Critical	Critical	Critical	High	Low	High	Low	Low	* Access of future decision-makers to conservation as resource * Legal or political external pressure from stakeholders
Awareness Campaign	* Messaging to change behavior * Savings from dormant lawns * No incentives * Less intense than current 1% program	13 MGD	18 MGD	$405 $0 $405	High	Critical	High	High	Medium	Medium	High	High	Medium	* Campaign to change behavior at time of surplus = mixed message
Program to Shave Peak	* Outdoor conservation only * Focus on dormant lawns and drought tolerant plants * Messaging plus incentives for measures such as rainbarrels and swimming pools * Less intense than current 1% program	3 MGD	10 MGD	$205 $105 $310	High	High	Medium	Medium	Low	Medium	High	High	Low	* Revenue loss during summer season * All conservation measures for outdoor use
Program/Investment #1	* Both messaging and incentives for indoor and outdoor conservation * Hardware incentives range from cooling/process improvements to showerheads * Savings from dormant lawns * Less intense than current 1% program	15 MGD	19 MGD	$315 $345 $660	Medium	High	High	Medium	Low	Medium	High	Medium	Medium	* State DOH's public goal setting process may find SPU's efforts inadequate
Program/Investment #2	* Includes messaging and incentives for indoor and outdoor conservation * Hardware incentives spread across more customer classes than Low Intensity #1 (above) * No reliance on savings from dormant lawns * Less intense than current 1% program	14 MGD	14 MGD	$510 $890 $1400	Medium	High	Medium	Medium	Low	Medium	Medium	Medium	Medium	*Too much reduction in conserv ation effort
Program/Investment #3	* Includes messaging and incentives for indoor and outdoor conservation * Outdoor savings from dormant lawns, car washes, and swimming pools * Relies more on behavior related measures than "Program/Investment #4" (below) * Less intense than current 1% program	19 MGD	23 MGD	$400 $1,100 $1,500	Medium	Medium	High	Low	Low	High	Medium	High	Medium	* Ability to achieve this level of behavioral savings would require City leaders' messaging
Program/Investment #4	* Includes messaging and incentives for indoor and outdoor conservation * Outdoor savings from dormant lawns, car washes, and swimming pools *Similar intensity to current 1% program	20 MGD	27 MGD	$570 $2,130 $2,700	Medium	Low	Low	Low	Low	Medium	Low	Medium	Medium	* Meets external expectations
Program/Investment #5	* Similar to "Program/Investment #4" (above) coupled with additional outdoor savings from incentives for irrigation hardware and low-water use plants *Greater intensity to current 1% program	25 MGD	33 MGD	$800 $3,200 $4,000	High	Low	Low	Low	Low	Medium	Low	Medium	High	* Limited external pressure to increase level of savings from current efforts

Note: This Water Conservation Driver's Analysis document was created in December 2005.

The following documents are references to this appendix:

- Water Conservation Potential Assessment, Revised May 2006
- Ten Year Conservation Program Plan, September 2002
- Regional 1% Water Conservation Program, 2004 Annual Report

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Water Conservation Potential Assessment

Updated December 2004
Revised May 2006

This report is available on the Seattle Public Utilities website, www.seattle.gov/util/services/. Many of the referenced documents are also available on that website.

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Acronyms

ccf	Cubic feet
CPA	Conservation Potential Assessment
CSO	Combined Sewer Overflow
CWA	Cascade Water Alliance
MF	Multifamily
mgd	(million gallons per day)
NR	Non-residential
O&M	Operation and Maintenance
PSRC	Puget Sound Regional Council
SCL	Seattle City Light
SF	Single Family
SPU	Seattle Public Utilities
SSO	Sanitary Sewer Overflow

Table of Contents

Figures

Appendices

Executive Summary

This executive summary provides an overview of the purpose, methodology, and results of the conservation potential assessment (CPA) analysis.

Purpose

The 2006 CPA Report is an analysis of the cost, volume, and reliability of water conservation opportunities available within Seattle Public Utilities' (SPU) retail service area and a portion of its wholesale service area through 2030. The CPA is a planning model that helps integrate demand management into SPU's regional water supply planning process. The CPA analysis is integral to the following three elements of water supply planning:

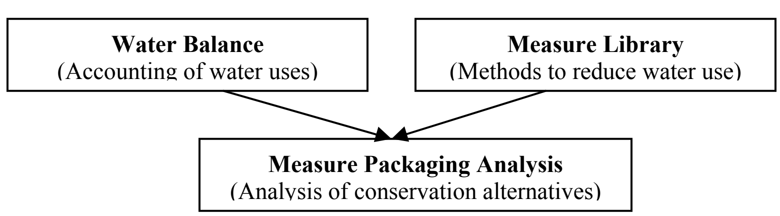
1. **Demand Forecast** – The CPA forecasts data related to conservation goals from 2005 through 2010, as well as projected plumbing code savings through 2030.
2. **Conservation Drivers Analysis** – The CPA provides cost/benefit information related to seven alternatives ranging from an "awareness only" campaign to a program intensity greater than current conservation efforts. The timeframe for the options is from 2011 through 2030.
3. **Water Supply Planning Model** – The CPA provides scenarios for the Drinking Water Supply Planning Model related to conservation as a source of supply. Conservation measures are packaged and analyzed for saving potential over various timeframes.

Methodology

The 2006 CPA Report is based on a computer model (CPA Model) that has three main components: the water balance, measure library, and measure packaging analysis. The relationship among these components is shown in Figure ES-1.

- The **water balance** is an accounting of all water uses and is comprised of end uses (methods of using water), demographics, and demands.
- The **measure library** contains 135 individual conservation measures that could be implemented by customers to decrease their water use.
- The **measure packaging analysis** analyzes desired conservation alternatives by combining a water balance and selected measures from the measure library.

Figure ES-1
CPA Components



Seven packages were analyzed for this report using the Measure Packaging Analysis. Table ES-1 displays the packages. The Commitments Through 2010 package reflects SPU's current commitments. Packages #2 - #7 each add savings to the Commitments Through 2010 package.

Table ES-1
Packages Analyzed

Package Name	Purpose	Applicable Years	Maximum % of Direct Cost Paid by SPU[1]	Savings Goal	Measures Included
1. Commitments Through 2010	Demand Forecast – Commitments Already Made	2006-2010	50%	Approximately 9 mgd peak	All
2. Drivers Analysis "Awareness"	Demand Forecast - Baseline Conservation	2011-2030	50%	Approximately 13 mgd annual	Behavior oriented
3. Drivers Analysis "Shave the Peak"				Approximately 3 mgd annual	End uses that peak sharply
4. Drivers Analysis "Varying Intensity"				Range of approximately 15-25 mgd annual	All
5. Technical Potential "Regular"	Water Supply Planning Model	2011-2030	100%	Technical Potential	All
6. Technical Potential "Ends Early"		2011-2020			
7. Technical Potential " Late Start"		2021-2030			

1. i.e., SPU rebate.

Results

The results for the seven analyzed packages are shown in Table ES-2. As described in Section 2.4, the CPA Model analyzes 11 "package intensities" for each package. The package intensities represent the range of all possible combinations of measures for each package, ranging from the lowest to highest marginal cost. The package intensities determined to best represent each package are included in Table ES-2. In some cases, this may be more than one package intensity.

Table ES-2 Package Results					
Package Name	Package Intensity	Annual Savings (mgd)	Peak Season Savings (mgd)	Utility Average Annual Cost	Marginal Cost Per ccf
Commitments Through 2010[1]	6	6.81	8.27	$4,150,303	$2.99
Drivers Analysis "Awareness"	4	13.79	18.48	$404,972	$0.91
Drivers Analysis "Shave the Peak"	4	2.63	7.86	$90,000	$1.54
	5	3.49	10.40	$308,174	$3.49
Drivers Analysis "Varying Intensity"	3	14.68	18.85	$654,475	$0.33
	4	19.05	23.75	$1,497,562	$0.79
	5	21.44	27.22	$2,689,353	$1.91
	6	25.85	32.55	$3,945,075	$4.63
Technical Potential "Regular"	6	34.17	45.96	$16,315,798	$20.78
Technical Potential "End Early"	3	8.66	10.69	$3,175,443	$0.78
	4	11.45	14.06	$6,738,867	$2.20
	5	15.37	20.74	$14,141,953	$6.20
	6	15.88	21.43	$15,762,091	$17.47
Technical Potential "Late Start"	3	9.39	11.48	$3,402,350	$0.81
	4	11.82	14.72	$7,493,556	$2.17
	5	16.12	21.78	$14,220,465	$5.82
	6	16.68	22.57	$15,440,311	$15.61

1. All other packages build on the Commitments Through 2010 package, which means their savings are above and beyond the savings obtained by the Commitments Through 2010 package.

The CPA analysis does not recommend one preferred conservation alternative. Rather, the various packages provide information inputs to multiple planning efforts. The Commitments Through 2010 package helps confirm that conservation commitments made through 2010 are achievable at reasonable costs. It can also assist conservation program staff make adjustments to current programs, if appropriate. The Drivers Analysis packages provide input for incorporating conservation into the demand forecast, including ensuring that programs are equitable across customer classes. The Technical Potential packages provide valuable input for SPU's new water supply planning model. Table ES-2 shows that the chosen Drivers Analysis packages, which were used to determine the baseline conservation included in the demand forecast, have a marginal cost lower than the Technical Potential "Regular" package.

SPU anticipates continued use of the CPA Model to explore newly formulated conservation measures and packages in future years.

Section 1
Introduction

1.1 Introduction to the 2006 Conservation Potential Assessment Report

In 1998, Seattle Public Utilities (SPU) completed a *Water Conservation Potential Assessment* (1998 CPA Report) at the request of the Seattle City Council. A subsequent City of Seattle Ordinance (Number 120532, September 2001) specified an update to the CPA every four years beginning in 2004. An update was published in 2004 (2004 CPA Report Update); this *Water Conservation Potential Assessment* (2006 CPA Report) supersedes that publication.

The 2006 CPA Report is an analysis of the cost, volume, and reliability of water conservation opportunities available within SPU's retail service area and a portion of its wholesale service area through 2030 (see Section 2.2 for a discussion of which purveyors are included).

The Seattle Ordinance also requires that the CPA should quantify best estimates of other benefits obtained by water conservation measures, including savings relating to reductions in demand for electricity use, along with wastewater and stormwater discharges. The 2006 CPA Report includes a description of the methodology used for valuing those indirect benefits and provides calculations for each measure and selected groupings (packages) of water conservation measures.

The 2006 CPA Report details enhancements to the 1998 CPA Report and 2004 CPA Report Update, defines the CPA's role in the SPU Water System Planning process, documents results of the CPA model runs, and describes SPU's use of the CPA for a variety of applications.

The CPA is based on a computer model (CPA Model) that provides analytical power and flexibility for SPU and the Seattle Water System Operating Board, interested stakeholders, water economists and analysts, and program planners. The CPA Model: 1) calculates water savings potential for 135 conservation measures based on various cost or savings policy criteria; 2) estimates the impacts of code and programmatic conservation for the SPU water demand forecast and *2007 Water System Plan Update* (2007 WSP); and 3) assists SPU program planners in designing programs to meet policy goals.

This 2006 CPA Report presents analysis for 135 conservation measures that are significant in terms of their water saving potential and have been tested by research and field experience.

The CPA uses the criterion that *no measure identified and analyzed will result in a loss of service or satisfaction for the customer.* Water shortage actions such as irrigation bans are considered curtailment rather than conservation, and are therefore not included in the CPA. However, letting lawns go dormant was included as a voluntary conservation measure as a reflection of common customer practice.

The CPA approach could be used by other water utilities. However, the CPA Model as configured by SPU incorporates inputs (e.g., demographics, cost estimates, etc.) that are relevant only to SPU's service area. The results of this CPA are SPU-specific and should not be used directly by other water utilities.

The 2006 CPA Report is part of a trio of related documents:

1. The **2006 CPA Report** presents results of an analysis of conservation opportunities related to various goals.
2. The **CPA User Guide** provides step-by-step directions on how to use the CPA Model – it can be thought of as user documentation.
3. The **CPA Technical Documentation** documents the programming of the CPA Model.

1.2 The 2006 CPA Report: Revised Analysis

The 1998 CPA Report laid the foundation for the 2006 CPA Report analytical effort along with the field experience of SPU conservation experts and market research. However, it should be noted that direct comparisons between conservation measures in the 1998 CPA Report and the 2006 CPA Report may not be applicable since underlying assumptions, such as costs or target audiences, may have changed.

The 2006 CPA Report calculates and reports on water savings and levelized costs for both average annual demand and peak season demand for 135 measures. The 1998 CPA Report reported only peak season demand and levelized cost for 65 measures. Also noteworthy is the fact that the 1998 CPA Report was able to identify a cost-effective package or group of measures that were less than the cost of the next new supply – described as "avoided cost".

In 2006, SPU completed analysis using its new water supply planning model[1], which evaluates the unit costs of new water supply alternatives along with a "value score" that captures the non-monetary benefits of each alternative. Preferred alternatives are selected based on costs and value-added, and not costs alone, so the concept of marginal cost is not used as the basis for selecting new sources of supply, including conservation. Because the demand forecast used in the analysis does not indicate that a new source of supply is needed until sometime after 2060, and much can change prior to when a new source is developed, no single alternative was selected for the next source for which to compare conservation. Therefore the analysis does not establish an avoided cost.

New also since the 1998 CPA Report are calculations of other benefits obtained by the conservation measures including savings from reductions in demand for electricity, stormwater, and wastewater.

The CPA is a tool that enables SPU to conduct detailed analysis and develop policies for the future role of conservation in its portfolio of supply options. The CPA should be viewed as a planning model to help integrate demand management into SPU's regional water supply planning process.

[1] CH2M HILL, "SPU Water Supply Planning Model," April 2006.

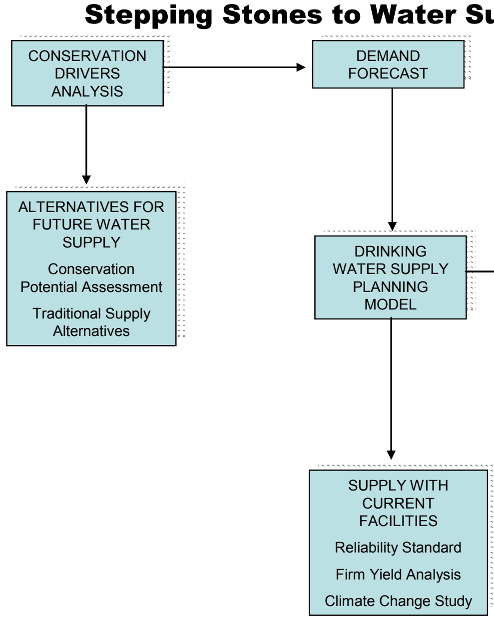
1.3 The 2006 CPA Report and Regional Water Planning

SPU provides drinking water to nearly 1.3 million people in its retail and wholesale service areas in the greater Seattle region. Prior to the 1980's, SPU's water supply planning and development followed a predictable path of acquisition of an incremental new water source based on a projected demand forecast. During the 1980's and more intensively in the 1990's, SPU recognized and utilized water conservation as a complementary strategy to meeting long term water supply needs.

Today, reliance on any single option to meet future demand is an increasingly high-risk gamble due to environmental, political, and demographic uncertainties. In response to this uncertain future, Seattle and its partners are creating a diverse portfolio of water supply and conservation options along with enhancements in system efficiency. This portfolio approach provides decision-makers with many options to meet growing water demand efficiently and reliably.

The 2006 CPA Report provides analysis and conservation inputs to the 2007 WSP. Figure 1 illustrates the front-end position of the CPA within the context of the current regional planning process. Appendix A defines the individual components of the "Stepping Stones to Water Supply Strategy".

Figure 1
Stepping Stones to Water Supply Strategy



The CPA analysis was integral to the following three planning efforts:

1. Demand Forecast – CPA forecasted data related to conservation goals from 2005 through 2010 (see "Commitments through 2010" package in Section 3.2) as well as projected plumbing code savings through 2030.
2. Conservation Drivers Analysis (2011 through 2030) – CPA provided cost/benefit information related to seven alternatives ranging from an "awareness only" campaign to a program intensity greater than the current "1%" effort. The timeframe for the options is from 2011

through 2030. The analysis included cost/benefit data from the CPA as well as a risk assessment. See Section 3.3 for supporting documentation.

3. Drinking Water Supply Planning Model – CPA provided scenarios for the Drinking Water Supply Planning Model related to conservation as a source of supply. Results are displayed in Section 3.4. Combinations of conservation measures were packaged and analyzed for water saving potential over various timeframes.

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Section 2
Understanding the CPA Model

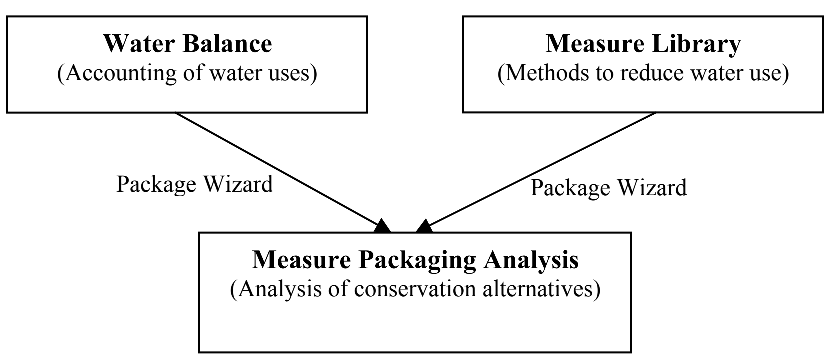
2.1 Overview

This section is presented in order to provide background information on the how the CPA Model functions and how the results discussed in Section 3 were generated. More detailed information is contained in Appendix B. Readers desiring a comprehensive explanation of CPA Model functions should consult the CPA User Guide, prepared separately from this report.

The CPA Model has three main components: the water balance, measure library, and measure packaging analysis. The relationship among these components is shown in Figure 2.

- The **water balance** is an accounting of all water uses and is comprised of end uses (methods of using water), demographics, and demands.
- The **measure library** contains a set of individual conservation measures that could be implemented by customers to decrease their water use. A conservation measure is defined as a change in water-using hardware or behavior that results in reduced water consumption. Measures that can be implemented by a utility, such as watermain leak repair, rate structures, or changes to the current plumbing codes, are not actions that customers can take, and thus they are not included in the measure library.
- The **measure packaging analysis** analyzes desired conservation alternatives by combining a water balance and selected measures from the measure library. This is performed by a tool called the Package Wizard, which allows analysis of multiple measures in combination with each other, and sharing of marketing costs between measures.

Figure 2
CPA Components



2.2 Water Balance

The water balance is an accounting of all water uses and has three main components: 1) end uses, 2) demographics, and 3) demands, as shown in Table 1. The information is presented in 5-year time increments from 1995 through 2030. For the historical time period (1995 through

2005), water was initially allocated to each end use based on the 1998 CPA Report, with updates from more recent national and local research and experience. Then the water balance was calibrated to match actual historical demands. For the future time period (2010 through 2030), water was allocated to each end use based on 2005 use patterns and then combined with forecasted demographics to calculate a demand forecast. All water balance data is divided into three main sectors: single family (SF), multifamily (MF), and non-residential (NR).

Table 1
Water Balance Components

Time Period	End Uses	Demographics[2]	Demands
Historical (1995 through 2005)[1]	Based on 1998 CPA Report, with updates from more recent national and local research and experience. Then calibrated to match actual historical demands.	U.S. Census data apportioned to water service areas. PSRC forecasts by TAZ and FAZ. Regional projections from Dick Conway and Associates.	Actual demands from SPU billing records and annual purveyor survey.
Future (2010 through 2030)	Based on 1998 CPA Report, with updates from more recent national and local research and experience.	PSRC forecasts by TAZ, FAZ.	Model calculates based on end uses and demographics.

1. 2005 was included in the historical time period through extrapolations of data from 2001 through 2004.
2. PSRC is the Puget Sound Regional Council. TAZ and FAZ are Traffic and Forecast Analysis Zones, which are geographic areas for which the PSRC presents demographic projections.

Data in the water balance covers SPU's entire retail service area and a portion of its wholesale service area, which is collectively called the "combined service area." SPU provides wholesale water service to a total of 25 purveyors. Only the 17 purveyors that participate in SPU's regional conservation program are included in the CPA Model. Table 2 lists which purveyors are included in the CPA Model and those that are not. The CPA Model was designed to allow separate analysis of the retail and wholesale service areas. However, the CPA Model is currently used for analysis in the combined service area.

There are three different water balances as follows:

- **Master Water Balance Without Code** - This water balance is the original water balance and does not incorporate efficiencies expected from the State Building Code relative to plumbing fixtures. This water balance is used only to estimate the expected code savings, which is calculated by comparing this water balance to the Master Water Balance With Code.
- **Master Water Balance With Code** – This water balance includes efficiencies expected from the code. This water balance was created by copying the Master Water Balance Without Code and adjusting the end uses to reflect shifts to more efficient hardware based on new construction and estimated fixture replacement rates for existing customers. This water balance is used for any analysis that seeks to include code efficiencies but exclude savings anticipated from SPU's 2006 through 2010 conservation commitments (see below).
- **Master Water Balance With Commitments Through 2010** – This water balance incorporates savings expected from SPU's conservation commitments from 2006 through 2010, as well as the code savings. The conservation commitments include the regional 1% Water Conservation Program and the requirements for Accelerated Conservation from the City of Seattle I-63 Settlement Ordinance Number 120532, referred to as I-63 SO. This water balance was created by copying the Master Water Balance With Code and adjusting the end uses based on a Measure Packaging Analysis designed to achieve the committed

savings. This water balance is used for any analysis that seeks to include these committed savings.

Table 2 Purveyor Relationship to the CPA Model		
#	Purveyor	Relationship to the CPA Model
1	Bellevue, City of	Excluded: Part of Cascade Water Alliance (CWA), which is no longer part of the Saving Water Partnership.
2	Bothell, City of	Included.
3	Cedar River Water & Sewer District	Included.
4	Coal Creek Utility District	Included
5	Duvall, City of	Included.
6	Edmonds, City of	Excluded: Participates in Everett's conservation programs.
7	Highline Water District	Included.
8	King County Water District 20	Included.
9	King County Water District 45	Included.
10	King County Water District 49	Included.
11	King County Water District 90	Included.
12	King County Water District 119	Included
13	King County Water District 125	Included.
14	Kirkland, City of	Excluded: Part of CWA.
15	Lake Forest Park, City of	Excluded: SPU provides only backup supply for fire flow.
16	Mercer Island, City of	Included.
17	Northshore Utility District	Included.
18	Olympic View Water & Sewer District	Included.
19	Redmond, City of	Excluded: Part of CWA.
20	Renton, City of	Excluded: SPU only provides supply to Boeing.
21	Shoreline Water District	Included.
22	Skyway Water & Sewer District	Excluded: Part of CWA.
23	Soos Creek Water & Sewer District	Included.
24	Tukwila, City of	Excluded: Part of CWA.
25	Woodinville Water District	Included.

25 total purveyors:17 included in CPA, 5 excluded related to CWA (Cascade Water Alliance), 3 excluded for other reasons.

2.3 Measure Library

The measure library contains information on conservation measures that could be implemented by customers to decrease water use. Conservation measures act on end uses, shifting customers from less efficient to more efficient equipment or behaviors. A measure can be applied only to one sector. Therefore, there are three versions of many measures: one for single family (SF), one for multifamily (MF), and one for non-residential (NR). Currently, the CPA Model is configured to apply all measures to the combined service area.

The conservation measures are listed in Table 3. Each measure is defined in Appendix C. There are 135 measures: 39 for the single family sector, 40 for the multifamily sector, and 56 for the non-residential sector. The table includes the end use the measure acts on.

Table 3 Measure List				
	Sector[1]			
Measure	SF	MF	NR	End Use
Air Cooling			X	Once Through
Boiler Performance Improvement			X	Boilers
Car Wash Low Flow Equipment			X	Vehicle Washing - Business With Own Equipment
Car Wash Recycle Improvement			X	Vehicle Washing - Retail Car Wash
Car Wash Replacement Water			X	Vehicle Washing - Retail Car Wash
Catchment in Detention System			X	Irrigation - Sprinkler In Ground Auto
Catchment in Rain Barrel	X			Irrigation - Hose & Sprinkler
Clotheswasher Efficient Model (Common Area)		X		Clotheswasher - Residential Capacity In Common Area
Clotheswasher Efficient Model (In Unit)	X	X		Clotheswasher - Residential Capacity In Unit
Clotheswasher Efficient Model			X	Clotheswasher - Laundromat
Clotheswasher Eliminate Partial Loads (Common Area)		X		Clotheswasher - Residential Capacity In Common Area
Clotheswasher Eliminate Partial Loads (In Unit)	X	X		Clotheswasher - Residential Capacity In Unit
Clotheswasher Ultra Efficient Model (In Unit)	X	X		Clotheswasher - Residential Capacity In Unit
Cooling Tower Performance Improvement			X	Other Equipment Towers
Dishwasher Efficient Model	X	X		Dishwashing – Machine Residential Capacity
Dishwasher Efficient Model			X	Dishwashing – Machine Commercial Capacity
Dishwasher Eliminate Partial Loads	X	X		Dishwashing – Machine Residential Capacity
Dishwasher Eliminate Partial Loads			X	Dishwashing – Machine Commercial Capacity
Disposal Use Decrease	X	X		Disposal - Residential Capacity
Disposal Use Decrease			X	Disposal - Commercial Capacity
Drip Irrigation	X	X	X	Irrigation - Sprinkler In Ground Auto
Faucet Aerator 0.5 gpm (Bath Flow)			X	Faucet - Bathroom by Flow
Faucet Aerator 1.5 gpm (Bath Flow)	X	X		Faucet - Bathroom by Flow
Faucet Flow Control (Kitchen Flow)			X	Faucet - Kitchen by Flow
Faucet Run Until Hot Recirculate (Bath Flow Customer)			X	Faucet - Bathroom by Flow
Faucet Run Until Hot Recirculate (Bath Flow Employee)			X	Faucet - Bathroom by Flow
Faucet Run Until Hot Recirculate (Bath Flow)	X	X		Faucet - Bathroom by Flow
Faucet Run Until Hot Recirculate (Kitchen Flow Employee)			X	Faucet - Kitchen by Flow
Faucet Run Until Hot Recirculate (Kitchen Flow)	X	X		Faucet - Kitchen by Flow
Faucet Use Decrease (Bath Flow Customer)			X	Faucet - Bathroom by Flow
Faucet Use Decrease (Bath Flow Employee)			X	Faucet - Bathroom by Flow
Faucet Use Decrease (Bath Flow)	X	X		Faucet - Bathroom by Flow
Faucet Use Decrease (Kitchen Flow Employee)			X	Faucet - Kitchen by Flow
Faucet Use Decrease (Kitchen Flow)	X	X		Faucet - Kitchen by Flow
Food Preparation and Washing Improvements			X	Food Processing
Fountain Efficiency	X	X	X	Leaks - Landscape
Hot Tub Use Improvement	X	X	X	Hot Tub
Irrigation Controllers Weather Based	X	X	X	Irrigation - Sprinkler In Ground Auto
Irrigation Scheduling Improvement	X	X	X	Irrigation - Sprinkler In Ground Auto
Irrigation System Performance Improvement	X	X	X	Irrigation - Sprinkler In Ground Auto
Laundry Wash Water Recycle			X	Clotheswasher - Industrial Capacity
Lawn Dormant (Auto)	X	X	X	Irrigation - Sprinkler In Ground Auto
Lawn Dormant (Hose & Sprinkler)	X	X		Irrigation - Hose & Sprinkler
Lawn Dormant (Manual)	X	X		Irrigation - Sprinkler In Ground Manual
Leak Reduction (Cooling)			X	Leaks - Cooling
Leak Reduction (Domestic)	X	X	X	Leaks - Domestic
Leak Reduction (Food Service)			X	Leaks - Food Service
Leak Reduction (Landscape)	X	X	X	Leaks - Landscape
Leak Reduction (Other)			X	Leaks - Other

Table 3 (cont.) Measure List				
	Sector			
Measure	SF	MF	NR	End Use
Leak Reduction (Process)			X	Leaks - Process
Leak Reduction (Recreation)			X	Leaks - Recreation
Plants Low Water Use	X	X	X	Irrigation - Sprinkler In Ground Auto
Process Water Control Improvements (Labs)			X	Laboratories
Process Water Recycle			X	Process Washing
Shower Run Until Hot Recirculate (Employee)			X	Shower
Shower Run Until Hot Recirculate	X	X		Shower
Shower Use Decrease (Customer)			X	Shower
Shower Use Decrease (Employee)			X	Shower
Shower Use Decrease	X	X		Shower
Showerheads 1.5 GPM	X	X	X	Shower
Showerheads 2.0 GPM	X	X	X	Shower
Sidewalk Cleaning by Broom	X	X	X	Sidewalk Washing
Soil Amendment Improvements	X	X	X	Irrigation - Sprinkler In Ground Auto
Soil Moisture Sensors	X	X	X	Irrigation - Sprinkler In Ground Auto
Sprinkler Rain Shutoff	X	X	X	Irrigation - Sprinkler In Ground Auto
Swimming Pool Use Improvement	X	X	X	Pool
Toilet 1.2 GPF	X	X		Toilet
Toilet 1.6 GPF	X	X	X	Toilet
Toilet 1.6 GPF Longlife	X	X	X	Toilet
Toilet Flush Decrease	X	X		Toilet
Toilet Flushes by Rainwater	X	X	X	Toilet
Urinal 0.5 GPF			X	Urinal
Urinal 1.0 GPF			X	Urinal
Urinal Flushes by Rainwater			X	Urinal
Urinal No Water			X	Urinal
Water Use Alerting	X	X	X	Leaks - Domestic
Total	39	40	56	

1. SF = single family; MF = multifamily; NR = non-residential.

For each conservation measure, the measure library contains information on estimated water savings, customer acceptance, costs, and other issues. Sources for this information include extensive input from SPU conservation staff, the original 1998 CPA Report, and local and national conservation research.

Measures were identified and included in the CPA Model based on four criteria: 1) no measure can negatively impact customer satisfaction or service; 2) all measures must provide reliable water savings; 3) measures must be proven in the marketplace; 4) the measures must meet regulatory or code requirements, where applicable. Some of the measures from the 1998 CPA Report were omitted from the CPA Model because they did not meet these four criteria or it was discovered since 1998 that they had significant implementation barriers (code or legislative restrictions, operation and maintenance issues, etc).

2.4 Measure Packaging Analysis

The CPA Model analyzes combinations of multiple conservation measures, using the measure packaging analysis. The measure packaging analysis allows for two main functions during a packaging optimization process. First, multiple measures can be simultaneously analyzed. Second, marketing costs can be shared among measures, when appropriate. In many cases, measures would be implemented together, which would reduce marketing costs since those costs would be shared across multiple measures. The measure packaging analysis pulls data from both the water balance and measure library described above.

Package optimization is the process by which the CPA Model generates 11 “package intensities”, representing the range of all possible packages from the lowest to the highest marginal cost. The lowest marginal cost package intensity will generally contain only one measure. The package intensities with higher marginal costs spend greater portions of their marketing budgets, allowing more measures to be included.

Each package intensity has a different quantity of savings, annual cost, and marginal cost. If the goal is to save a certain amount of water, then the package intensity with savings closest to the savings goal would be selected. If the goal is to match an annual budget, then the package intensity with the budget closest to the budget goal would be selected. If the goal is to stay under a certain marginal cost, then the package intensity with the marginal cost closest to the marginal cost goal would be selected.

For a detailed description of the package optimization process, please refer to the CPA Users Guide.

Section 3
CPA Analysis Results

3.1 Packages Description Overview

Seven packages were analyzed for this report, using the Measure Packaging Analysis process previously described. Table 4 shows the following selected aspects for each of the seven packages: the associated water balance; the applicable years; the maximum percent of the direct cost paid by SPU (i.e., the rebate); the savings goal; and, the measures included. Packages #2 - #7 each build on the Commitments Through 2010 package, which mean their savings are above and beyond the savings obtained by the Commitments Through 2010 package.

<table>
<tr><th colspan="6">Table 4
Packages Analyzed</th></tr>
<tr><th>Package Name</th><th>Water Balance</th><th>Applicable Years</th><th>Maximum % of Direct Cost Paid by SPU</th><th>Savings Goal</th><th>Measures Included</th></tr>
<tr><td>1. Commitments Through 2010</td><td>Master Water Balance With Code</td><td>2006-2010</td><td>50%</td><td>Approximately 9 mgd peak</td><td>All</td></tr>
<tr><td>2. Drivers Analysis “Awareness”</td><td rowspan="3">Master Water Balance With Commitments Through 2010</td><td rowspan="3">2011-2030</td><td rowspan="3">50%</td><td>Approximately 13 mgd annual</td><td>Behavior oriented</td></tr>
<tr><td>3. Drivers Analysis “Shave the Peak”</td><td>Approximately 3 mgd annual</td><td>End uses that peak sharply</td></tr>
<tr><td>4. Drivers Analysis “Varying Intensity”</td><td>Range of approximately 15-25 mgd annual</td><td>All</td></tr>
<tr><td>5. Technical Potential “Regular”</td><td rowspan="3">Master Water Balance With Commitments Through 2010</td><td>2011-2030</td><td rowspan="3">100%</td><td rowspan="3">Technical Potential</td><td rowspan="3">All</td></tr>
<tr><td>6. Technical Potential “Ends Early”</td><td>2011-2020</td></tr>
<tr><td>7. Technical Potential “ Late Start”</td><td>2021-2030</td></tr>
</table>

There are three main categories of packages, each used for a particular purpose.

The first package category is the Commitments Through 2010 package, which is the package that best represents the conservation commitments SPU and wholesale customers have made through 2010 including the 1% Water Conservation Program and savings requirements from the I-63 SO. Since this package begins prior to 2010, the Master Water Balance With Code is used in order to exclude savings anticipated from SPU’s 2006 through 2010 conservation commitments. The package was run for five years from 2006 through 2010. The Maximum Percent of Direct Cost Paid by SPU is 50%, to reflect the fact that SPU generally only pays a portion of the direct cost and expects the customer to cost-share with the utility. All measures are analyzed for this package.

The second package category is the Drivers Analysis packages, which represent the alternatives for the baseline level of conservation SPU expects to pursue beyond 2010 and include in its demand forecast. There are three versions of the Driver's Analysis package. The first version, "Awareness", is considered the minimal level of investment and analyzes only behavior oriented measures. The second version, "Shave the Peak", is aimed at reducing the peak season demand and analyzes only measures for end uses that peak sharply in the summer months. The third version, "Varying Intensity", analyzes all measures. All three versions run for 20 years from 2011 through 2030. Since these packages begin after 2010, they use the Master Water Balance Commitments Through 2010 in order to capture the savings anticipated by 2010. The Maximum Percent of Direct Cost Paid by SPU is 50%, to reflect the fact that SPU generally only pays a portion of the direct cost and expects the customer to cost-share with the utility.

The third package category contains the Technical Potential packages, which represent savings beyond that included in the demand forecast, savings which can be considered for future supply alongside traditional supply alternatives in SPU's water supply planning model. These packages are in some ways similar to the packages analyzed in the 1998 CPA Report. However, the reader is cautioned not to compare these results directly to the 1998 CPA Report, since many of the underlying assumptions have changed. There are three versions of these packages, each running for a different time period. The first version, Technical Potential "Regular", runs 20 years from 2011 through 2030. The second version, "Technical Potential Ends Early", runs 10 years from 2011 through 2020. The third version, Technical Potential "Late Start", runs 10 years from 2021 through 2030. Since these packages begin after 2010, they use the Master Water Balance Commitments Through 2010 in order to reflect the savings anticipated by 2010. The Maximum Percent of Direct Cost Paid by SPU is 100%, since the intent is to determine the technical potential, regardless of whether SPU or the customer pays the cost.

It may be helpful to explain the term "technical potential" since it is a common, but sometimes misinterpreted, term. The term does not mean the absolute highest level of conceivable savings. Rather, it is the highest *reasonable and achievable* level of savings attainable, given parameters such as customer acceptance and fiscal responsibility.

The results for the seven analyzed packages are presented in the following sections. For each package, the 11 package intensities resulting from the CPA Model's package optimization process are provided. As discussed in Section 2.4, the 11 package intensities represent all possible package intensities ranging from the lowest to the highest marginal cost. The lowest marginal cost package intensity will generally contain only one measure. The package intensities with higher marginal costs have more measures that spend greater portions of their marketing budgets. More detailed information is provided for two packages with wide applications, Commitments Through 2010 and Technical Potential "Regular."

3.2 Commitments Through 2010 Package

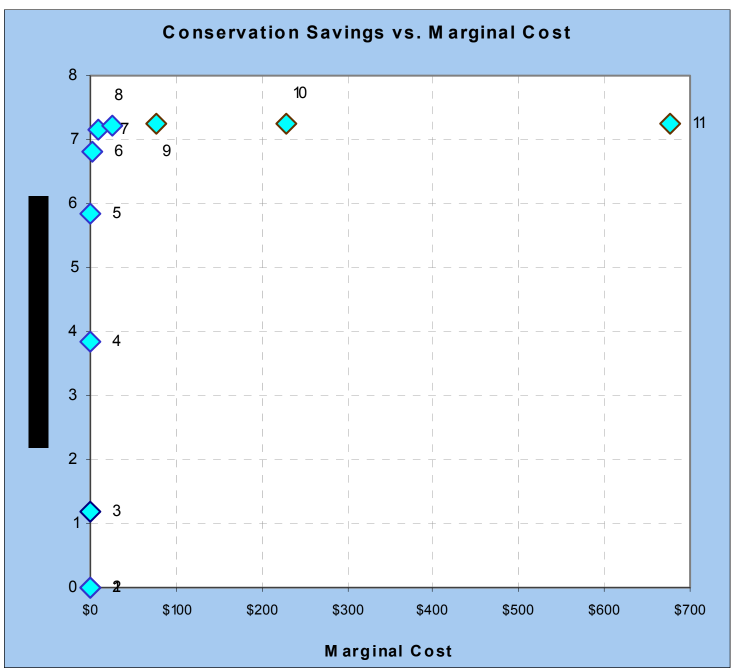
This package category best represents the conservation commitments SPU and wholesale customers have made through 2010 including the 1% Water Conservation Program and savings requirements from the I-63 SO. The 11 package intensities for the Commitments Through 2010 package are shown in Table 5 and plotted in Figure 3. Package intensity #6, which is shaded in the table, was chosen to best represent the package since it achieves nearly the requisite volume of savings, and does so at acceptable annual and marginal costs. By 2010, package intensity #6 achieves 6.81 mgd of savings on an average annual basis and 8.27 mgd on a peak season basis. The utility average annual cost from 2006 through 2010, which includes all utility costs such as overhead, marketing, and rebates, is $4,150,303. Costs used herein are represented in 2005 dollars. The marginal cost, which is the cost of the last unit of water saved, is $2.99 per 100 cubic feet (ccf).

Table 5
Commitments Through 2010
Package Intensities

Intensity	Annual Savings (mgd)[1]	Peak Season Savings (mgd)[1]	Utility Average Annual Cost	Marginal Cost Per ccf[2]
1	0.01	0.01	$20,092	$0.01
2	0.01	0.01	$20,092	$0.04
3	1.19	1.19	$220,452	$0.12
4	3.86	4.87	$863,981	$0.34
5	5.85	6.99	$3,078,706	$1.01
6	6.81	8.27	$4,150,303	$2.99
7	7.17	8.75	$4,924,509	$8.84
8	7.23	8.84	$5,294,060	$26.14
9	7.25	8.87	$5,415,977	$77.33
10	7.249	8.875	$5,462,627	$228.74
11	7.250	8.875	$5,476,577	$676.64

Shaded row is the package intensity chosen to best represent this package.
1. mgd = million gallons per day
2. ccf = 100 cubic feet

Figure 3
Commitments Through 2010
Package Intensities



The labels next to each data point represent the package intensity.

Details for the measures in package intensity #6 are shown in Table 6, including the average annual savings, the peak season savings, and the utility average annual cost. The table is sorted alphabetically by measure name.

Table 6 Commitments Through 2010 Package Intensity #6 Details			
Measure Name	Annual Savings (mgd)	Peak Season Savings (mgd)	Utility Average Annual Cost
Air Cooling CNR	.1083	.1083	$58,400
Car Wash Low Flow Equip CNR	.0137	.0137	$10,447
Car Wash Recycle Improvement CNR	.019	.019	$12,667
Car Wash Replacement Water CNR	.0238	.0238	$22,667
Clotheswasher Efficient Model (Common Area) CMF	.0807	.0807	$48,150
Clotheswasher Efficient Model CNR	.0177	.0177	$20,100
Clotheswasher Efficient Model CSF	.055	.055	$173,260
Clotheswasher Eliminate Loads (Common Area) CMF	.0574	.0574	$11,100
Clotheswasher Eliminate Loads (In Unit) CMF	.1694	.1694	$11,100
Clotheswasher Eliminate Partial Loads CSF	.3096	.3096	$12,000
Clotheswasher Ultra Efficient Model CSF	.3375	.3375	$554,575
Cooling Tower Performance Improvement CNR	.0117	.0233	$12,000
Dishwasher Efficient Model CNR	.1609	.1609	$145,983
Dishwasher Eliminate Partial Loads CMF	.009	.009	$11,100
Dishwasher Eliminate Partial Loads CNR	.1128	.1128	$10,833
Dishwasher Eliminate Partial Loads CSF	.013	.013	$12,000
Disposal Use Decrease CMF	.0197	.0197	$17,500
Disposal Use Decrease CNR	.2236	.2236	$10,000
Disposal Use Decrease CSF	.0643	.0643	$21,500
Faucet Aerator 0.5 gpm (Bath Flow) CNR	.0641	.0641	$19,897
Faucet Aerator 1.5 gpm (Bath Flow) CMF	.0785	.0785	$30,383
Faucet Aerator 1.5 gpm (Bath Flow) CSF	.1321	.1321	$41,408
Faucet Flow Control (Kitchen Flow) - CNR	.03	.03	$15,900
Faucet Use Decrease (Bath Flow C) CNR	.0007	.0007	$8,501
Faucet Use Decrease (Bath Flow E) CNR	.0018	.0018	$8,510
Faucet Use Decrease (Bath Flow) CMF	.0869	.0869	$11,100
Faucet Use Decrease (bath Flow) CSF	.1236	.1236	$12,000
Faucet Use Decrease (Kitchen Flow E) CNR	.0013	.0013	$8,500
Faucet Use Decrease (Kitchen Flow) CMF	.0333	.0333	$11,100
Faucet Use Decrease (Kitchen Flow) CSF	.0245	.0245	$12,000
Food Preparation and Washing Improvements CNR	.227	.227	$10,833
Laundry Wash Water Recycle CNR	.0122	.0122	$20,500
Lawn Dormant (Auto) CMF	.02	.0598	$22,500
Lawn Dormant (Auto) CNR	.0517	.1546	$32,500
Lawn Dormant (Auto) CSF	.1051	.3143	$20,833
Lawn Dormant (Hose & Sprinkler) CSF	.363	1.0855	$20,833
Lawn Dormant (Man) CSF	.1154	.3452	$20,833
Leak Reduction (Domestic) CMF	.0115	.0115	$33,293
Leak Reduction (Domestic) CNR	.0166	.0166	$26,160
Leak Reduction (Domestic) CSF	.2959	.2959	$88,650
Leak Reduction (Process) CNR	.1089	.1089	$17,600

Table 6 (cont.) Commitments Through 2010 Package Intensity #6 Details			
Measure Name	**Annual Savings (mgd)**	**Peak Season Savings (mgd)**	**Utility Average Annual Cost**
Process Water Control Improve (Labs) CNR	.0297	.0297	$25,000
Process Water Recycle CNR	.0135	.0135	$20,000
Shower Use Decrease CMF	.2179	.2179	$27,500
Shower Use Decrease CSF	.2757	.2757	$30,000
Showerheads 1.5 GPM CMF	.1014	.1014	$34,526
Showerheads 1.5 GPM CNR	.0062	.0062	$9,782
Showerheads 1.5 GPM CSF	.153	.153	$38,076
Showerheads 2.0 GPM CMF	.0765	.0765	$44,049
Showerheads 2.0 GPM CNR	.0041	.0041	$9,809
Showerheads 2.0 GPM CSF	.0907	.0907	$48,323
Sidewalk Cleaning by Broom CSF	.0081	.0163	$13,500
Swimming Pool Use Improvement CNR	.0071	.0212	$9,000
Swimming Pool Use Improvement CSF	.0625	.1868	$19,500
Toilet 1.6 gpf Longlife CMF	.3288	.3288	$581,279
Toilet 1.6 gpf Longlife CNR	.2292	.2292	$283,177
Toilet 1.6 gpf Longlife CSF	.6221	.6221	$1,121,720
Toilet Flush Decrease CMF	.189	.189	$27,500
Toilet Flush Decrease CSF	.5786	.5786	$30,000
Urinal 0.5 GPF CNR	.072	.072	$12,000
Urinal 1.0 GPF CNR	.0248	.0248	$83,201
Urinal No Water CNR	.0095	.0095	$13,144
Total	**6.81**	**8.27**	**$4,150,303**

The pie charts in Figures 4 through 6 provide useful characterization of package intensity #6. As shown in Figure 3, slightly over half of the savings, 55%, are attributed to the single family sector, 22% to multifamily, and 24% to non residential. As shown in Figure 5, the majority of the savings, 88%, are derived from indoor measures, while 12% are from outdoor measures. As shown in Figure 6, the majority of the savings, 89%, are associated with measures without strong peaking characteristics, while 11% are from measures that save water primarily during periods of peak demand. These findings using the CPA Model are consistent with SPU's empirical experience that recent program savings, and expected savings through 2010, are primarily obtained through residential indoor- and hardware oriented programs.

Figure 4
Commitments Through 2010
Package Intensity #6 Sector Savings

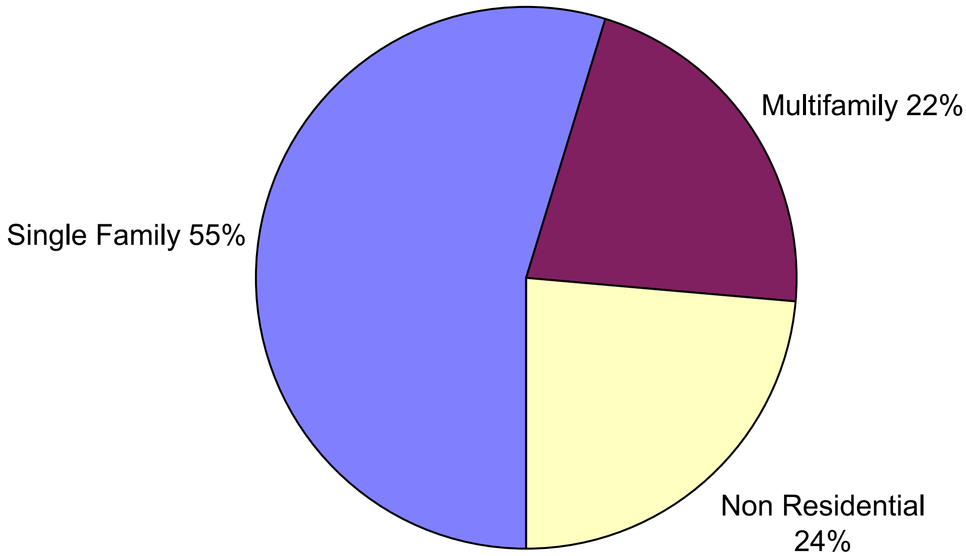


Figure 5
Commitments Through 2010
Package Intensity #6
Indoor vs Outdoor Savings

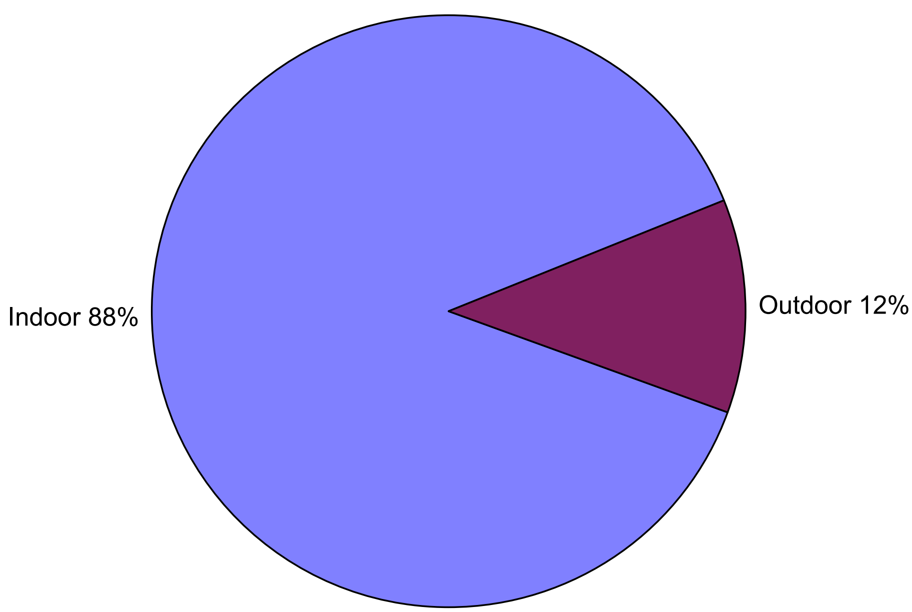
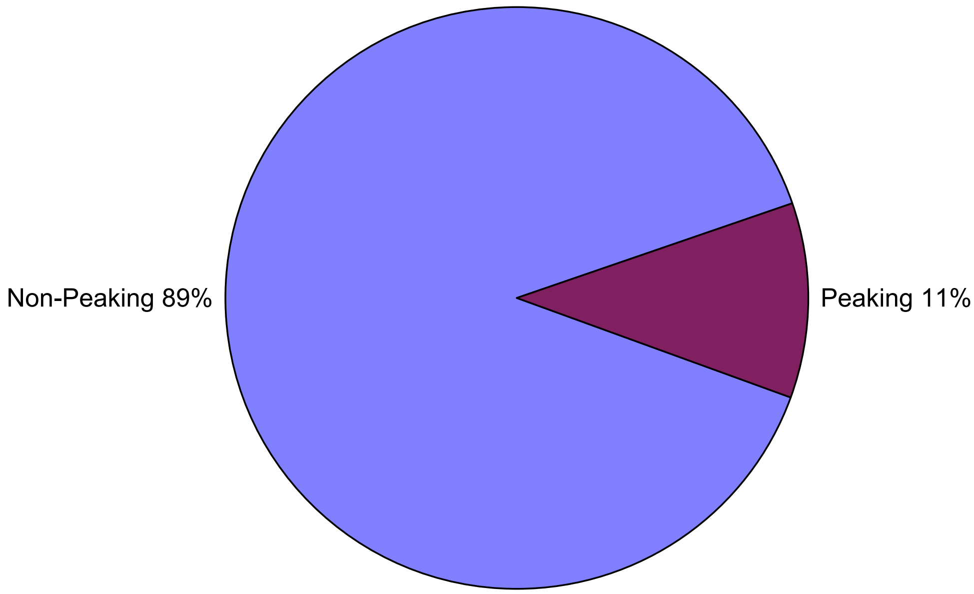


Figure 6
Commitments Through 2010
Package Intensity #6
Savings from Peaking and Non-Peaking Measures



3.3 Drivers Analysis Packages

3.3.1 Awareness Package

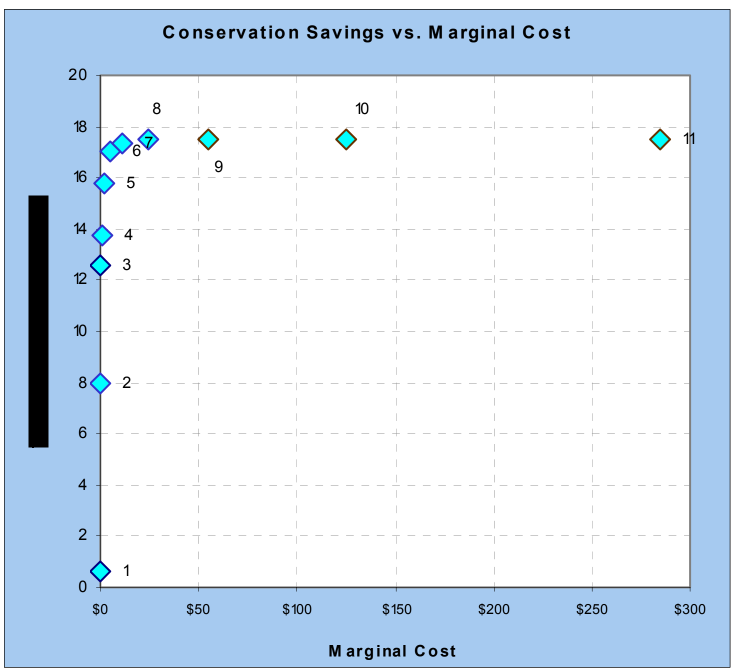
This section contains results for the Drivers Analysis "Awareness" package model run. This run is considered the minimum level of investment and analyzes only behavior-oriented measures (not hardware measures). The 11 package intensities are shown in Table 7 and plotted in Figure 7. Package intensity #4, which is shaded in the table, was chosen to best represent the package since it was determined to provide adequate savings at a reasonable cost and comes just before a jump in the marginal cost. By 2030, package intensity #4 achieves 13.79 mgd of savings on an average annual basis and 18.48 mgd on a peak season basis. The utility average annual cost from 2011 through 2030, which includes all utility costs such as overhead, marketing, and rebates, is $404,972. The marginal cost, which is the cost of the last unit of water saved, is $0.91 per ccf.

Table 7
Drivers Analysis "Awareness"
Package Intensities

Intensity	Annual Savings (mgd)[1]	Peak Season Savings (mgd)[1]	Utility Average Annual Cost	Marginal Cost Per ccf[2]
1	0.60	0.60	$34,000	$0.08
2	8.00	11.62	$208,500	$0.18
3	12.57	16.74	$338,509	$0.40
4	13.79	18.48	$404,972	$0.91
5	15.75	21.63	$596,852	$2.08
6	17.06	23.65	$853,586	$4.72
7	17.35	24.13	$989,029	$10.70
8	17.47	24.36	$1,083,367	$24.30
9	17.52	24.47	$1,131,093	$55.17
10	17.530	24.482	$1,160,190	$125.24
11	17.531	24.484	$1,173,217	$284.33

Shaded row is the package intensity chosen to best represent this package.
1. mgd = million gallons per day
2. ccf = 100 cubic feet

Figure 7
Drivers Analysis "Awareness"
Package Intensities



The labels next to each data point represent the package intensity.

3.3.2 "Shave the Peak" Package

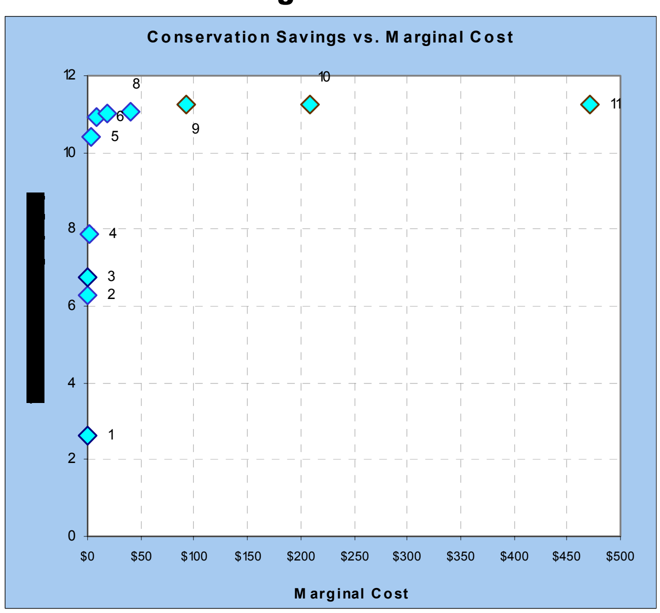
This section contains results for the Drivers Analysis "Shave the Peak" package model run. This run is aimed at reducing peak season demand, and analyzes only measures for end uses that peak sharply in the summer months. The 11 package intensities are shown in Table 8 and plotted in Figure 8. Package intensities #4 and #5, which are shaded in the table, were chosen to best represent reasonable savings just prior to a significant increase in the marginal cost. Their savings on an average annual basis range from 2.63 mgd to 3.49 mgd by 2030. Their savings on a peak season basis range from 7.86 mgd to 10.40 mgd by 2030. Their utility average annual costs from 2011 through 2030, which includes all utility costs such as overhead, marketing, and rebates, range from $90,000 to $308,174. Their marginal costs, which is the cost of the last unit of water saved, range from $1.54 per ccf to $3.49 per ccf.

Table 8
Drivers Analysis "Shave the Peak"
Package Intensities

Intensity	Annual Savings (mgd)[1]	Peak Season Savings (mgd)[1]	Utility Average Annual Cost	Marginal Cost Per ccf[2]
1	0.88	2.64	$32,500	$0.13
2	2.10	6.27	$47,500	$0.30
3	2.26	6.77	$52,500	$0.68
4	2.63	7.86	$90,000	$1.54
5	3.49	10.40	$308,174	$3.49
6	3.69	10.93	$379,949	$7.90
7	3.72	11.00	$402,537	$17.91
8	3.75	11.08	$432,175	$40.56
9	3.80	11.23	$461,675	$91.90
10	3.805	11.238	$468,675	$208.20
11	3.806	11.240	$472,675	$471.67

Shaded rows are the package intensities chosen to best represent this package.
1. mgd = million gallons per day
2. ccf = 100 cubic feet

Figure 8
Drivers Analysis "Shave the Peak"
Package Intensities



The labels next to each data point represent the package intensity.

3.3.3 "Varying Intensity" Package

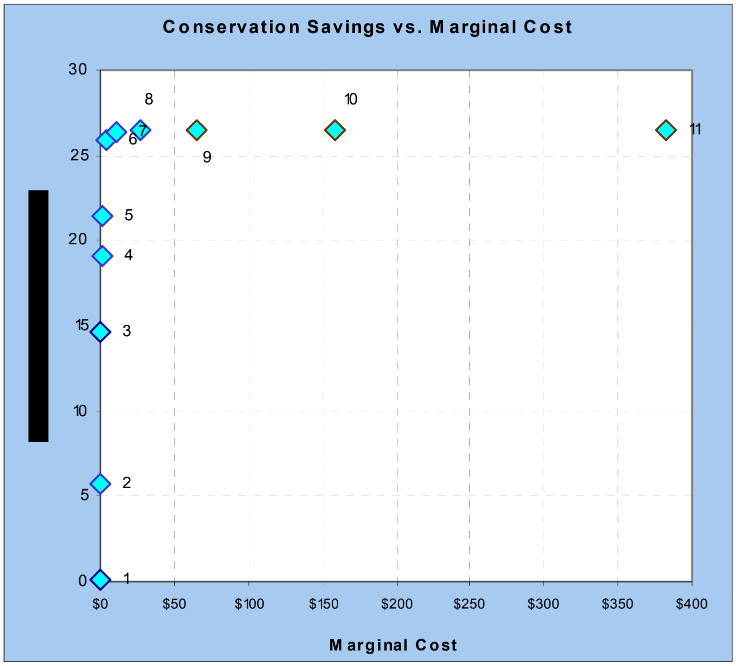
This section contains results for the Drivers Analysis "Varying Intensity" package model run. This run analyzes all measures. The 11 package intensities are shown in Table 9 and plotted in Figure 9. Package intensities #3 - #6, which are shaded in the table, were selected as they represent significant savings just prior to a large increase in the marginal cost. Their savings on an average annual basis range from 14.68 to 25.85 mgd by 2030. Their savings on a peak season basis range from 18.85 to 32.55 mgd by 2030. Their utility average annual costs from 2011 through 2030, which includes all utility costs such as overhead, marketing, and rebates, range from $654,475 to $3,945,075. Their marginal costs, which is the cost of the last unit of water saved, range from $0.33 per ccf to $4.63 per ccf.

Table 9
Drivers Analysis "Varying Intensity"
Package Intensities

Intensity	Annual Savings (mgd)[1]	Peak Season Savings (mgd)[1]	Utility Average Annual Cost	Marginal Cost Per ccf[2]
1	0.12	0.12	$10,500	$0.06
2	5.72	7.48	$171,500	$0.14
3	14.68	18.85	$654,475	$0.33
4	19.05	23.75	$1,497,562	$0.79
5	21.44	27.22	$2,689,353	$1.91
6	25.85	32.55	$3,945,075	$4.63
7	26.31	33.19	$4,351,794	$11.19
8	26.47	33.49	$4,625,248	$27.06
9	26.49	33.54	$4,699,279	$65.42
10	26.495	33.546	$4,730,252	$158.17
11	26.496	33.549	$4,746,097	$382.45

Shaded rows are the package intensities chosen to best represent this package.
1. mgd = million gallons per day
2. ccf = 100 cubic feet

Figure 9
Drivers Analysis "Varying Intensity"
Package Intensities



The labels next to each data point represent the package intensity.

3.4 Technical Potential Packages

3.4.1 Technical Potential "Regular" Package

The 11 package intensities for the Technical Potential "Regular" package are shown in Table 10 and plotted in Figure 10. This package runs from 2011 through 2030. Package intensity #6, which is shaded in the table, was chosen to best represent the package since it achieves a high volume of savings, and does so at acceptable annual and marginal costs. Beyond package intensity #6, the marginal cost is higher than what might be considered fiscally responsible to pursue. Package intensity #6 achieves 34.17 mgd of savings on an average annual basis and 45.96 mgd on a peak season basis by 2030. The utility average annual cost from 2011 through 2030, which includes all utility costs such as overhead, marketing, and rebates, is $16,315,798. The marginal cost, which is the cost of the last unit of water saved, is $20.78 per ccf.

Details for the measures in package intensity #6 are shown in Table 11, including the average annual savings, the peak season savings, and the utility average annual cost. The table is sorted alphabetically by measure name. The list allows for a comparison to the Commitments Through 2010 package to show where the Technical Potential "Regular" package achieves additional conservation. The additional savings come from three sources. First, through higher participation in the same measures due to paying a 100%

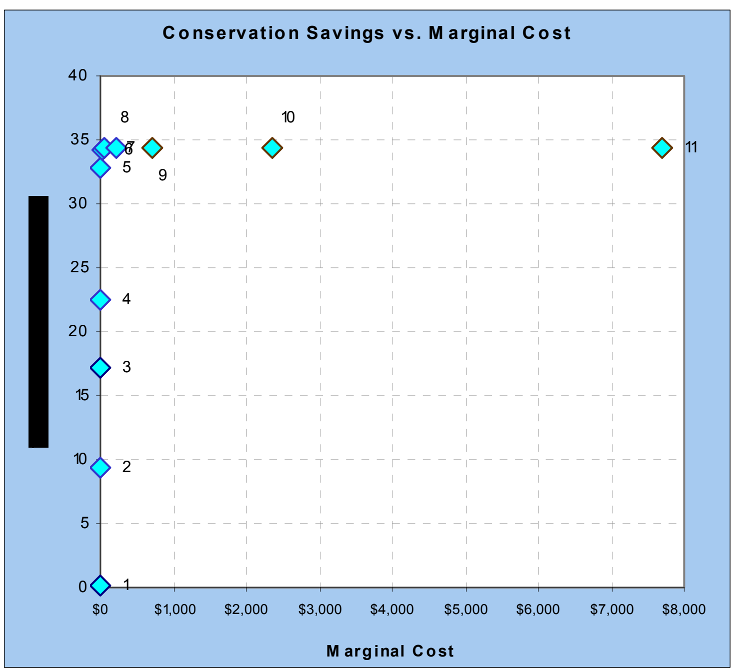
rebate. Second, from the same measures applied to new customers built after 2010. Third, from employing additional measures in all three sectors.

Table 10
Technical Potential "Regular"
Package Intensities

Intensity	Annual Savings (mgd)[1]	Peak Season Savings (mgd)[1]	Utility Average Annual Cost	Marginal Cost Per ccf[2]
1	0.12	0.12	$10,500	$0.06
2	9.41	13.03	$324,166	$0.18
3	17.24	21.74	$1,171,962	$0.60
4	22.48	28.70	$4,726,665	$1.95
5	32.74	44.21	$11,944,137	$6.36
6	34.17	45.96	$16,315,798	$20.78
7	34.34	46.27	$16,904,361	$67.84
8	34.36	46.33	$17,251,768	$221.50
9	34.37	46.33	$17,368,097	$723.23
10	34.366	46.336	$17,393,489	$2,361.41
11	34.366	46.336	$17,396,666	$7,710.23

Shaded row is the package intensity chosen to best represent this package.
1. mgd = million gallons per day
2. ccf = 100 cubic feet

Figure 10
Technical Potential "Regular"
Package Intensities



The labels next to each data point represent the package intensity.

Table 11 Technical Potential "Regular" Package Intensity #6 Details			
Measure Name	Annual Savings (mgd)	Peak Season Savings (mgd)	Utility Average Annual Cost
Air Cooling CNR	.5158	.5158	$144,433.33
Boiler Performance Improvement CNR	.0641	.0641	$28,053.56
Car Wash Low Flow Equip CNR	.0663	.0663	$11,356.73
Car Wash Recycle Improvement CNR	.0734	.0734	$16,083.33
Car Wash Replacement Water CNR	.1366	.1366	$53,333.33
Catchment in Detention System CNR	.0582	.1741	$19,950.00
Catchment in Rain Barrel CSF	.3327	.9949	$130,686.67
Clotheswasher Efficient Model (Common Area) CMF	.3516	.3516	$69,958.82
Clotheswasher Efficient Model (In Unit) CMF	.32	.32	$199,880.35
Clotheswasher Efficient Model CNR	.0703	.0703	$25,698.97
Clotheswasher Efficient Model CSF	.5883	.5883	$331,147.79
Clotheswasher Eliminate Loads (Common Area) CMF	.2983	.2983	$11,500.00
Clotheswasher Eliminate Loads (In Unit) CMF	.9006	.9006	$11,500.00
Clotheswasher Eliminate Partial Loads CSF	1.0738	1.0738	$12,500.00
Clotheswasher Ultra Efficient Model (In Unit) CMF	1.27	1.27	$977,086.33
Clotheswasher Ultra Efficient Model CSF	2.2581	2.2581	$1,448,095.61
Cooling Tower Performance Improvement CNR	.0589	.1178	$10,833.33
Dishwasher Efficient Model CMF	.1305	.1305	$216,085.31
Dishwasher Efficient Model CNR	.8619	.8619	$351,073.78
Dishwasher Efficient Model CSF	.1882	.1882	$304,796.15
Dishwasher Eliminate Partial Loads CMF	.0475	.0475	$11,500.00
Dishwasher Eliminate Partial Loads CNR	.5076	.5076	$10,000.00
Dishwasher Eliminate Partial Loads CSF	.0496	.0496	$12,500.00
Disposal Use Decrease CMF	.1225	.1225	$23,500.00
Disposal Use Decrease CNR	1.0703	1.0703	$10,000.00
Disposal Use Decrease CSF	.2515	.2515	$25,500.00
Drip Irrigation CMF	.0429	.1281	$39,410.25
Drip Irrigation CNR	.0649	.1941	$76,483.62
Drip Irrigation CSF	.0903	.2699	$149,867.67
Faucet Aerator 0.5 gpm (Bath Flow) CNR	.0532	.0532	$20,405.50
Faucet Aerator 1.5 gpm (Bath Flow) CMF	.3767	.3767	$44,759.57
Faucet Aerator 1.5 gpm (Bath Flow) CSF	.4623	.4623	$56,777.17
Faucet Flow Control (Kitchen Flow) - CNR	.1494	.1494	$19,500.00
Faucet Run Til Hot Recirc (Bath Flow Cust) CNR	.0018	.0018	$9,854.15
Faucet Run Til Hot Recirc (Bath Flow Employ) CNR	.005	.005	$11,266.77
Faucet Run Til Hot Recirc (Bath Flow) CMF	.083	.083	$110,409.97
Faucet Run Til Hot Recirc (Bath Flow) CSF	.0541	.0541	$137,289.16

Table 11 (cont.) Technical Potential "Regular" Package Intensity #6 Details			
Measure Name	Annual Savings (mgd)	Peak Season Savings (mgd)	Utility Average Annual Cost
Faucet Run Til Hot Recirc (Kitchen Flow E) CNR	.0036	.0036	$9,767.14
Faucet Run Til Hot Recirc (Kitchen Flow) CMF	.0627	.0627	$142,294.40
Faucet Run Til Hot Recirc (Kitchen Flow) CSF	.0328	.0328	$148,664.43
Faucet Use Decrease (Bath Flow C) CNR	.0049	.0049	$9,835.47
Faucet Use Decrease (Bath Flow E) CNR	.0133	.0133	$9,863.00
Faucet Use Decrease (Bath Flow) CMF	.4265	.4265	$11,500.00
Faucet Use Decrease (bath Flow) CSF	.4368	.4368	$12,500.00
Faucet Use Decrease (Kitchen Flow E) CNR	.0095	.0095	$9,833.33
Faucet Use Decrease (Kitchen Flow) CMF	.1705	.1705	$11,500.00
Faucet Use Decrease (Kitchen Flow) CSF	.0896	.0896	$12,500.00
Food Preparation and Washing Improvements CNR	1.1176	1.1176	$10,000.00
Hot Tub Use Improvement CNR	.0123	.0123	$13,500.00
Hot Tub Use Improvements CSF	.1185	.1185	$21,500.00
Irrigation Controllers Weather Based CMF	.0341	.1019	$20,183.63
Irrigation Controllers Weather Based CNR	.0516	.1544	$28,188.73
Irrigation Controllers Weather Based CSF	.0729	.218	$38,083.83
Irrigation Scheduling Improvement CMF	.0797	.2383	$76,245.61
Irrigation Scheduling Improvement CNR	.2058	.6153	$188,545.98
Irrigation Scheduling Improvement CSF	.1678	.5017	$238,159.23
Irrigation System Performance Improvement CMF	.0507	.1514	$107,151.43
Irrigation System Performance Improvement CNR	.0767	.2294	$291,308.99
Irrigation System Performance Improvement CSF	.1076	.3217	$393,001.41
Laundry Wash Water Recycle CNR	.0702	.0702	$29,074.85
Lawn Dormant (Auto) CMF	.1968	.5884	$12,500.00
Lawn Dormant (Auto) CNR	.2974	.8893	$12,500.00
Lawn Dormant (Auto) CSF	.4534	1.3555	$11,666.67
Lawn Dormant (Hose & Sprinkler) CMF	.0204	.0611	$12,500.00
Lawn Dormant (Hose & Sprinkler) CSF	1.4905	4.4566	$11,666.67
Lawn Dormant (Man) CMF	.0147	.0441	$12,500.00
Lawn Dormant (Man) CSF	.4949	1.4796	$11,666.67
Leak Reduction (Cooling) CNR	.0359	.0359	$22,455.76
Leak Reduction (Domestic) CMF	.0734	.0734	$32,401.82
Leak Reduction (Domestic) CNR	.1138	.1138	$49,651.44
Leak Reduction (Domestic) CSF	1.1931	1.1931	$118,634.05
Leak Reduction (Food Service) CNR	.0286	.0286	$25,077.60
Leak Reduction (Other) CNR	.0247	.0247	$23,243.92
Leak Reduction (Process) CNR	.5389	.5389	$23,161.47
Plants Low Water Use CMF	.1753	.5241	$155,390.00

Table 11 (cont.) Technical Potential "Regular" Package Intensity #6 Details			
Measure Name	Annual Savings (mgd)	Peak Season Savings (mgd)	Utility Average Annual Cost
Plants Low Water Use CNR	.2652	.7929	$291,515.00
Plants Low Water Use CSF	.4019	1.2016	$515,686.67
Process Water Control Improve (Labs) CNR	.1487	.1487	$36,730.46
Process Water Recycle CNR	.0925	.0925	$44,000.00
Shower Run Til Hot Recirculate (Employ) CNR	.0014	.0014	$9,594.96
Shower Run Til Hot Recirculate CMF	.1519	.1519	$180,766.34
Shower Run Til Hot Recirculate CSF	.0322	.0322	$50,704.64
Shower Use Decrease CMF	1.0929	1.0929	$32,500.00
Shower Use Decrease CSF	.9592	.9592	$32,500.00
Showerheads 1.5 GPM CMF	.5614	.5614	$48,966.80
Showerheads 1.5 GPM CNR	.0303	.0303	$9,807.19
Showerheads 1.5 GPM CSF	.6343	.6343	$47,029.36
Showerheads 2.0 GPM CMF	.4094	.4094	$67,149.71
Showerheads 2.0 GPM CNR	.0204	.0204	$9,856.04
Showerheads 2.0 GPM CSF	.37	.37	$63,158.06
Sidewalk Cleaning by Broom CSF	.0535	.1071	$21,500.00
Soil Amendment Improvements CNR	.0451	.1348	$139,400.00
Soil Amendment Improvements CSF	.0542	.1621	$172,216.67
Soil Moisture Sensors CMF	.0292	.0874	$28,750.24
Soil Moisture Sensors CNR	.0443	.1323	$47,511.62
Soil Moisture Sensors CSF	.0433	.1296	$51,271.27
Sprinkler Rain Shutoff CMF	.0146	.0437	$15,025.38
Sprinkler Rain Shutoff CNR	.0221	.0662	$20,088.74
Sprinkler Rain Shutoff CSF	.0217	.0648	$28,085.62
Swimming Pool Use Improvement CNR	.061	.1825	$11,500.00
Swimming Pool Use Improvement CSF	.2867	.8573	$25,500.00
Toilet 1.6 gpf Longlife CMF	.3726	.3726	$787,939.00
Toilet 1.6 gpf Longlife CNR	.2376	.2376	$334,676.50
Toilet 1.6 gpf Longlife CSF	.6989	.6989	$1,583,150.00
Toilet Flush Decrease CMF	.9474	.9474	$32,500.00
Toilet Flush Decrease CSF	1.9137	1.9137	$32,500.00
Toilet Flushes by Rainwater CNR	.0975	.0975	$477,500.00
Toilet Flushes by Rainwater CSF	.6284	.6284	$2,741,000.00
Urinal 0.5 GPF CNR	.3281	.3281	$11,250.00
Urinal 1.0 GPF CNR	.0211	.0211	$95,139.00
Urinal Flushes by Rainwater CNR	.05	.05	$252,250.00
Urinal No Water CNR	.05	.05	$14,383.00
Water Use Alerting CMF	.0502	.0502	$39,455.67
Water Use Alerting CNR	.1134	.1134	$82,550.89
Water Use Alerting CSF	1.1931	1.1931	$319,394.02
Total	**34.17**	**45.96**	**$16,315,798**

The pie charts in Figures 11 through 13 provide useful characterization of package intensity #6. As shown in Figure 11, approximately half of the savings, 51%, are attributed to the single family sector, 26% to multifamily, and 23% to non residential. As shown in Figure 12, the majority of the savings, 81%, are derived from indoor measures, while 19% are from outdoor measures. As shown in Figure 13, the majority of the savings, 83%, are associated with non-peaking measures, while 17% are from measures that are associated with peak water uses.

Figure 11
Technical Potential "Regular"
Package Intensity #6
Sector Savings

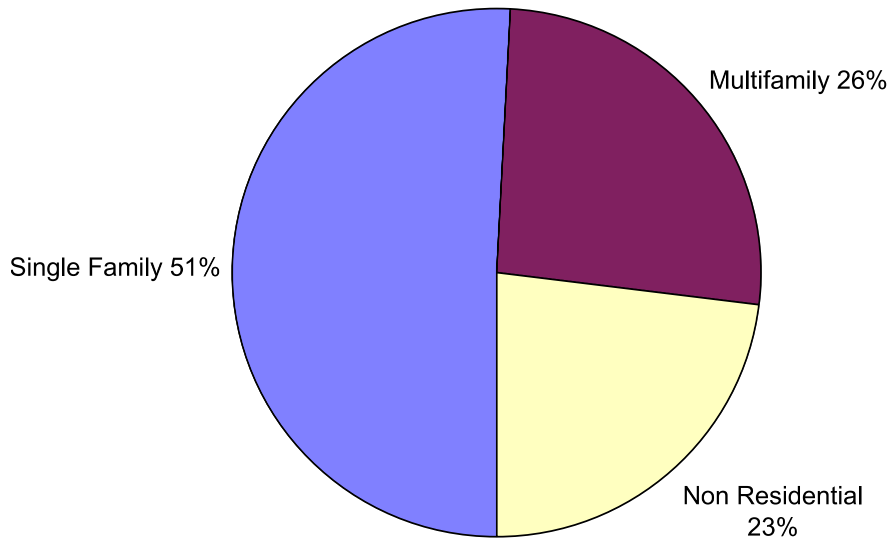


Figure 12
Technical Potential "Regular"
Package Intensity #6
Indoor vs Outdoor Savings

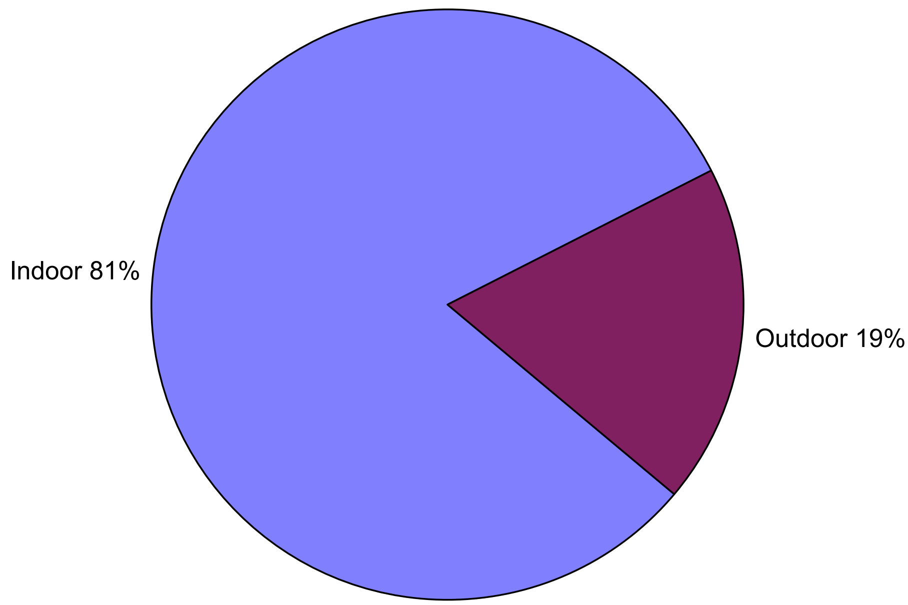
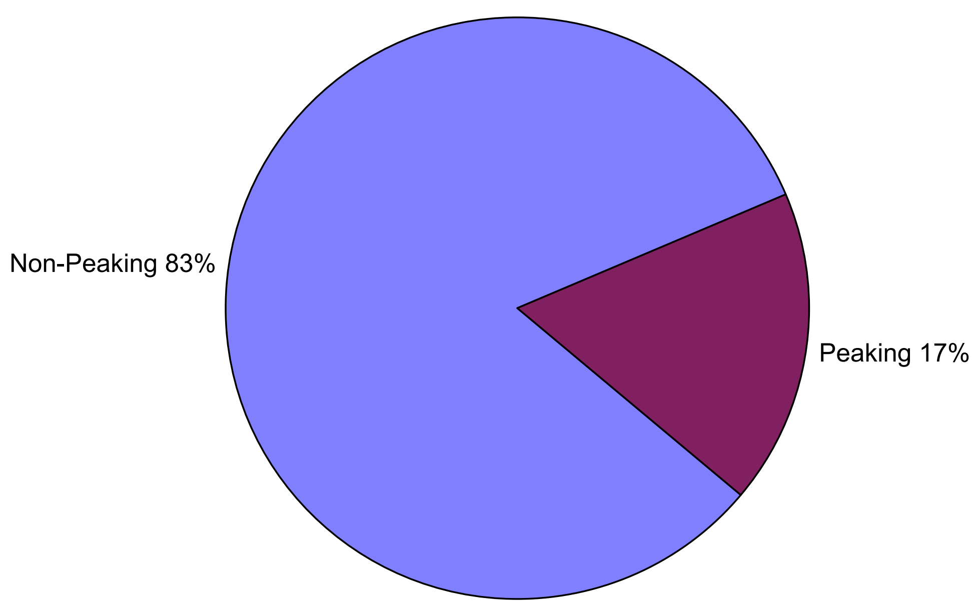


Figure 13
Technical Potential "Regular"
Package Intensity #6
Savings from Peaking and Non-Peaking Measures



3.4.2 Technical Potential "Ends Early" Package

This section contains results for the Technical Potential "Ends Early" package model run. This package represents technical potential running for a shortened time period, from 2011 through 2020. The 11 package intensities for the Technical Potential "Ends Early" package are shown in Table 12 and plotted in Figure 14.

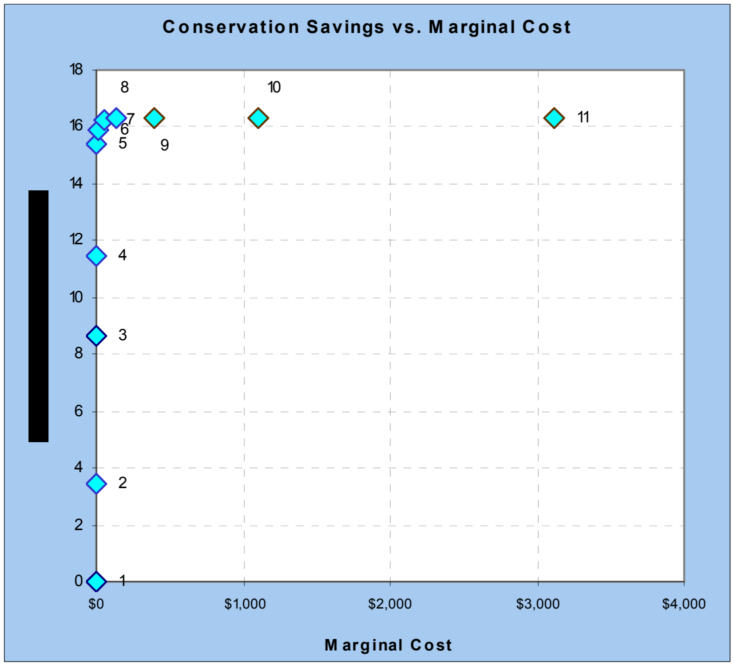
Package intensities #3 - #6, which are shaded in the table, were chosen to best represent the package since the marginal cost is significantly lower than #7 with similar savings to #7 - #11. The savings on an average annual basis ranges from 8.66 to 15.88 mgd by 2020. The savings on a peak season basis ranges from 10.69 to 21.43 mgd by 2020. The utility average annual cost, which includes all utility costs from 2011 through 2020 such as overhead, marketing, and rebates, ranges from $3,175,443 to $15,762,091. The marginal cost, which is the cost of the last unit of water saved, ranges from $0.78 per ccf to $17.47 per ccf.

Table 12
Technical Potential "Ends Early"
Package Intensities

Intensity	Annual Savings (mgd)[1]	Peak Season Savings (mgd)[1]	Utility Average Annual Cost	Marginal Cost Per ccf[2]
1	0.02	0.02	$11,226	$0.10
2	3.42	4.28	$747,417	$0.28
3	8.66	10.69	$3,175,443	$0.78
4	11.45	14.06	$6,738,867	$2.20
5	15.37	20.74	$14,141,953	$6.20
6	15.88	21.43	$15,762,091	$17.47
7	16.27	21.88	$18,987,150	$49.26
8	16.28	21.89	$19,076,302	$138.87
9	16.29	21.92	$19,316,120	$391.50
10	16.293	21.922	$19,344,253	$1,103.73
11	16.293	21.922	$19,355,796	$3,111.63

Shaded rows are the package intensities chosen to best represent this package.
1. mgd = million gallons per day
2. ccf = 100 cubic feet

Figure 14
Technical Potential "Ends Early"
Package Intensities



The labels next to each data point represent the package intensity.

3.4.3 Technical Potential "Late Start" Package

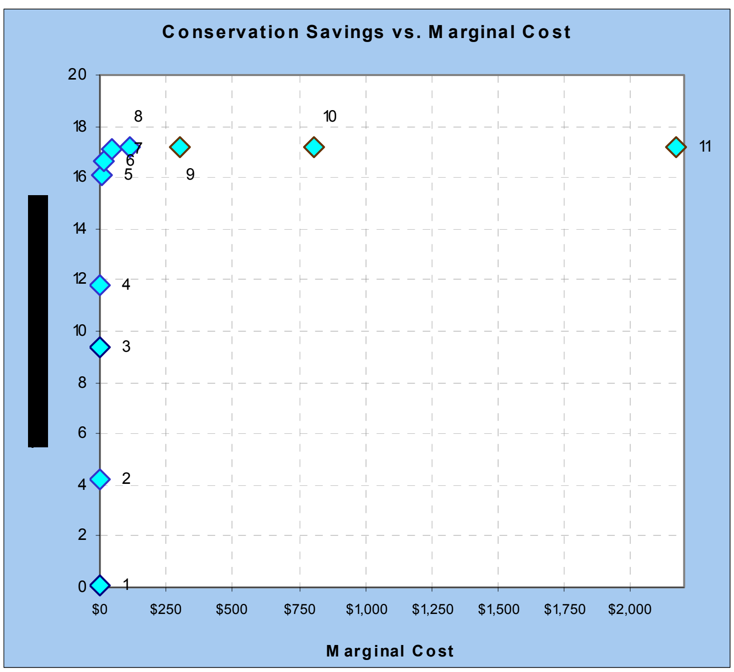
This section contains results for the Technical Potential "Late Start" package model run. This package represents technical potential running for a shortened time period, from 2021 through 2030. The 11 package intensities for the package are shown in Table 13 and plotted in Figure 15.

Package intensities #3-#6, which are shaded in the table, were chosen to best represent the package since they show significant savings at a range of reasonable marginal costs. The savings on an average annual basis ranges from 9.39 to 16.68 mgd by 2030. The savings on a peak season basis ranges from 11.48 to 22.57 mgd by 2030. The utility average annual cost for 2021 through 2030, which includes all utility costs such as overhead, marketing, and rebates, ranges from $3,402,350 to $15,440,311. The marginal cost, which is the cost of the last unit of water saved, ranges from $0.81 per ccf to $15.61 per ccf.

Table 13 Technical Potential "Late Start" Package Intensities				
Intensity	Annual Savings (mgd)[1]	Peak Season Savings (mgd)[1]	Utility Average Annual Cost	Marginal Cost Per ccf[2]
1	0.06	0.06	$10,500	$0.11
2	4.23	5.63	$777,153	$0.30
3	9.39	11.48	$3,402,350	$0.81
4	11.82	14.72	$7,493,556	$2.17
5	16.12	21.78	$14,220,465	$5.82
6	16.68	22.57	$15,440,311	$15.61
7	17.14	23.10	$19,276,968	$41.88
8	17.15	23.11	$19,307,881	$112.34
9	17.16	23.14	$19,224,417	$301.36
10	17.160	23.143	$19,242,573	$808.39
11	17.160	23.144	$19,258,051	$2,168.52

Shaded rows are the package intensities chosen to best represent this package.
1. mgd = million gallons per day
2. ccf = 100 cubic feet

Figure 15
Technical Potential "Late Start"
Package Intensities



The labels next to each data point represent the package intensity.

3.5 Incorporation of Indirect Benefits

The 1998 CPA Report noted that many of the conservation measures have additional economic and environmental benefits beyond water savings. For example, installation of water recycling systems in industrial applications can reduce energy use as well as wastewater and stormwater discharges. Similarly, more efficient clotheswashers reduce energy use and wastewater discharges in both residential and commercial sectors.

The 1998 CPA Report identified which water conservation measures had indirect benefits but did not quantify the benefits. The 2006 CPA Report presents a methodology for analyzing these benefits along with calculations. This analysis meets a requirement of the City of Seattle's Ordinance Number 120532, that the CPA should quantify "best estimates of other benefits obtained by conservation measures, including savings relating to reduced demand for electricity, sewer, stormwater, etc."

The indirect benefits from water conservation for energy[2], wastewater, and stormwater were determined to be: 1) energy savings to customers for reduced hot water usage ; and 2) a delay in the construction of Sanitary Sewer Overflow (SSO) and Combined Sewer Overflow (CSO) facilities by Seattle Public Utilities and King County. Impact to King County wastewater facilities and operations was considered as an indirect benefit, but was ultimately not incorporated per the reasons discussed in Appendix D. Benefits to improved water quality and habitat protection from reduced irrigation were not easily quantified and are therefore not included.

Determining the indirect benefits for measures and/or packages is a three step process.

- The first step is to ascribe a positive, negative or neutral wastewater, stormwater, and energy indirect benefit to each measure. This characterization is shown in Table 14. Appendix D describes the methodology and assumptions used to determine those characterizations.
- The second step is to calculate a unit value for each indirect benefit category. The wastewater/stormwater benefit was defined as the annual average savings to utilities from a delay in the need to invest in CSO/SSO storage facilities valued at $10/gallon. The annual average energy benefits are the energy savings from reduced hot water usage. Energy savings for the region were based on the avoided cost of electricity valued by Seattle City Light (SCL) at $36/kwh.[3]
- The third step is to calculate the indirect benefit over the life of the measure, based on the volume of water saved by the measure or package and the unit value for each indirect benefit category.

[2] The Ordinance reference to "electricity" was interpreted more broadly as "energy" – including both natural gas and electricity.
[3] SCL avoided cost or marginal cost of electricity is the utility wholesale rate. Based on conversation with Michael Little and Debra Tachibana of SCL in Nov 2004.

Table 14 Measure Indirect Benefits Characterization							
	Sector			Indirect Benefits			
Measure	SF	MF	NR	Waste Water	Storm Water	Energy	% Hot Water
Air Cooling			X	Positive	Neutral	Negative	0%
Boiler Performance Improvement			X	Positive	Neutral	Positive	100%
Car Wash Low Flow Equip			X	Positive	Neutral	Positive	75%
Car Wash Recycle Improvement			X	Positive	Neutral	Positive	75%
Car Wash Replacement Water			X	Positive	Neutral	Positive	75%
Catchment in Detention System			X	Neutral	Neutral	Neutral	0%
Catchment in Rain Barrel	X			Neutral	Neutral	Neutral	0%
Clotheswasher Efficient Model (Common Area)		X		Positive	Neutral	Positive	50%
Clotheswasher Efficient Model (In Unit)	X	X		Positive	Neutral	Positive	50% MF, 35% SF
Clotheswasher Efficient Model			X	Positive	Neutral	Positive	50%
Clotheswasher Eliminate Partial Loads (Common)		X		Positive	Neutral	Positive	50%
Clotheswasher Eliminate Partial Loads (In Unit)	X	X		Positive	Neutral	Positive	50% MF, 35% SF
Clotheswasher Ultra Efficient Model (In Unit)	X	X		Positive	Neutral	Positive	50% MF, 35% SF
Cooling Tower Performance Improvement			X	Positive	Neutral	Negative	0%
Dishwasher Efficient Model	X	X		Positive	Neutral	Positive	100%
Dishwasher Efficient Model			X	Positive	Neutral	Positive	100%
Dishwasher Eliminate Partial Loads	X	X		Positive	Neutral	Positive	100%
Dishwasher Eliminate Partial Loads			X	Positive	Neutral	Positive	100%
Disposal Use Decrease	X	X		Positive	Neutral	Neutral	0%
Disposal Use Decrease			X	Positive	Neutral	Neutral	0%
Drip Irrigation	X	X	X	Neutral	Neutral	Neutral	0%
Faucet Aerator 0.5 gpm (Bath Flow)			X	Positive	Neutral	Positive	20%
Faucet Aerator 1.5 gpm (Bath Flow)	X	X		Positive	Neutral	Positive	20%
Faucet Flow Control (Kitchen Flow)			X	Positive	Neutral	Positive	20%
Faucet Run Til Hot Recirculate (Bath Flow Cust)			X	Positive	Neutral	Positive	100%
Faucet Run Til Hot Recirculate (Bath Flow Employ)			X	Positive	Neutral	Positive	100%
Faucet Run Til Hot Recirculate (Bath Flow)	X	X		Positive	Neutral	Positive	100%
Faucet Run Til Hot Recirculate (Kitchen Flow Employ)			X	Positive	Neutral	Positive	100%
Faucet Run Til Hot Recirculate (Kitchen Flow)	X	X		Positive	Neutral	Positive	100%
Faucet Use Decrease (Bath Flow Cust)			X	Positive	Neutral	Positive	20%
Faucet Use Decrease (Bath Flow Employ)			X	Positive	Neutral	Positive	20%
Faucet Use Decrease (Bath Flow)	X	X		Positive	Neutral	Positive	20%
Faucet Use Decrease (Kitchen Flow Employ)			X	Positive	Neutral	Positive	70%
Faucet Use Decrease (Kitchen Flow)	X	X		Positive	Neutral	Positive	70%
Food Preparation and Washing Improvements			X	Positive	Neutral	Positive	20%
Fountain Efficiency	X	X	X	Neutral	Neutral	Neutral	0%
Hot Tub Use Improvement	X	X	X	Positive	Neutral	Positive	100%
Irrigation Controllers Weather Based	X	X	X	Neutral	Neutral	Neutral	0%

Table 14 (cont) Measure Indirect Benefits Characterization							
	Sector			Indirect Benefits			
Measure	SF	MF	NR	Waste Water	Storm Water	Energy	% Hot Water
Irrigation Scheduling Improvement	X	X	X	Neutral	Neutral	Neutral	0%
Irrigation System Performance Improvement	X	X	X	Neutral	Neutral	Neutral	0%
Laundry Wash Water Recycle			X	Positive	Neutral	Positive	50%
Lawn Dormant (Auto)	X	X	X	Neutral	Neutral	Neutral	0%
Lawn Dormant (Hose & Sprinkler)	X	X		Neutral	Neutral	Neutral	0%
Lawn Dormant (Man)	X	X		Neutral	Neutral	Neutral	0%
Leak Reduction (Cooling)			X	Neutral	Positive	Positive	10%
Leak Reduction (Domestic)	X	X	X	Neutral	Neutral	Neutral	0%
Leak Reduction (Food Service)			X	Neutral	Positive	Positive	10%
Leak Reduction (Landscape)	X	X	X	Neutral	Neutral	Neutral	0%
Leak Reduction (Other)			X	Neutral	Positive	Positive	10%
Leak Reduction (Process)			X	Neutral	Positive	Positive	10%
Leak Reduction (Recreation)			X	Neutral	Positive	Positive	75%
Plants Low Water Use	X	X	X	Neutral	Neutral	Neutral	0%
Process Water Control Improvements (Labs)			X	Positive	Neutral	Neutral	0%
Process Water Recycle			X	Positive	Neutral	Neutral	0%
Shower Run Til Hot Recirculate (Employ)			X	Positive	Neutral	Positive	100%
Shower Run Til Hot Recirculate	X	X		Positive	Neutral	Positive	100%
Shower Use Decrease (Cust)			X	Positive	Neutral	Positive	75%
Shower Use Decrease (Employ)			X	Positive	Neutral	Positive	75%
Shower Use Decrease	X	X		Positive	Neutral	Positive	75%
Showerheads 1.5 GPM	X	X	X	Positive	Neutral	Positive	75%
Showerheads 2.0 GPM	X	X	X	Positive	Neutral	Positive	75%
Sidewalk Cleaning by Broom	X	X	X	Neutral	Positive	Neutral	0%
Soil Amendment Improvements	X	X	X	Neutral	Neutral	Neutral	0%
Soil Moisture Sensors	X	X	X	Neutral	Neutral	Neutral	0%
Sprinkler Rain Shutoff	X	X	X	Neutral	Neutral	Neutral	0%
Swimming Pool Use Improvement	X	X	X	Positive	Neutral	Positive	100%
Toilet 1.2 GPF	X	X		Positive	Neutral	Neutral	0%
Toilet 1.6 GPF	X	X	X	Positive	Neutral	Neutral	0%
Toilet 1.6 GPF Longlife	X	X	X	Positive	Neutral	Neutral	0%
Toilet Flush Decrease	X	X		Positive	Neutral	Neutral	0%
Toilet Flushes by Rainwater	X	X	X	Positive	Positive	Neutral	0%
Urinal 0.5 GPF			X	Positive	Neutral	Neutral	0%
Urinal 1.0 GPF			X	Positive	Neutral	Neutral	0%
Urinal Flushes by Rainwater			X	Positive	Positive	Neutral	0%
Urinal No Water			X	Positive	Neutral	Neutral	0%
Water Use Alerting	X	X	X	Neutral	Neutral	Neutral	0%

When applied to the Technical Potential "Regular" Package Intensity #6, the results for indirect benefits are as follows:

$1,100,000	Stormwater and Wastewater Benefit to Utilities
+$6,900,000	Energy Benefit to Customers
$8,000,000	Total Annual Average Indirect Benefit (at end of program in 2030).

Most of the benefits are energy savings to customers. Although the CSO/SSO benefits are not insignificant, it is unlikely that utilities will delay investments in CSO/SSO based on expectations for water conservation. The assumption that they would delay their investments was made for analysis purposes only.

Section 4
Conclusion

The CPA Model provides a valuable tool for SPU to analyze a wide range of conservation alternatives. The results presented in this report will be used in ongoing regional planning activities for water supply, including the 2007 Seattle Public Utilities Water System Plan, as described in Section 1.3. SPU anticipates continued use of the CPA Model to explore newly formulated conservation measures and packages in future years.

Appendix A
Definitions of Water Supply Planning "Stepping Stones"

- **Conservation Drivers Analysis** – An SPU analysis of external commitments and customer expectations related to its water conservation efforts. The analysis helps answer the following questions: 1) What are the reasons SPU provides water conservation programs if it is not to offset the need for additional water supply?; and 2) What volume of savings is needed to meet those objectives? The result of this work, informed by the CPA, sets SPU's baseline level of conservation to feed into the demand forecast, and form the foundation of SPU's policy direction for conservation in the *2007 Water System Plan Update.*

- **Alternatives for Future Water Supply** – There are two components:

  1) Conservation Potential Assessment: The CPA's primary purpose is to zero in on the most desirable conservation opportunities. It is a rigorous analysis of the cost, volume, and reliability of water conservation opportunities available within Seattle's wholesale and direct service areas through 2030.

  2) Traditional Supply Alternatives: SPU has updated information on alternative supply sources other than conservation that may be developed to meet future water demands. The supply alternatives include ways to make more use of the current sources and development of new sources of supply. Information used to evaluate the different alternatives available to SPU includes up-to-date estimates of firm yield and costs, as well as assessments of environmental impacts, implementation issues, and operational criteria.

- **Demand Forecast Model** – SPU has developed a Variable Flow Factor Demand Forecast Model that projects demand through 2060. Water demand flow factors by sector (single and multi-family residential, commercial, etc.) for Seattle and each wholesale customer has been developed based on current consumption, demographic and weather data. Rather than keeping the flow factors constant over the forecast period, the factors are adjusted over time to reflect the impacts on consumption of conservation and changes in water/sewer prices and household income. The CPA Model is used to estimate the impacts of code and programmatic conservation on the flow factors over time.

- **Drinking Water Supply Planning Model** – SPU has created a planning model to help make water supply investment decisions that consider risks and uncertainties associated with future demands and supplies. The model includes both a decision tree model to evaluate cost risks and a weighted criteria model to incorporate the environmental and social aspects of alternatives that are not easily converted to monetary units. The demand forecast, firm yield of current and alternative sources of supply, and the CPA provide information to the planning model. This model is used to compare supply alternatives, including conservation.

- **Supply with Current Facilities** – SPU currently supplies water to its customers from its surface water facilities on the Cedar River and the South Fork Tolt River, as well as from its well fields south of Seattle. These sources can supply up to 171 million gallons per day on an average annual basis at 98% reliability. SPU periodically updates the firm yield estimates for its supply sources to account for recent hydrologic events, changes in regulations and instream flow requirements, and other factors. Recently, SPU has studied the potential impacts that climate change could have on its sources, and considers this information in its water supply planning efforts.

- **2007 Update of Water System Plan** – Every six years SPU is required to update its comprehensive water system plan, which provides guidance for the different aspects of utility functions. Meeting future demand is a key element of the plan, along with maintaining reliability in delivering water, continuing to meet water quality regulations, and sustaining a financially sound position for ratepayers. To address how SPU will meet future demand, SPU must prepare a demand forecast, an analysis of yield and supply alternatives, and an evaluation of conservation as a source of supply. The CPA provides the analysis of conservation alternatives for this exercise.

Appendix B
Understanding the CPA Model – Supplemental Information

This appendix includes further details on the CPA Model to supplement information presented in the main report. The following five subsections are included:

- Water Balance - End Uses Component
- Water Balance - Demographics Component
- Water Balance - Demand Component
- Measure Library - Measure Costs
- Measure Library - Measure Optimization

Water Balance - End Uses Component

The end uses component of the water balance consists of 60 end uses, which are ways customers use water such as toilet flushing, irrigation, and boiler operation. The 60 end uses, and their peak factor, are listed in Table B-1. The peak factor is the ratio of peak season demand to average annual demand. The peak season is 4 months (May 15 to September 15) and is characterized by increased demand due to increased seasonal uses such as irrigation. An end use with a peak factor of 1.0, such as toilets, is considered "non-peaking" since its consumption is the same year-round. In contrast, an end use with a peak factor larger than 1.0 (e.g., 2.99), such as irrigation, is considered "peaking" since its consumption is higher in the peak season.

For several of the end uses, the number of fixtures per customer is important since it can factor into the cost of conservation measures associated with those end uses. For example, the cost of a conservation measure replacing showerheads in single family households depends on the number of showerheads in single family households. Table B-2 shows the average number of fixtures per customer for the relevant end uses. These numbers are from the 1998 CPA Report or updated with more recent information from local or regional research, if available.

Table B-1
End Uses

#	End Use	Peak Factor	#	End Use	Peak Factor
1	Animal Care	1	31	Irrigation - Sprinkler In Ground Auto	2.99
2	Bath	1	32	Irrigation - Sprinkler In Ground Manual	2.99
3	Boilers	1	33	Jacuzzi	1
4	Canning/Bottling	1	34	Laboratories	1
5	Child's Play	2.99	35	Leaks - Cooling	1
6	Clotheswasher – Industrial Capacity	1	36	Leaks - Domestic	1
7	Clotheswasher – Laundromat	1	37	Leaks - Food Service	1
8	Clotheswasher – Res. Capacity in Common Area	1	38	Leaks - Landscape	2.99
9	Clotheswasher – Res. Capacity In Unit	1	39	Leaks - Other	1
10	Construction	1	40	Leaks - Process	1
11	Dishwashing – Machine Comm. Capacity	1	41	Leaks - Recreation	1
12	Dishwashing – Machine Res. Capacity	1	42	Material Transport	1
13	Disposal – Comm. Capacity	1	43	Once through	1
14	Disposal – Res. Capacity	1	44	Other Equip Towers	1.4
15	Distillation	1	45	Other Food Prep	1
16	Dry Cleaning	1	46	Other Food Washing	1
17	Dust Control	1	47	Other Washing	1
18	Faucet – Bathroom by Flow[1]	1	48	Pollution Scrubbers	1
19	Faucet – Bathroom by Vol[1]	1	49	Pool	2.99
20	Faucet - Kitchen by Flow[1]	1	50	Process Washing	1
21	Faucet - Kitchen by Vol[1]	1	51	Product Input	1
22	Film Processing	1	52	Quenching/Dipping	1
23	Food Processing	1	53	Refrigerators	1
24	Fountains	1	54	Shower	1
25	Hot Tub	1	55	Sidewalk Washing	2
26	HVAC Towers	2	56	Toilet	1
27	Ice-Makers	1	57	Urinal	1
28	Irrigation - Drip / Soaker	2.99	58	Vehicle Washing - Business W/ Own Equip	1
29	Irrigation - Hand Held	2.99	59	Vehicle Washing - Hose	2
30	Irrigation - Hose & Sprinkler	2.99	60	Vehicle Washing - Retail Car Wash	1

[1] Faucets are designated as either "flow" or "volume." The "flow" version is when the reason for water use occurs simultaneously with water flowing down the drain, such as with dish washing and teeth brushing. Conservation is applicable to "flow" faucets since the reason for water use can be accomplished while also reducing the flow rate and/or duration of use. The "volume" version is when the reason for water use is associated with obtaining a specific volume of water, such as filling a cooking pot or glass of water. Conservation is not applicable to "volume" faucet use since the use is consumptive.

Table B-2 Average Number of Fixtures per Customer			
Fixture	**Single Family Households**	**Multifamily Households**	**Non-Residential Customers**
Toilets	2.35	1.10	5.22
Showerheads	1.94	1.20	0.83
Faucets - All	n/a	n/a	4.72
Faucets - Bathroom	2.47	1.50	3.52
Faucets - Kitchen	1.00	1.00	1.20
Urinal	n/a	n/a	1.30

Every end use has a volume and a behavior. The volume is an indication of how efficient the equipment is (e.g., 3.5 gallons per flush, for a toilet). The behavior is an indication of how intensively the end use is employed (e.g., 5 flushes per day per person, for a toilet). There are several options for each end use's volume and behavior (e.g., 4.5, 3.5, and 1.6 gpf). Each option is allocated a percent, which is the percent of customers having that option (e.g., 10% with 4.5 gpf, 40% with 3.5 gpf, and 50% with 1.6 gpf). In the CPA Model, the volume and behavior options generally remain constant over the time period analyzed. However, the percentages often shift from higher (less efficient) options to lower (more efficient) options due to code savings and conservation programs.

Water Balance - Demographics Component

The demographics component of the water balance consists of demographic data such as the number of households, businesses, people per household, employees, etc. Table B-3 details the demographic data listed by service area and sector. For the historical time period (1995 through 2005), the numbers are based on data and analysis from the U.S. Census, the Puget Sound Regional Council (PSRC), and Dick Conway and Associates. For the future time period (2010 through 2030), the numbers are based on data from PSRC.

Table B-3 Demographics											
		Single Family		Multifamily				Non-Residential			
Service Area	Year	Households	Persons Per Household	Households	Complexes	Households Per Complex	Persons Per Household	Businesses	Employees	Employees Per Business	Customers Per Business
Direct	1990	146,890	2.58	110,539	5,527	20.00	1.72	12,222	495,144	40.51	134.62
Direct	1995	148,964	2.59	119,226	5,961	20.00	1.73	13,268	524,842	39.56	133.98
Direct	2000	151,070	2.61	128,604	6,430	20.00	1.74	14,379	557,005	38.74	133.42
Direct	2005	151,363	2.62	138,705	6,935	20.00	1.75	14,684	559,598	38.11	131.75
Direct	2010	151,746	2.59	152,082	7,604	20.00	1.73	16,622	624,648	37.58	130.33
Direct	2015	153,043	2.58	166,673	8,334	20.00	1.72	17,505	652,810	37.29	130.28
Direct	2020	154,352	2.58	182,669	9,133	20.00	1.72	18,426	682,243	37.03	130.24
Direct	2025	156,045	2.57	200,952	10,048	20.00	1.71	19,195	705,738	36.77	130.24
Direct	2030	157,758	2.56	221,071	11,054	20.00	1.70	19,998	730,053	36.51	130.24
Purveyor	1990	102,541	2.93	35,033	1,752	20.00	1.83	2,842	106,244	37.38	91.78
Purveyor	1995	107,854	2.94	38,794	1,940	20.00	1.83	3,379	123,059	36.42	91.65
Purveyor	2000	113,633	2.93	43,196	2,160	20.00	1.83	4,056	144,572	35.64	91.54
Purveyor	2005	113,253	2.93	46,029	2,301	20.00	1.83	3,937	136,483	34.66	89.88
Purveyor	2010	116,095	2.91	51,272	2,564	20.00	1.82	4,649	157,467	33.87	88.54
Purveyor	2015	120,180	2.90	55,514	2,776	20.00	1.81	5,083	168,475	33.15	87.73
Purveyor	2020	124,525	2.89	60,137	3,007	20.00	1.81	5,546	180,387	32.53	87.05
Purveyor	2025	126,682	2.89	64,822	3,241	20.00	1.80	6,033	192,483	31.91	86.47
Purveyor	2030	128,976	2.88	69,889	3,494	20.00	1.80	6,572	205,627	31.29	85.97
Combined	1990	249,432	2.72	145,572	7,279	20.00	1.75	15,064	601,388	39.92	126.54
Combined	1995	256,818	2.74	158,020	7,901	20.00	1.76	16,647	647,901	38.39	125.38
Combined	2000	264,703	2.75	171,800	8,590	20.00	1.76	18,435	701,577	38.06	124.21
Combined	2005	264,616	2.76	184,734	9,237	20.00	1.77	18,621	696,081	37.38	122.89
Combined	2010	267,841	2.73	203,354	10,168	20.00	1.75	21,271	782,115	36.77	121.20
Combined	2015	273,224	2.72	222,187	11,109	20.00	1.75	22,588	821,285	36.36	120.71
Combined	2020	278,877	2.72	242,806	12,140	20.00	1.74	23,971	862,630	35.99	120.24
Combined	2025	282,727	2.71	265,774	13,289	20.00	1.73	25,227	898,221	35.60	119.77
Combined	2030	286,734	2.70	290,960	14,548	20.00	1.73	26,570	935,680	35.22	119.29

Water Balance - Demand Component

The demand component of the water balance consists of model-calculated demands generated by combining demographics, end use options, and percentages for end use options. The CPA Model calculates demand for all time periods. For the historical time period (1995 through 2005), the model-calculated demand has been calibrated to match actual historical demand. For the future time period (2010 through 2030), the model-calculated demand provides a demand forecast. Table B-4 shows the actual historical demands

Table B-4 Actual Historical Demand (mgd)							
Service Area	Year	Single Family		Multifamily		Non-Residential	
		Annual	Peak	Annual	Peak	Annual	Peak
Direct	1995	26.54	32.78	14.35	15.07	30.75	34.75
Direct	2000	26.69	33.06	14.39	15.16	27.14	30.76
Direct	2005	23.39	28.90	12.22	12.84	23.47	26.53
Purveyor	1995	23.87	31.76	6.47	7.54	6.55	8.92
Purveyor	2000	24.72	33.87	7.07	8.29	7.51	10.52
Purveyor	2005	22.83	29.71	6.82	8.02	6.86	9.73
Combined	1995	50.41	64.54	20.82	22.61	37.30	43.67
Combined	2000	51.41	66.93	21.46	23.45	34.65	41.28
Combined	2005	46.22	58.61	19.04	20.86	30.33	36.26

Measure Library - Measure Costs

The cost of a measure is comprised of four components: direct cost, operation and maintenance (O&M) cost, overhead cost, and market saturation cost. Each of these costs is discussed below.

Direct Cost: This is the direct cost to implement the measure, regardless of whether SPU (via a rebate) or the customer pays. Depending on the measure, this category could include hardware purchases, installation fees, the cost of audits, or other costs. Cost is per household or business and therefore includes the cost of all fixtures (e.g., 1.94 showerheads per single family household). Direct costs are not shared with other measures when using the Package Wizard.

The direct costs that are included in a measure depend on two assumptions. The first assumption is whether the customer is ready to purchase new equipment, whether SPU is accelerating that purchase, or whether the customer never would have purchased the equipment on their own. The second assumption is whether the customer can purchase only efficient models or whether they have the choice of purchasing non-efficient models as well. Table B-5 summarizes this information.

Table B-5 Direct Cost Components		
Situation	**Cost Components**	**Example**
1. Customer Ready to Purchase.		
1a. Option exists to purchase regular and efficient models.	Difference between efficient and regular model.	Clotheswasher.
1b. Can only purchase efficient model.	No cost.	1.6 gpf toilet, if not accelerating.
2. SPU Accelerating Purchase (assume equipment is at 50% of its life).		
2a. Option exists to purchase regular and efficient models.	50% depreciation on old equipment + difference between efficient and regular model.	1.2 gpf toilet.
2b. Can only purchase efficient model.	50% depreciation on old equipment.	1.6 gpf toilet.
3. Customer Would Never Purchase on Own.	Full cost of new equipment.	Stormwater for toilet flushing.

O&M Cost: This is the annual cost to the customer for any operating and maintenance costs such as increased energy (e.g., switching from water cooling to air cooling) or increased labor (e.g., more frequent maintenance). Most measures do not have an O&M cost.

Overhead Cost: This is the annual overhead cost to SPU, which was estimated by SPU staff to be $7,500 for every measure ($4,500 for staff + $3,000 for furniture, phone, rent, etc.).

Market Saturation Cost: This is the annual cost to deliver information about the measure to every targeted customer. This includes both marketing and variable administration costs. The market saturation cost for each measure assumes that it is the only measure implemented. However, the Package Wizard allows this cost to be shared by multiple measures. For example, low-flow showerheads and faucet aerators may be given away together in an indoor retrofit kit. Even though they will share marketing and variable administration costs, the market saturation cost for each assumes it is the only measure implemented.

Measure Library - Measure Optimization

Measure optimization is the process by which the CPA Model determines the appropriate marketing budget and rebate level, with the goal of achieving the largest water savings. Measures can be optimized on two bases: participation rates and annual budget. In both cases, the CPA Model analyzes spending different percentages of the Market Saturation Cost and different rebate levels. When optimizing based on participation rates, the model selects the combination of Market Saturation Cost spent and rebate that results in the highest possible participation rate, which is always the highest marketing budget and rebate level. When optimizing based on an annual budget, the CPA Model does the same process but within the limits of a particular budget.

For a detailed description of the measure optimization process, please refer to the CPA Users Guide.

Appendix C
Measure Definitions

(Note: SF means single family, MF means multifamily, and NR means non-residential.)

Air Cooling (NR) - Convert equipment from a water-cooled flow-through system to an air-cooled system with external heat exhaust coil. Examples include ice machines and refrigeration equipment.

Boiler Performance Improvement (NR) - Improve water quality control and increase boiler cycles. For some boilers, this may also include steam condensation recovery. Direct costs includes chemicals and increased monitoring.

Car Wash Low Flow Equipment (NR) - Convert car washing from hose and bucket technique to more efficient techniques such as on-site power washers or switch to commercial car washes.

Car Wash Recycle Improvement (NR) - Install equipment that treats and recycles wash water for use in washing other vehicles. Does not completely eliminate the need for potable water, but reduces it to approximately 10 to 20% for make up water.

Car Wash Replacement Water (NR) - Substitute non-potable water (such as reclaimed water) for potable water used for car washing.

Catchment in Detention System (NR) - Substitute stormwater for potable water for non-potable uses, such as irrigation, by making use of water in stormwater detention ponds. This measure differs from Catchment in Rain Barrels since it has larger volumes and uses water for automatic irrigation systems rather than for hand-held watering.

Catchment in Rain Barrel (SF) - Substitute rainwater for potable water for hand-held irrigation by directing gutters to small barrels. Use is restricted to customers with very small irrigation needs (10 gallons a day or less) since rainfall in the Seattle area limits barrel filling to under 10 times in an “average” summer.

Clotheswasher Efficient Model (Common Area) (MF) - Replace inefficient clotheswashers with more efficient models. These machines are located in a common area of an apartment building, serve multiple apartments, and are usually coin-operated.

Clotheswasher Efficient Model (In Unit) (SF, MF) - Replace inefficient clotheswashers with more efficient models. These machines are located in individual units, whether a single family house, condo, townhouse, or apartment. For SF, the machine is usually owned by the occupant, unless the occupant is a renter. For MF, the machine is usually not owned by the occupant.

Clotheswasher Efficient Model (NR) - Replace inefficient clotheswashers with more efficient models. These machines are located in laundromats, institutions, dorms, or at non-residential sites. They are usually coin-operated machines serving many users.

Clotheswasher Eliminate Partial Loads (Common Area) (MF) - Decrease the frequency of use by encouraging customers to load machines to full capacity, rather than doing a series of smaller loads. These machines are located in a common area of an apartment building, serve multiple apartments, and are usually coin-operated.

Clotheswasher Eliminate Partial Loads (In Unit) (SF, MF) - Decrease the frequency of use by encouraging customers to load machines to full capacity, rather than doing a series of smaller loads. These machines are located in individual units, whether a single family house, condo, townhouse, or apartment.

Clotheswasher Ultra Efficient Model (In Unit) (SF, MF) - Replace inefficient clotheswashers with ultra efficient models (water factor less than 6.0). These machines are located in individual units, whether a single family house, condo, townhouse, or apartment. For SF, the machine is usually owned by the occupant, unless the occupant is a renter. For MF, the machine is usually not owned by the occupant.

Cooling System Performance Improvement (NR) - This measure covers all water cooling applications except conversion from water-cooling to air-cooling. It includes: (1) adding monitoring equipment to adjust feed water and increase concentration cycles (less purge water and less drinking water make-up); (2) periodic inspection for water overflows and other maintenance issues related to water use; and (3) converting single pass cooling to a loop system.

Dishwasher Efficient Model (SF, MF, NR) - Replace inefficient dishwashers with more efficient models. For SF and MF, the machines are residential capacity. For NR, the machines are commercial capacity.

Dishwasher Eliminate Partial Loads (SF, MF, NR) - Decrease the frequency of use by encouraging customers to load the machine to full capacity, rather than doing a series of smaller loads.

Disposal Usage Decrease (SF, MF, NR) - Decrease the frequency of use by encouraging pre-screening and removal/composting of certain types of food waste.

Drip Irrigation (SF, MF, NR) - Use soaker hoses or micro-irrigation technology that delivers water close to the root zone of plants and reduces losses associated with evaporation and runoff.

Faucet Aerator 0.5 gpm (Bath Flow) (NR) - Replace less efficient bathroom faucet aerators with 0.5-gpm models, which the code specifies for new commercial construction.

Faucet Aerator 1.5 gpm (Bath Flow) (SF, MF) - Replace less efficient bathroom faucet aerators with 1.5-gpm models.

Faucet Flow Control (Kitchen Flow) (NR) - Replace less efficient pre-rinse sprayheads in commercial kitchens with 1.6-gpm models.

Faucet Run Until Hot Recirculate (Bath Flow Customer) & (Bath Flow Employee) (NR) - Install a recirculating system that returns cold water to the hot water tank via the cold water line instead of disposing it down the drain while waiting for hot water. This consists of a pump, thermal sensor, and plumbing. Depending on the size of the business, more than one system per business may be required to address all fixtures (bathroom faucets, kitchen faucets, showers). Since the model restricts a measure to only one end use, the cost of a recirulating system is spread across all these fixtures. Therefore, all Run Till Hot Recirculate measures within a sector must be implemented together.

Faucet Run Until Hot Recirculate (Bath Flow) (SF, MR) - Install a recirculating system that returns cold water to the hot water tank via the cold water line instead of disposing it down the drain while waiting for hot water. This consists of a pump, thermal sensor, and plumbing. One system per household addresses all fixtures (bathroom faucets, kitchen faucets, showers). However, since the model restricts a measure to only one end use, the cost of a recirulating system is spread across all these fixtures. Therefore, all Run Till Hot Recirculate measures within a sector must be implemented together.

Faucet Run Until Hot Recirculate (Kitchen Flow Employee) (NR) - Install a recirculating system that returns cold water to the hot water tank via the cold water line instead of disposing it down the drain while waiting for hot water. This consists of a pump, thermal sensor, and plumbing. Depending on the size of the business, more than one system per business may be required to address all fixtures (bathroom faucets, kitchen faucets, showers). Since the model restricts a measure to only one end use, the cost of a recirulating system is spread across all these fixtures. Therefore, all Run Till Hot Recirculate measures within a sector must be implemented together.

Faucet Run Until Hot Recirculate (Kitchen Flow) (SF, MR) - Install a recirculating system that returns cold water to the hot water tank via the cold water line instead of disposing it down the drain while waiting for hot water. This consists of a pump, thermal sensor, and plumbing. One system per household addresses all fixtures (bathroom faucets, kitchen faucets, showers). However, since the model restricts a measure to only one end use, the cost of a recirulating system is spread across all these fixtures. Therefore, all Run Till Hot Recirculate measures within a sector must be implemented together.

Faucet Use Decrease (Bath Flow Customer) & (Bath Flow Employee) (NR) - Decrease bathroom faucet run time by turning off water while hand washing, shaving, brushing teeth, cleaning items, etc.

Faucet Use Decrease (Bath Flow) (SF, MF) - Decrease bathroom faucet run time by turning off water while hand washing, shaving, brushing teeth, cleaning items, etc.

Faucet Use Decrease (Kitchen Flow Employee) (NR) - Decrease kitchen faucet run time by greater use of automatic dishwasher without pre-wash and/or use of sink and stopper.

Faucet Use Decrease (Kitchen Flow) (SF, MF) - Decrease kitchen faucet run time by greater use of automatic dishwasher without pre-wash and/or use of sink and stopper.

Food Preparation and Washing Improvement (NR) - Convert from common commercial kitchen practice of thawing frozen food under running water to thawing food in the refrigerator.

Fountain Efficiency (SF, MF, NR) - Improve maintenance and operation of outdoor fountains and ponds to minimize leaks, overflows, and evaporation.

Hot Tub Use Improvement (SF, MF, NR) - Reduce the number of times pools are drained and the amount of make-up water needed by better use of chemical treatment to maintain high quality water. This also involves proper maintenance of refill valves and hot tub side cleanup.

Irrigation Controllers Weather Based (SF, MF, NR) - Install automatic irrigation timer systems that adjust watering schedules to meet weather-adjusted plant water needs.

Irrigation Scheduling Improvement (SF, MF, NR) - Provide on-site recommendations or self-auditing checklists to decrease the frequency or duration of watering. This requires periodic manual adjustment of automatic controllers, as opposed to automatic adjustments as done in the case of Irrigation Controllers Weather Based.

Irrigation System Performance Improvement (SF, MF, NR) - Improve the efficiency of irrigation systems by adjusting spray patterns, repairing leaks, and reducing the number and location of sprayheads.

Laundry Wash Water Recycle (NR) - Install equipment that treats and recycles wash water so a portion of it can be used again in another cycle or load. This can involve ozone or other treatment methods.

Lawn Dormant (Auto) (SF, MF, NR) - Near elimination of lawn watering by customers who normally water their lawn with in-ground sprinkler systems with automatic controllers. This does not completely eliminate watering since a small amount is necessary as maintenance water.

Lawn Dormant (Hose & Sprinkler) (SF, MF) - Near elimination of lawn watering by customers who normally water their lawn with a hose and moveable sprinkler. This does not completely eliminate watering since a small amount is necessary as maintenance water.

Lawn Dormant (Auto) (SF, MF) - Near elimination of lawn watering by customers who normally water their lawn with in-ground sprinkler systems with manual controllers. This does not completely eliminate watering since a small amount is necessary as maintenance water.

Leak Reduction (Cooling) (NR) - Identify and repair leaks associated with cooling equipment.

Leak Reduction (Domestic) (SF, MF, NR) - Identify and repair -leaks associated with toilets, shower, and faucets.

Leak Reduction (Food Service) (NR) - Identify and repair leaks associated with food service equipment.

Leak Reduction (Landscape) (SF, MF, NR) - Identify and repair leaks associated with irrigation equipment.

Leak Reduction (Other) (NR) - Identify and repair leaks associated with uses other than cooling, domestic, food service, landscape, process, or recreation.

Leak Reduction (Process) (NR) - Identify and repair leaks associated with process water.

Leak Reduction (Recreation) (NR) - Identify and repair leaks associated with recreation equipment.

Plants Low Water Use (SF, MF, NR) - Low water use landscaping including proper design (right plant/right place), soil preparation, plant installation, and periodic care. This type of landscaping typically lacks an in-ground irrigation system, since extensive watering is not necessary after plant establishment. This measure is best suited to new construction and re-landscaping.

Process Water Control Improvements (Labs) (NR) - Modify or add equipment or practices in laboratories, such as reverse washing technology.

Process Water Recycle (NR) - Install equipment that treats and recycles used process water to be used again for another non-potable use.

Shower Run Until Hot Recirculate (Employee) (NR) - Install a recirculating system that returns cold water to the hot water tank via the cold water line instead of disposing it down the drain while waiting for hot water. This consists of a pump, thermal sensor, and plumbing. Depending on the size of the business, more than one system per business may be required to address all fixtures (bathroom faucets, kitchen faucets, showers). Since the model restricts a measure to only one end use, the cost of a recirulating system is spread across all these fixtures. Therefore, all Run Till Hot Recirculate measures within a sector must be implemented together.

Shower Run Until Hot Recirculate (SF, MR) - Install a recirculating system that returns cold water to the hot water tank via the cold water line instead of disposing it down the drain while waiting for hot water. This consists of a pump, thermal sensor, and plumbing. One system per household addresses all fixtures (bathroom faucets, kitchen faucets, showers). However, since the model restricts a measure to only one end use, the cost of a recirulating system is spread across all these fixtures. Therefore, all Run Till Hot Recirculate measures within a sector must be implemented together.

Shower Use Decrease (Customer) & (Employee) (NR) - Decrease shower run time (about 10% less time per person per shower) by using a shower timer or other visual reminder.

Shower Use Decrease (SF, MF) - Decrease shower run time (about 10% less time per person per shower) by using a shower timer or other visual reminder.

Showerheads 1.5 gpm (SF, MF, NR) - Replace less efficient showerheads with ultra efficient models using only 1.5 gpm. These models save more water per shower than the 2.0-gpm model, but have lower customer acceptance.

Showerheads 2.0 gpm (SF, MF, NR) - Replace less efficient showerheads with 2.0-gpm models.

Sidewalk Cleaning by Broom (SF, MF, NR) - Convert from washing sidewalks with a hose to using a broom instead.

Soil Amendment Improvements (SF, MF, NR) - Use of proper soil preparation including aeration, compost, and soil conditioning, so plants develop healthy and drought-tolerant root systems and soils can hold more moisture. This measure is best suited to new construction and re-landscaping.

Soil Moisture Sensors (SF, MF, NR) - Install sensors that override automatic irrigation system controllers and prevent irrigation if the soil moisture indicates plants do not need water.

Sprinkler Rain Shutoff (SF, MF, NR) - Install rain shutoff sensors that override automatic irrigation system controllers and prevent irrigation if the sensor detects recent rainfall.

Swimming Pool Use Improvement (SF, MF, NR) - Reduce the number of times pools are drained and the amount of make-up water needed by better use of chemical treatment to maintain high quality water. This also involves proper maintenance of refill valves and pool-side cleanup

Toilet 1.2 GPF (SF, MF) - Replace less efficient toilets with dual flush toilets. Dual flush toilets use a smaller flush volume for liquid waste than for solid waste and average flushes use 1.2 gallons per flush.

Toilet 1.6 GPF (SF, MF, NR) - Replace less efficient toilets with standard 1.6-gpf models. These standard models require periodic flapper replacement to retain their savings. This measure assumes code-acceleration.

Toilet 1.6 GPF Longlife (SF, MF, NR) - Replace less efficient toilets with long life 1.6-gpf models. These long life models do not require frequent flapper replacement to retain savings and are designed so the volume per flush will not increase significantly if an improper replacement flapper is installed. This measure includes, but is not limited to, flapperless toilet designs.

Toilet Flush Decrease (SF, MF) - Decrease the frequency of toilet flushing by not flushing after every liquid-only toilet use. This measure is not appropriate for commercial settings.

Toilet Flushes by Rainwater (SF, MF) - Substitute rainwater for potable water to flush toilets. This requires plumbing permits, storage, dual plumbing, and frequently added energy use for pumping the water. This can require increased maintenance and use of potable water for flushing during periods of low rainfall or freezing.

Urinal 0.5 gpf (NR) - Convert less efficient urinals to use only 0.5 gpf by modifying the flush valve. This conversion will work in most cases; however, in some cases the entire urinal must be replaced.

Urinal 1.0 gpf (NR) - Replace less efficient urinals with 1.0-gpf models.

Urinal Flushes by Rainwater (NR) - Substitute rainwater for potable water to flush urinals. This requires plumbing permits, storage, dual plumbing, and frequently added energy use for pumping the water. This can require increased maintenance and use of potable water for flushing during periods of low rainfall or freezing. This measure must be combined with Toilet Flushes by Rainwater, since it would not be done independently.

Urinal No Water (NR) - Replace water-using urinals with urinals not requiring water. These urinals use a neutralizing fluid to reduce odors.

Water Use Alerting (SF, MF, NR) - Install a metering device that warns users and/or cuts off water flow at levels set to avoid waste. Equipment may include alarms or volume or time measurement. If the water is not automatically shut off (for example, a spring-loaded faucet or solenoid), the alert stimulates the water user to take specific water saving measures.

Appendix D
Indirect Benefits Methodology

The following describes the methodology and assumptions used to ascribe a positive, negative or neutral wastewater, stormwater, and energy indirect benefit to each of the water conservation measures.

Wastewater

An indirect benefit from water conservation on wastewater is a reduction in the sizing of SSO/CSO facilities by Seattle Public Utilities.

The allocation of wastewater benefits was allocated to each of the measures in the following manner:

- All landscaping measures are neutral (except for "grey water for irrigation") since this water would not have gone to the sewer system.
- Most non-landscaping measures are positive since this water would have gone to the sewer system.
- A few exceptions exist where the water would have not have gone to the sewer system and therefore are classified as neutral. This is the case for leaks, outdoor sweeper, and dry sidewalk cleaning.

Reduction in sewer volume may have an impact on capacity issues in King County's wastewater system in three ways:

1. Impact capacity constraints on the conveyance system.
2. Change operations at treatment facility.
3. Delay date of bringing new King County Brightwater treatment plant on-line.

Reduction in sewer volume going to sewage treatment facility was assumed to have no benefit to King County, since it was indeterminate whether a reduction in volume of water was a positive or negative impact on King County operations, and has not been quantified. The reduction in volume going to King County facilities may have little impact since sizing of the facility is driven by peak flows from storm water, and from solids loading[4]. Reduction in the volume of wastewater from north Seattle being sent to King County may delay the bringing on of the Brightwater plant, but the benefit was not quantified. No indirect benefit was attributed to King County treatment from water conservation by the City of Seattle.

[4] Email from Karen Huber of King County 11/17/2004

Stormwater

An indirect benefit from water conservation on stormwater is a reduction in the sizing of SSO/CSO facilities by local stormwater/wastewater utilities.

The allocation of stormwater benefits was allocated to each of the measures in the following manner:

- All landscaping measures are neutral since landscape water is used during the summer, and the reduction in sizing of CSO and SSO facilities is based on winter flows
- Most non-landscaping measures are neutral since this water would not have gone to the stormwater system
- A few exceptions exist where water would have gone to the stormwater system and therefore are classified as positive. This is the case for leaks, outdoor sweeper, dry sidewalk cleaning, and toilet/urinal flushing with stormwater.

Assumptions in CSO/SSO benefit calculation:

- $10/gallon was an estimate of CSO/SSO detention construction costs (including hard and soft costs), but cost depends on project size and can range from $6/gallon for large projects to $10+/gallon to smaller ones
- By instituting a water conservation measure, it was assumed that a utility investment in CSO/SSO detention could be delayed until the end of the program life. The benefit from the delay was estimated from the annual payment that would be made on the investment
- Discount rate is 3% and project life of CSO/SSO projects was estimated at 100 years
- The final mgd savings at the end of program life was the amount of water used to calculate SSO/CSO storage needs
- CSO/SSO benefits were overestimated since benefits were ascribed regionwide, regardless of whether the basin is experiencing a CSO/SSO overflow problem
- A reduction in water usage will most likely increase the maintenance cost of sewer systems, since water volumes help to keep sewer systems functioning optimally. This increased cost was not quantified in this analysis.

Energy

The allocation of energy benefits was allocated to each of the measures in the following manner:

- Any measure with a hot water percentage is positive, otherwise it is neutral
- A few exceptions exist for measures that will now require more energy and are therefore identified as negative. This is the case for air cooling, recirculating cooling systems, and cooling tower improvements
- Energy was valued at $36/kWh, the estimated future marginal cost of electricity to Seattle City Light.

Water heaters are fueled by natural gas and electricity and are supplied in the region by Puget Sound Energy and Seattle City Light

Assumptions in energy benefit calculation:

- 3412 BTU = 1 kWh
- 722.8 BTUs per gallon to raise from 55º to 120º at 75% efficiency of water heaters (regardless of water's enduse – hot tub, dishwasher, shower etc.)[5]

The difference in cost per BTU between natural gas and electricity was not considered.

[5] "Technical Memorandum – Water Conservation Audit, Washington Corrections Center for Women, Pierce County, Washington" January 2002, Economic and Engineering Services, Inc.

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Ten Year Conservation Program Plan

September 2002

Acknowledgements

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City of Bellevue
City of Bothell
City of Duvall
City of Edmonds
City of Kirkland
City of Mercer Island
City of Redmond
City of Tukwila
Coal Creek Utility District
Highline Water District
King County Water District No. 20
King County Water District No. 45
King County Water District No. 49
King County Water District No. 85
King County Water District No. 90
King County Water District No. 119
King County Water District No. 125
Lake Forest Park Water District
Northshore Utility District
Olympic View Water & Sewer District
Seattle Public Utilities
Shoreline Water District
Skyway Water & Sewer District
Soos Creek Water & Sewer District
Woodinville Water District

TEN YEAR CONSERVATION PROGRAM PLAN

Water conservation (Conservation) is integral to how Seattle Public Utilities (SPU) and its purveyor partners' plan to meet future water demands and fulfill the role of environmental steward. Conservation is an economically and environmentally responsible way to accommodate competing demands for drinking water to meet long-term population growth and at the same time protect instream flows needed for fish. As a proven water resource, conservation has demonstrated reliable savings that are expected to continue over the next 20 years.

The 2001 Water System Plan Update (WSP) established a vision for conservation in the SPU regional service area that includes rates, codes, system reductions and programmatic conservation working together to achieve significant savings. The WSP outlined how codes, rates and system efficiencies will be implemented to generate expected savings. It also affirmed the 1% Conservation Program (1% Program) as the approach to programmatic conservation in the SPU regional service area. The 1% Program is based on direction from the Seattle Mayor and City Council following completion of the Conservation Potential Assessment by SPU in 1998. It was approved as a regional program by purveyor partners in 2000. While the WSP identified the savings goal and direction for the 1% Program, it did not specify how the program savings would be achieved.

The 1% Program has served as a basis for discussion with stakeholders on various supply and conservation issues, which resulted in several other conservation commitments. The purpose of this plan is to describe how SPU intends to meet its various conservation commitments through 2010, and more generally until 2020. Most of the Plan applies to both retail and wholesale parts of the regional service area, but clarifies where additional commitments have been made in the retail service area. This plan is a compilation of thinking on what strategies would be used to achieve programmatic conservation savings through the 1% Program as well as how other conservation commitments will be met. The plan may evolve over time as program evaluation leads to refinement in strategies or timing due to changes in customer preferences and advances in technology. Nonetheless, this plan serves as a general blueprint for the future, showing the overall direction of conservation in the SPU regional service area.

I. THE ROLE OF CONSERVATION

While the Puget Sound region appears to have abundant water, the quantity and seasonal nature of our rain does not coincide with the use pattern. Additionally, growth pressures and environmental constraints have put significant burdens on the available supplies causing them to be limited. The City of Seattle is committed to an integrated strategy for water supply that includes maximizing efficiency of our existing water resources while evaluating new sources of supply that can be developed in an environmentally sensitive manner. Water conservation is a key component of that strategy.

I.A. The Relationship of Conservation to Regional Water Management

Reliance on any one water supply option to meet future demand is increasingly risky. To increase the level of water supply certainty, Seattle has adopted a diverse portfolio of options that includes water conservation, reuse, system efficiencies, and new resources. These supply options are planned and frequently exercised simultaneously. By planning and mobilizing several options at a time, Seattle and its utility partners intend to meet the projected needs of the regional service area.

In an ideal world, development of these supply options would be prioritized and sequenced just ahead of when they are needed. In reality, sequencing and implementation is impaired by delays and restrictions related to regulatory, environmental, jurisdictional and financial reasons.

Interrelationships form around many of these supply-planning strategies, such that one can't be done in isolation or in exclusion of the others. For example, regulators often will not permit a new source of supply unless the utility has completed significant water conservation measures and tightened system operations.

The degree to which conservation's role fits into a water supply planning strategy depends on the support and confidence decision-makers have in these programs for producing and maintaining long-term water savings. Seattle's successes demonstrate that long-term conservation can be a reliable way of meeting long-term water demands. Successful selection and implementation of conservation measures requires the integration of financial planning, system reliability, customer acceptance, and proper packaging and sequencing of the measures to be taken.

I.B. Historic Success

Annual average water consumption has dropped from 170 (mgd) in 1990 to below 150 mgd today. Consumption today is below what it was in 1980, despite the fact that the population served has grown by more than 20% since that time. Current water demand in the SPU service area is estimated to be more than 30 mgd less than projected without conservation. By encouraging sustainable improvements in resource efficiency without negative impacts on lifestyles or the economy, water consumption per capita has fallen by over 20% in the SPU service area since 1990. This historic success, and existing conservation infrastructure, forms a strong foundation for meeting our future long-term conservation commitments.

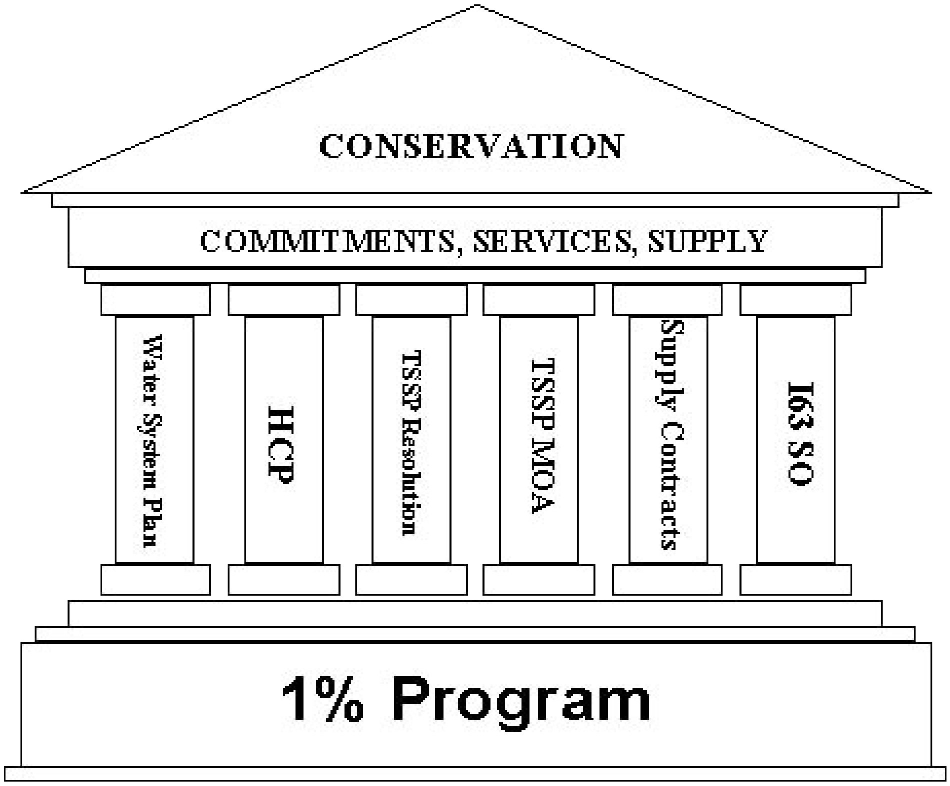
II. COMMITMENTS TO CONSERVATION

In the past two years, SPU has made commitments to conservation that have been negotiated with key stakeholders as part of several agreements, resolutions and ordinances. These obligations help to shape conservation program implementation over the next decade and are spelled out in six documents:

- 2001 Water System Plan Update (WSP)
- Cedar River Watershed Habitat Conservation Plan (HCP)
- Tacoma Second Supply Project (TSSP) Resolution
- Memorandum of Agreement between the TSSP partners and the Washington State Departments of Health (DOH) and Ecology (DOE)
- New wholesale supply contracts
- Initiative 63 Settlement Ordinance (I-63 SO)

Each of these commitments builds on the 1% Program, differing mostly in who is involved and the extent of water savings over time. In effect, each conservation commitment affirms (HCP, Water System Plan, New Supply Contracts), refines (TSSP Partners, DOH, and DOE Memorandum of Agreement), and/or expands the 1% Program (TSSP Resolution, I-63 SO). Some of these obligate SPU to more rigorous implementation of programs than was originally intended in the 1% Program. These commitments establish the framework for conservation that is being implement by SPU and its partners. Exhibit 1 depicts how these commitments, along with the 1% Program, shape SPU's overall conservation effort.

Exhibit 1



II.A. Seattle's 1% Conservation Program

The City created the 1% Program in 1999 and expanded it to include purveyor participation in 2000. It was based on conservation measures identified in the 1998 Conservation Potential Assessment (CPA) that were cost effective (i.e., less than or equal to Seattle's avoided cost of new supply). These measures were incorporated into the 1% Program that was designed to reduce personal and business water consumption in the Seattle regional service area by 1% each year through 2010. This savings goal roughly corresponds to the forecasted growth in water demand over the same time period. Achieving this goal will hold water demand in the SPU service area at the end of 2010 to approximately the same level as in 1999.

The 1% goal was selected to achieve a number of objectives, including:

Keeping up with demand. If each person and business in the region became 10% more water efficient over the next ten years, the region would save approximately 18 million gallons of drinking water per day. This amount of water will meet the needs of 130,000 people or approximately the amount of projected growth within the Seattle service region over the next ten years.

Resource stewardship and endangered species protection. Leveling out the impact of growth on the region's water supplies means there is no need for additional river diversions, preserving more water for salmon, other aquatic life, recreation, water quality, and other important purposes. The federal Endangered Species Act (ESA) listing of the Chinook salmon has added emphasis to these goals for governmental agencies whose operations may have impacts on the Chinook.

Cost effective extension of existing supply. The measures identified in the 1% Program are less costly on a per unit basis than developing traditional new sources of water supply. This benefits customers by keeping rates lower than they would be if a new source of supply were added to the system to meet demand in lieu of reducing demand through conservation.

Customer service. Conservation provides a direct benefit to participating customers by giving them more control over their individual water bills. Participation in conservation measures has other benefits including lower wastewater, electric, and gas utility bills, convenience, labor savings, and in some cases like clothes washing, improved performance.

Reliability. Developing traditional new water supply sources have lengthy regulatory approval processes. Conservation programs can be implemented quickly by utilities without permits, approvals, or revisions to comprehensive plans. Furthermore, because these programmatic savings are largely technology based, savings can be obtained with certainty.

II.A.1. Conservation Potential Assessment

SPU's Conservation Potential Assessment (CPA) provides an expansive toolbox of conservation measures that can produce reliable, long-term water savings. To provide a rigorous analysis of the cost, volume, and reliability of conservation opportunities available within Seattle's wholesale and direct service areas through 2020, SPU completed the CPA in 1998. Over seventy customer-based water savings measures were assessed. Conservation measures were defined as changes in water-using hardware or behaviors resulting in reduced water consumption. None that would result in a loss of service or satisfaction for the customer were identified or analyzed. For example, Water shortage actions such as irrigation bans that would reduce customer service were not considered.

The CPA was the result of a substantial review of literature and applied research into customer water use habits and conservation measures. A detailed, accurate regional water use and demographics baseline was developed that could be easily updated for changing conditions. The information used to prepare the CPA was the latest and best available for residential and commercial water use.

The CPA found that substantial water savings from conservation programs, up to 31 million gallons per day (mgd), could be achieved over the next 20 years. The CPA savings estimates are considered to be conservative. The CPA did not model the benefits of improved future technology, which will likely increase the potential savings while reducing the cost. In addition, the CPA did not calculate non-water benefits such as energy savings, process control improvements, and reduced sewer costs that would likely make the conservation measures more cost-effective to implement.

II.A.2 Customer Perspective

Over the years, SPU and its wholesale customers have systematically conducted quantitative and qualitative market research with their residential customers to track various indicators and assess program acceptance and success. The most recent results show increasing customer understanding of the importance of conservation and their ability to help solve water supply problems. Ninety-four percent of the customers surveyed believed it was important for their household to actively conserve. Eighty-eight percent of customers believed it was important for their water utility to provide conservation programs.

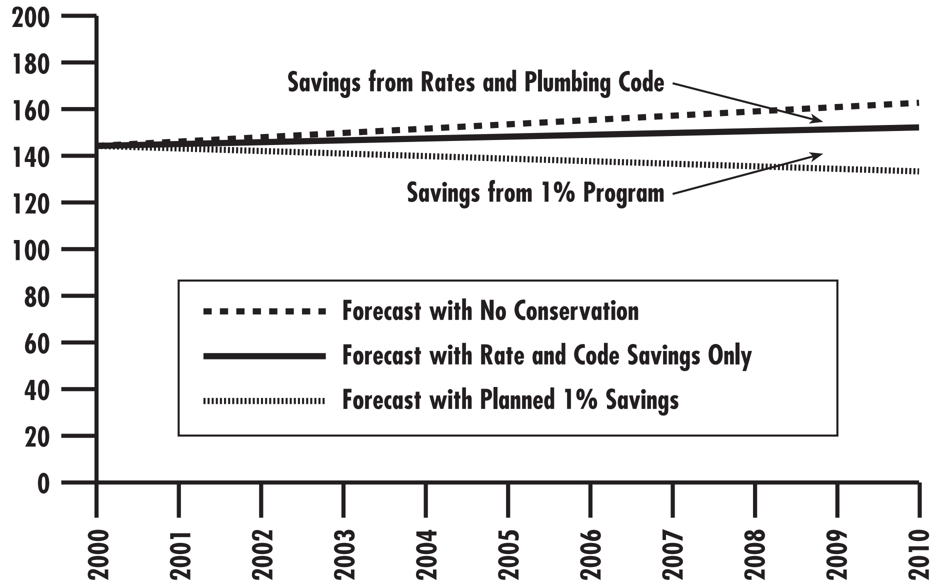
Overall, three-quarters of customers felt they could save more water in their households, and their projections of how much they could save were just slightly less than in earlier surveys. Thus, even though they have reduced use (58% reporting they have reduced their use in the past year), they believed they could save more. Protecting the environment continues to be rated as the strongest component in customer's motivation to save water, although saving money was also high on their list.[1]

[1] SPU and Purveyor 2001 Water Conservation Survey, prepared by: Dethman & Tangora Llc. The survey was fielded in November 2001. The draft report was written January 2002.

II.A.3. Conservation Effects on Forecasted Demand through 2010

Exhibit 2 shows forecasted water demand in SPU's regional service area (retail and wholesale) with no conservation, with conservation savings from water rates and plumbing codes only, and with savings from the 1% Program. Savings from rates and plumbing codes are expected to reach 11 million gallons per day (mgd) by 2010. The 1% Program is expected to achieve an additional 18 mgd by 2010. While this plan focuses on 1% Program efforts, the savings from rates and codes are also important, although they would be achieved without programmatic conservation efforts.

Exhibit 2: Water Demand and Conservation



II.B. 2001 Water System Plan Update

The WSP identifies the 1% Conservation Program as SPU's adopted water conservation program. Savings from the 1% Program were incorporated in the demand forecast contained in the WSP. The WSP was approved by City Council in December 2001. The Plan was also approved by DOH who requires SPU to implement the plan and amend it if significant revisions are made. The plan cites the Conservation Potential Assessment and the 1996 Long-Range Conservation Plan as the basis for the program.

II.C. Habitat Conservation Plan

In 1999, SPU finalized its Habitat Conservation Plan for the Cedar River Watershed. One commitment in this agreement (City of Seattle Resolution 30091) was that SPU implement the 1% Program based on the 1998 CPA. In addition, SPU committed to limited funding for conservation promotion efforts related to fish protection.

II.D. Tacoma Second Supply Project Resolution

In 2000, the Mayor and City Council included conservation commitments in City of Seattle Resolution No. 30259, which was passed in conjunction with the ordinance authorizing SPU to enter into the Tacoma Second Supply Project agreement (TSSP). The resolution:

- Directed SPU to conduct conservation efforts along with the TSSP partners that would save 10% over ten years in the combined service areas of the TSSP partners.
- Directed SPU to include the 1% Program through 2010 and cost-effective conservation through 2020 in its new wholesale supply contract negotiations.
- Directed SPU to develop a work plan for implementing measures beyond the CPA definition of cost-effective to include the cost of the TSSP.
- Directed SPU to work with the Central Puget Sound Water Suppliers' Forum to create a regional water conservation entity.

Since that resolution was adopted, Tacoma and Seattle were not able to resolve certain terms of the agreement that are fundamental to Seattle. As a result, Tacoma and the other partners chose to move forward with the project without Seattle's participation. Nonetheless, SPU will continue to work on fulfilling the relevant commitments identified in the resolution.

II.E. TSSP Memorandum of Agreement

The TSSP resolution also committed SPU to complete a Memorandum of Agreement between the TSSP parties, DOH and DOE that was already being negotiated for the purpose of extending Tacoma's second diversion water right. This agreement, signed in October 2001, included water conservation and planning elements that:

- Encompasses the region covered by the five TSSP partners
- Commits the parties to an aggregate 10% demand reduction by 2010
- Defines regular reporting and evaluation periods.
- Establishes a baseline for conservation.

Since the TSSP participation has changed, the basic precept of the commitments made in the MOA no longer apply. SPU is discussing this with DOH and DOE to determine what responsibility remains for fulfillment of the MOA.

II.F. I-63 Settlement Ordinance

In October, 2001, the Mayor and City Council adopted City of Seattle Ordinance No. 120532, otherwise known as I-63 Settlement Ordinance (I-63 SO), as a settlement agreement to a citizen-sponsored initiative. The ordinance commits SPU to:

- Increase conservation savings in Seattle's retail service by 3 mgd more than the 1% Program goal (9 mgd) by 2010 for a total of 12 mgd by 2010
- Increase funding for conservation in low-income housing
- Review and possibly restructure rates for commercial customers
- Set aside specified quantities of water for fish

Exhibit 3 summarizes and compares the commitments made in these different resolutions and ordinances.

EXHIBIT 3: SUMMARY OF CONSERVATION COMMITMENTS

Document/ Year	Conservation Commitment to 2010		Conservation Commitment after 2010		Other Conservation Commitments
	Goal	Area Involved	Goal	Area Involved	
2001 Water System Update	1% per year	Retail and wholesale	All cost-effective conservation programs identified in CPA.	Retail	None
Habitat Conservation Plan (1999)	1% per year	Retail and wholesale areas	None	None	Funding of conservation messages related to fish
TSSP Resolution (2000)2	10% over 10 years	Retail and in new wholesale contracts.	All cost-effective conservation identified in CPA.	Retail and in new wholesale contracts.	1. Participate in Central Puget Sound Water Suppliers Forum Conservation Work Group 2. Develop Conservation Entity 3. Update CPA every 5 years
	Consider conservation beyond cost-effective as defined in CPA	Retail service area only			
TSSP MOA (2001)2	10% over 10 years	Combined savings with other utilities party to the agreement. All of Seattle's and Tacoma's service area	None	None	1. Work with Central Puget Sound Water Suppliers Forum on conservation measures and evaluation
I-63 SO (2001)	Additional 3 mgd	Retail only	All cost-effective conservation	Retail only	1. Implement low-income housing retrofit program 2. Develop conservation incentive rates for commercial customers 3. Update CPA every 4 years

[2] Since the resolution and MOA were adopted, the TSSP project agreement no longer includes Seattle. Nonetheless, SPU will continue to work on fulfilling most of the commitments identified in those documents.

III. IMPLEMENTATION

Conservation programs, whether based on technological fixes or behavioral changes, evolve as new information emerges, regulations are adopted, and programs are evaluated. For that reason, the programs and timelines described here portray the delivery strategy based on what we know today. The specifics of this plan could change as information, circumstances, technology, and customer preference change. While the details of the plan may evolve, conservation commitments will continue to be met and programmatic conservation will continue to be prominent in how SPU meets future water demand.

The 1% Program goal is to achieve 18 mgd savings by 2010. These savings will be obtained from three types of customer-based water uses: domestic, landscape and commercial/industrial/institutional processes. Within the 2010 timeframe, there are more than 25 measures that are expected to produce the 18 mgd from customer-based program measures. This does not include savings from I-63 SO provisions.

After 2010, the official SPU forecast includes savings from implementing the remaining CPA cost-effective programs within the retail portion of the SPU service area. This would involve continuing programs implemented before 2010, and adding new programs. Actual conservation goals after 2010, however, will be determined in the future for the entire service area, serving both retail and wholesale customers.

III.A. Purveyor Involvement

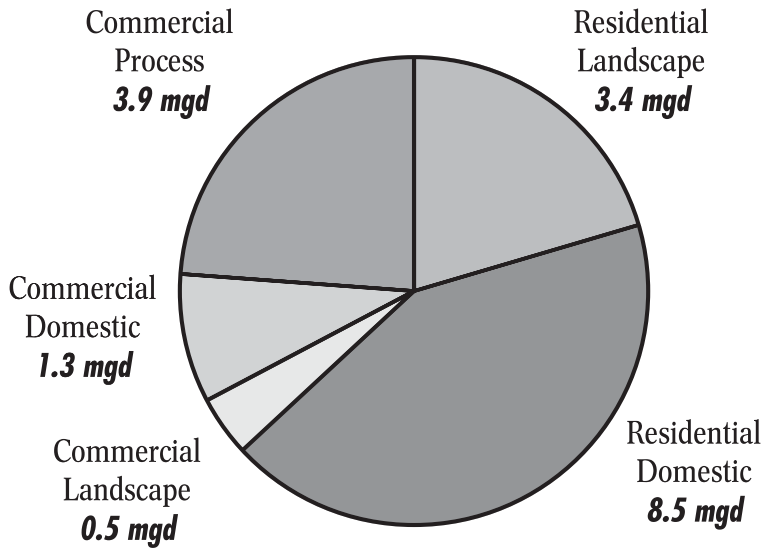
Twenty-six of SPU's wholesale customers, or purveyors, were involved in the preparation of the CPA and have been intensively involved in the ramp-up of 1% Program implementation. Purveyors supported the Conservation element of the 2001 WSP Update, which identified the 1% Program as the approach to reducing demand over the next ten years.

Purveyors are, and continue to be, active partners with SPU in program planning, design, implementation, and evaluation of the 1% Program. The Purveyor Conservation Committee meets monthly to discuss conservation progress and issues. Six Working Groups have been formed within the Conservation Committee that provide in-depth input into strategy development and implementation for the areas of Youth Education, Marketing, Residential Indoor, Residential Landscape, Commercial/ Industrial/ Institutional and overall 1% Program evaluation. The working groups officially formed in 2000, although some were active years before, and plan to remain active throughout the lifetime of the program. Each working group has been developing program delivery strategies for 1% Program implementation across all customer sectors, as well as program tracking and evaluation.

III.B. 1% Program Measures & Strategies

Achieving the goals of the 1% Program requires significant conservation savings across all customer sectors and end uses. Exhibit 4 describes each customer sector's contribution to the total conservation goal. Implementation is proceeding through the development of a series of program delivery strategies that focus on each of the different customer sectors and types of use: residential domestic, residential landscape, commercial domestic, commercial landscape, commercial process, youth education, and overall marketing. Each strategy includes program activities specifically designed to reach a particular type of customer. The different strategies are woven together by an overall marketing effort that promotes a conservation ethic and establishes an identity for the entire 1% Program. Detailed program delivery strategies have been developed in separate reports.

Exhibit 4: Savings by Program Area - MGD



Achieving the first 18 mgd of the 1% Program by 2010, has been estimated to cost $54 million. Spending is projected to increase gradually from 2002 through 2010 to build the 18 mgd savings. This level of investment is necessary to produce the gradual increase in savings associated with customer lifestyle changes and timing of hardware retrofits. Roughly $6 million has been spent for the combined years of 2000 and 2001.

Exhibit 5 summarizes total savings and costs over the ten-year period from 2001 to 2010 for 1% Program implementation in each of the five customer sectors.

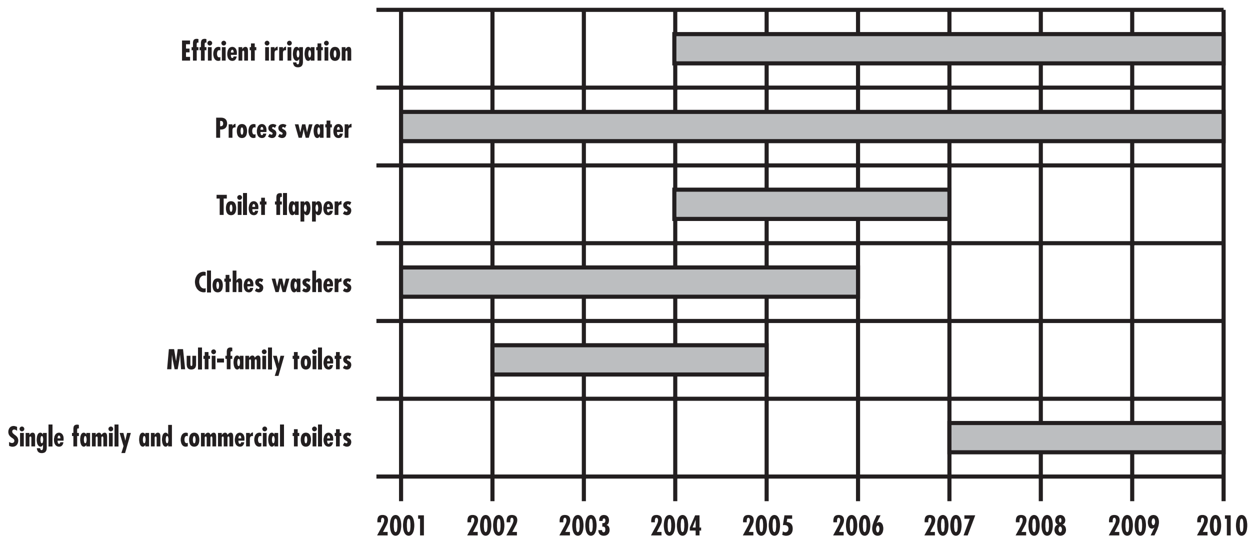
Exhibit 5: 1% Program Implementation Summary of Savings and Costs 2001-2010

Customer Sector	Examples of Measures	Savings (mgd)	Cost
Residential Domestic	Toilet, faucet, and showerhead retrofits; efficient clothes washers	8.5	$22M
Residential Landscape	Irrigation systems and scheduling efficiencies; natural lawns and gardens	3.4	$14M
Commercial Process	Air cooling; process water and cooling tower efficiencies; laundry wash water recycling	3.9	$14M
Commercial Domestic	Low flush toilets and urinals; waterless urinals; swimming pool & hot tub efficiencies	1.3	$2M
Commercial Landscape	Weather-based irrigation; Irrigation system and scheduling efficiencies; soil moisture sensors	0.5	$2M
Total	Implementation of 70 cost-effective conservation measures	**18 mgd**	**$54M**

mgd= million gallons a day

A schedule for reaching these conservation goals has also been developed. While both the programs and their timing could change over time, Exhibit 6 shows the approximate schedule for implementing major conservation measures through 2010.

Exhibit 6: Implementation Schedule for Major Conservation Measures



III.B.1. Residential Landscape

Program emphasis in the near-term will encourage savings through an integrated multi-resource conservation education effort that combines water, waste reduction and stormwater pollution prevention. This approach leverages partnerships with, and funding resources from, other utilities, agencies, and the landscape industry while building natural lawn and garden themes.

The Natural Lawn and Garden concept is the cornerstone of the 1% Program's approach to residential landscape savings. Six printed guides cover the full range of SPU's resource protection priorities for landscaping that includes building healthy soils, choosing the right plants and watering smart. They are available and being distributed to customers in the regional service area.

A convincing, repetitive long-term customer message over many years is needed to gradually change residential practices and the attitudes driving those practices. Most customers tend to remodel and change their landscapes slowly. Furthermore, market transformation to a new landscaping ethic is a long-term educational effort, where short-term savings are more difficult to achieve and small increments of long-term savings are built over time.

From 2002 to 2004 program development efforts will focus on selected landscape watering devices that will be connected with landscape behavior messages. Opportunities to encourage water efficient landscapes in new construction are being developed. In 2002 and 2003, incentive programs will include soaker hoses, mulch mowers, and compost. In addition, extensive field application projects will help identify the best irrigation devices, landscape practices, and delivery strategies for major incentive programs in 2004 and beyond.

Residential landscape savings will come from customers adopting numerous efficiency measures. These savings will be achieved if 30% of the customers who irrigate in the Seattle regional service area improve irrigation scheduling, 30% of customers with automatic irrigation systems improve the performance of those systems, and 50% install automatic rain shut-off devices. Other measures implemented would need to have similar adoption rates to achieve desired savings.

III.B.2. Residential Domestic

For the near term, program emphasis in this sector will be in washing machine and toilet upgrades. The WashWise residential laundry program will use progressively scaled-back incentives and increased promotion to convince as many customers as possible to purchase a more efficient machine prior to the scheduled change of federal efficiency codes in 2004 and 2007. Capture of these early years of savings will result in higher overall value per dollar invested since customers tend to have limited purchasing opportunities. The average customer keeps their machine for 14 years.

The multi-family residential customer sector will emphasize toilet, showerhead and faucet aerator replacements. Multi-family replacements have large water savings potential per toilet replaced and the slowest natural replacement rates. Toilet replacements are promoted by offering financial incentives to customers. Due to rapid changes in how multi-family owners bill tenants for water use by sub-metering or utility cost allocation systems, motivation for multi-family toilet replacement by property owners is steadily declining. Accelerating multi-family toilet replacement thus represents a major opportunity for water savings.

A financial incentive program for low-income multi-family housing in the region is being conducted, with a higher financial incentive than for other multifamily customers in order to achieve participation targets. Initial emphasis will be placed on public housing authorities and large non-profit low-income housing providers.

For the single-family sector, the toilet program will consist of an active education and information effort, with the possibility of a financial incentives program in later years. Because of the overwhelming success of the 2001 toilet round-up events, some limited single family toilet rebate promotions may be included in the early years depending on funding availability.

Replacement toilet flappers (devices that close the flush valve after the tank has emptied) will be promoted to customers who have potential leaks and are not yet ready to make a new toilet investment.

This program is timed before 2007 to avoid overlap and duplication with single family toilet incentives, and to capture the lowest cost savings first. An extensive education and information program will focus on both the how and why of conservation, using broadcast and targeted marketing, youth education, and partnerships with other agencies and organizations.

Achieving the savings goals for these residential programs requires that 60% of customers with high flush toilets will install ultra-low flush toilets, 30% will install water efficient clothes washers, and 30% will decrease unnecessary faucet use. Other measures implemented would need to have similar adoption rates to achieve desired savings.

III.B.3. Commercial Landscape

To reduce landscape water use for this sector, there will be continuing emphasis on site assessments and irrigation audits, and incentives for upgrading existing irrigation systems. Work in this sector will target site owners, facility managers and landscape and irrigation industry professionals. No-cost technical assistance will be offered to customers that help them make changes in irrigation system operation and landscape management. Professional landscape and irrigation auditors will visit sites, check an irrigation system's performance and plant location, and make recommendations for improving efficiency. Opportunities will be pursued related to new irrigation technologies and applications, development of model regulations, and field studies to improve new construction and new irrigation system water and resource efficiency. In later years, or sooner as opportunities arise, emphasis will be on development of efficiency standards to regulate new systems.

Education and training will emphasize natural lawn and garden themes. A network of partnerships with the landscaping and irrigation industry will be built to promote efficient irrigation. Training workshops will target facilities managers to increase their knowledge about the costs and benefits of efficiently managed systems and how to qualify for financial incentives for irrigation upgrades. In 2002, the Business and Industry Resource Venture, an integrated resource conservation partnership with the Greater Seattle Chamber of Commerce, is helping to recruit business participants.

Commercial landscape savings will come from customers adopting numerous efficiency measures. These savings will be achieved if 30% of the customers who irrigate in the Seattle regional service area improve irrigation scheduling, 30% of customers with automatic irrigation systems improve the performance of those systems, and 50% install weather-based irrigation controllers. Other measures implemented would need to have similar adoption rates to achieve desired savings.

III.B.4. Commercial Domestic

In the area of commercial domestic use, restroom upgrades to more efficient fixtures will be emphasized through information outreach in early years and through incentives in later years. In years 2004-2006, a replacement flapper distribution program will complement the information and education effort. Whenever possible, a strong effort will be made to integrate domestic fixture upgrades for customers who are already participating in commercial cooling and process water projects. This helps avoid repetition of multiple program measures and staff contacts over time with the same customer.

Achieving the savings goals for these commercial programs requires that 60% of customers with high flush toilets and urinals will install ultra-low flush fixtures, along with other measures implemented with similar adoption rates.

III.B.5. Commercial Process

In the area of commercial cooling and process water use, efficiency measures will be emphasized that are relatively easy to implement, and where the customer is indicating motivation to invest resources. Less motivated customers, who, for a variety of reasons do not see water conservation as a priority, will be the focus of more intensive marketing in the years 2007-2010. It is expected that in later years, more marketing will be needed to obtain the same annual level of participation and savings. Future water and sewer rates will also be an important factor. Program marketing in the early years will emphasize standard business perspectives like return on investment, and public relations (i.e. being good environmental stewards).

During the first five years, commercial conservation efforts will concentrate on conversion of inefficient water use practices known to be widespread in the commercial sector. Examples include ice machine cooling conversion, elimination of other pass-through cooling applications, cooling tower upgrades, process water used for cleaning and washing, commercial clothes washers, and water-using medical equipment upgrades. Partnerships with other agencies, such as school districts, governments, and energy and wastewater utilities will continue to leverage both program dollars and multiple program benefits.

In order to achieve the savings goals in the commercial sector, 45% of the largest customers with cooling towers will have to improve tower performance by 2010. Thirty percent of the largest customers with process water use will have to recycle the water used in those systems. In addition, 55% of commercial customers with water-cooled equipment will have to replace that equipment with air-cooled equipment. Other measures with similar adoption rates would also be implemented to reach savings goals in this area.

III.B.6. Overall Marketing and Youth Education

Underlying the success of implementing the conservation measures of the 1% Program is the Overall Marketing Strategy and Youth Education Program. Marketing a conservation ethic forms the foundation for behavior changes that result in real savings. The aim of these efforts is to maintain increasingly strong, positive customer attitudes toward conservation and to strengthen the belief that our customers can affect whether there is enough water to meet future water needs. Over time, messages will transition from awareness to action messages that respond to evolving trends in customer preferences. This messaging will also be designed to maintain conservation behaviors as they are adopted over time. Repetition of messages, and building customer awareness of the need for, and how-to's of conservation is key to long-term sustained program success. Customer reaction following the 2001 drought may also require addressing the relationship between utility rates and conservation.

Youth education plays an important role in creating and sustaining future savings. Annual investments in youth education pay long term dividends in the attitudes of the future adult population. These programs also reach parents of those students, which generates more immediate potential savings.

III.C. 1% Program Implementation Schedule and Budget

Ten implementation criteria drive the 1% Program plan and schedule:

1) Balance the level of investment and savings potential from specific efficiency measures analyzed in the Conservation Potential Assessment (CPA) over the ten year life of the program.
2) Produce a dependable stream of water savings at a relatively constant cost to reduce utility revenue fluctuations and minimize rate and budget impacts.
3) Incorporate realistic staffing limits for program managers, consultants, purveyor and agency partners, and other utility staff.
4) Reduce the impact of customers who would have participated without an incentive by appropriate program sequencing.
5) Take advantage of emerging codes and regulations by following a progressive strategy of information, education, incentives, and limited regulation.
6) Sequence measures that provide the greatest savings at the lowest cost first, building up to the more expensive measures later.
7) Time conservation investment opportunities to take advantage of water rate increases when customers will be more motivated to reduce their water bill.
8) Recognize regional customer equities and the need to spread conservation opportunities between customer sectors as well as geographically and demographically.
9) Package conservation measures identified in the CPA into logical customer programs to reduce delivery and marketing costs, and to maximize customer participation opportunities.
10) Increase customer participation levels. Obtaining customer participation rates shown on the implementation table will be very challenging. This level of customer participation is pushing the envelope of what other utilities have been able to achieve. In the last years of the program (2007-2010), much greater emphasis may need to be placed on increasing customer participation, particularly in the area of changing customer behaviors.

A detailed estimate of costs for and water savings from implementing the 1% Program as envisioned by this plan for each year between 2001 and 2010 is shown in Exhibit 7. The actual investment and resulting savings may vary depending on the budget adopted each biennium. The dollars shown in the table are in thousands of 2001 dollars, and some totals may not exactly match due to rounding. The water savings are shown in thousands of gallons per day. In addition, the participation rates reflect the percent participation expected to be achieved within the eligible customer accounts in order to meet the program savings goals in the different customer sectors.

Exhibit 7: Water Saving Partnership (1% Program) Implementation Schedule and Funding- Working Draft (shaded areas denoting program emphasis)

(Dollars noted are in thousands; water savings are noted in thousands of gallons per day)

	"Ramp Up" 2-Year Total	2002	2003	2004	2005	2006	2007	2008	2009	2010	Totals	% Customer Participation
Residential Landscape												**40%**
Naturals theme, specific behavior messaging	425	180	300	300	300	300	300	350	400	450	3,305	
Product (Hardware) Design and Selection	50	100	700	200	100	100	100			-	1,350	
Hardware Device Incentives (new programs)	125	100	100	700	800	1,000	1,000	1,000	1,000	1,000	6,825	
Umbrella, general behavior, partnerships, evaluation	530	200	200	200	200	200	200	200	200	200	2,330	
Residential Landscape Total $'s	**$1,130**	**$580**	**$1,300**	**$1,400**	**$1,400**	**$1,600**	**$1,600**	**$1,550**	**$1,600**	**$1,650**	**$13,810**	
Residential Landscape Water Savings	400	100	320	350	350	380	380	380	380	380	3,420	
Residential Domestic												**90%**
Multi-family toilets	15	1,000	1,000	900	300	200	100	100	100	100	3,815	
Single family toilets	390	150	200	200	300	300	1,350	1,450	1,550	1,650	7,540	
Flappers		-	100	300	600	400	100				1,500	
Washwise laundry	1,241	450	800	600	700	800	200				4,791	
Behavior, youth education, partnerships, marketing, evaluation**	650	120	300	300	400	400	400	600	700	800	4,670	
Residential Domestic Total $'s	**$2,296**	**$1,720**	**$2,400**	**$2,300**	**$2,300**	**$2,100**	**$2,150**	**$2,150**	**$2,350**	**$2,550**	**$22,316**	
Residential Domestic Water Savings	1,150	610	950	900	900	860	770	770	780	780	8,470	
Commercial Landscape												**50%**
Landscape Audits and Incentives, New Codes	370	200	200	200	200	200	200	300	400	450	2,720	
Specific Commercial Marketing & Behavior, Evaluation**												
Commercial Domestic												
Restroom Upgrades	175	50	200	200	200	200	300	400	400	300	2,425	
Specific Commercial Marketing & Behavior, Evaluation**	50	25	25	25	25	25	25	25	25	250		
Commercial Process												
Cooling, Process and Other Incentives	1,850	1,000	800	800	800	1,000	1,200	1,300	1,400	1,600	11,750	
Specific Commercial Marketing & Behavior, Evaluation**	240	200	50	50	50	50	50	50	50	50	840	
Commercial Total $'s	**$2,635**	**$1,600**	**$1,300**	**$1,300**	**$1,300**	**$1,500**	**$1,800**	**$2,100**	**$2,300**	**$2,450**	**$18,285**	
Commercial Total Water Savings	1,250	410	380	380	380	380	380	610	700	730	5,710	
TOTAL PROGRAM $'s	**$6,061**	**$3,900**	**$5,000**	**$5,000**	**$5,000**	**$5,200**	**$5,550**	**$5,800**	**$6,250**	**$6,650**	**$54,411**	
TOTAL PROGRAM Water Savings	2,800	1,120	1,730	1,710	1,710	1,660	1,730	1,790	1,890	1,950	18,090	

* Savings are based upon Conservation Potential Assessment estimates - assumes O&M budget at CPA required levels for savings to be achieved.
** CPA development and program evaluation are included in evaluation items.

III.D. Implementation of Other Conservation Commitments

The other conservation commitments contained in the resolutions and ordinances described in Section II have goals that are either linked to or expand on the 1% Program. Consequently, implementation of some of these commitments are within the scope of the 1% Program. Some of them entail further effort. This section describes how these other commitments will be met.

III.D.1. Habitat Conservation Plan

The 1% Program budget contains funds for overall marketing. Some of those funds will be used to promote the value of conserving to help the environment. This covers the commitment made in the HCP.

III.D.2. TSSP Resolution and Memorandum Of Agreement

As the ramifications of changes to the TSSP agreement partnership unfold, SPU's approach to the commitments in both the MOA and Resolution will likely change. The following discussion describes activities SPU anticipates leading in relation to the commitments made.

The TSSP Resolution directs SPU to examine conservation alternatives that go beyond the cost–effective definition in the CPA. Efforts were underway to meet this commitment when the I-63 Settlement Ordinance was passed by City Council. That ordinance commits SPU to conserve an additional 3 mgd by 2010. Implementation of that ordinance will essentially accomplish the results intended by this requirement in the TSSP Resolution.

SPU is directed to work with Tacoma and the other TSSP partners to develop a plan for meeting an aggregate 10% conservation commitment. If this were to be implemented, it would not likely change what SPU is doing in its 1% Program, except possibly the timing or intensity of implementation activities based on partnering opportunities that might develop. Since the TSSP participation has changed, the basic precept of the commitments made in the MOA no longer apply. SPU is working with the Department of Ecology to determine what responsibility remains for fulfillment of the agreement.

The Conservation Entity called for in the TSSP Resolution is in the formative development stage. SPU is working with other regional leaders and stakeholders to define the Entity's mission, objectives and scope of responsibilities. The Entity is anticipated to be established by the end of 2002, although its role will evolve over time.

In addition to these efforts, SPU has negotiated new wholesale customer contracts that contain a commitment to participate in SPU's 1% Program. The first of these contracts were signed in May of 2001. As negotiations with other wholesale customers continue over the next few years, staff will continue to seek the same commitments for conservation.

III.D.3. I-63 Settlement Ordinance

The plan for obtaining the additional 3 mgd of water conservation in SPU's retail service area by 2010 will be developed by March 2003. It will likely include system efficiency savings and the additional increment of savings from implementing the low income housing component of I-63 SO.

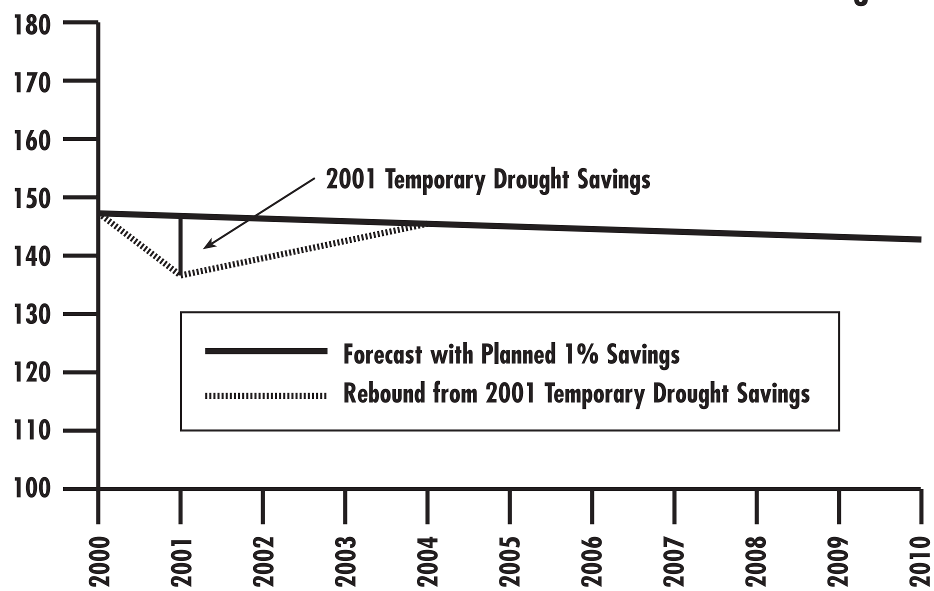
An implementation plan has been prepared specifically for the low-income housing program. It outlines a strategy for achieving desired savings, although it will evolve as opportunities arise and more is learned about the constraints and costs of implementing such a program. Initially, large public housing providers will be targeted. The primary focus will be given to the installation of toilets, showerheads, and faucet aerators. In addition, extremely low-income and very low-income single-family households, as defined in the ordinance, will also be served during the first phase of the low-income housing conservation program. Efforts in the later years will focus on smaller housing providers, and larger housing providers not yet participating in the program. Conservation retrofits will include toilets, showerheads, faucet aerators, irrigation systems and washing machines.

III.E. 2001 Drought Impact on Conservation Commitments

The winter of 2001 turned out to be the driest in 70 years. A statewide drought was declared and SPU asked customers throughout its regional service area to voluntarily curtail water use by 10% during the spring and summer months. Customers responded enthusiastically, generating a dramatic one-year decline in water use. Savings in 2001 are estimated to be 10 mgd. Of those savings, 5 mgd are short-term transitory drought savings, 2 mgd are savings from ongoing price and code affects that were expected for 2001, 2 mgd are from new long-term programmatic savings, and 1 mgd is from extra, one-time system water savings.

Following the 1992 drought, water consumption steadily rebounded until the transitory savings disappeared and demand resumed its long-term downward trend. This was successfully accomplished by continuing investments in long-lived hardware, fixture and technology programs and behavior maintenance programs. Exhibit 8 shows that demand from 2001 will gradually rebound from the temporary savings that were associated with customers' response to the 2001 drought. SPU expects that these temporary savings will disappear by 2004, similar to the experience following the 1992 drought.

Exhibit 8: Rebound in Water Demand from 2001 Drought



This rebound could be faster without the planned conservation efforts.

III.F. Revenue and Rate Impacts

The demand reduction resulting from planned, long-term conservation programs is built into the demand forecast. Conservation savings are thereby factored into the revenue requirements of the utility and addressed during the rate setting process. Unanticipated reductions from drought occurrences or other emergency curtailment of water use, however, may cause temporary declines in revenue that have not been factored into revenue requirements.

IV. PLAN EVALUATION AND UPDATES

Since SPU's first conservation efforts over twenty years ago, there have been significant changes and additions to conservation measures and methods. Changes in available technology have made it possible to secure reliable demand reductions by changing out old water using fixtures with newer, more efficient ones. Building codes have changed, requiring water efficient hardware or providing landscape guidelines that have increased water efficiency. Some programs became cost-efficient because multiple benefits with electric or drainage and wastewater programs lowered SPU costs for implementation.

Other opportunities in the future will likely stimulate changes in the types of measures that should be implemented. Water reuse, which has benefits for wastewater treatment, stormwater management, and aquatic habitat protection as well as water supply, may prove to be one such opportunity. These changes will be considered during evaluation and refinement of conservation measure implementation over the planning horizon.

There are some key milestones at which the program will be evaluated and refined based on SPU's commitments and WSP requirements. They include annual reporting, update of the CPA and the Water System Plan update. The commitments are described in the sections below and shown in Exhibit 9. The evaluation and report schedule is shown in Exhibit 10.

Exhibit 9: Evaluation Commitments

Commitment	**Source**
CPA every 5 years, beginning in 2003	TSSP Resolution
Evaluate progress every two years	TSSP Resolution MOA
CPA every 4 years, beginning in 2004	Conservation Ordinance
Annual Tracking	Conservation Ordinance
Conservation Plan Update every 6 years	Water System Plan Update

Exhibit 10: Evaluation and Report Schedule

Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Mile-stone	Annual Report	Annual Report	Annual Report -CPA Update	-Annual Report	Annual Report	-Annual Report -WSP Update	-Annual Report -CPA Update	-Annual Report	Annual Report

IV.A. Annual Evaluation and Reporting

Evaluation is essential to measuring the success of the 1% Program and its component parts. Evaluation will track implementation progress, help direct resource allocation, and identify needed program refinements. An important component of overall program evaluation will be ongoing customer research to gauge the attitudes and preferences of our customers in order to encourage the greatest participation at the least cost. Through the annual evaluation, it will also be possible to track participation rates and other assumptions to determine what program refinements are necessary to achieve the 2010 savings goal.

The first annual report on the progress of 1% Program implementation was completed in May 2002. The report includes the status and results of overall and individual program implementation. Data has been presented on current and cumulative savings toward achievement of the 2010 goal, including savings achieved in 2001. The annual report fulfills SPU's reporting commitments made in the TSSP Resolution & MOA, and I-63 SO.

IV.B. Conservation Potential Assessment Update

The CPA will be updated periodically to re-analyze existing conservation measures and analyze new potential conservation measures to determine their cost and savings. It will also review participation rates and assumptions about implementation costs for different conservation measures so that strategies can be reviewed and revised appropriately. This will provide data for revising the Conservation Plan to reflect changes in technology and information. To meet the commitment in the I-63 SO, the next CPA update will be in 2004 and every four years thereafter.

IV.C. Water System Plan Update

A conservation plan is one of the required elements of a Water System Plan (WSP). The WSP sets overall direction for how conservation fits into the water supply and demand picture. In doing so, information from the CPA update is considered. If there were no change in policy direction in the next WSP Update, then the WSP would reference this Conservation Program Plan. Likewise, this program plan would be updated according to any changes in direction set in the WSP. The next WSP update is due to DOH in 2007.

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Regional 1% Water Conservation Program

2004 Annual Report
June 2005

Saving Water Partnership

Seattle and Participating Area Water Utilities

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Saving Water Partnership
Regional 1% Water Conservation Program

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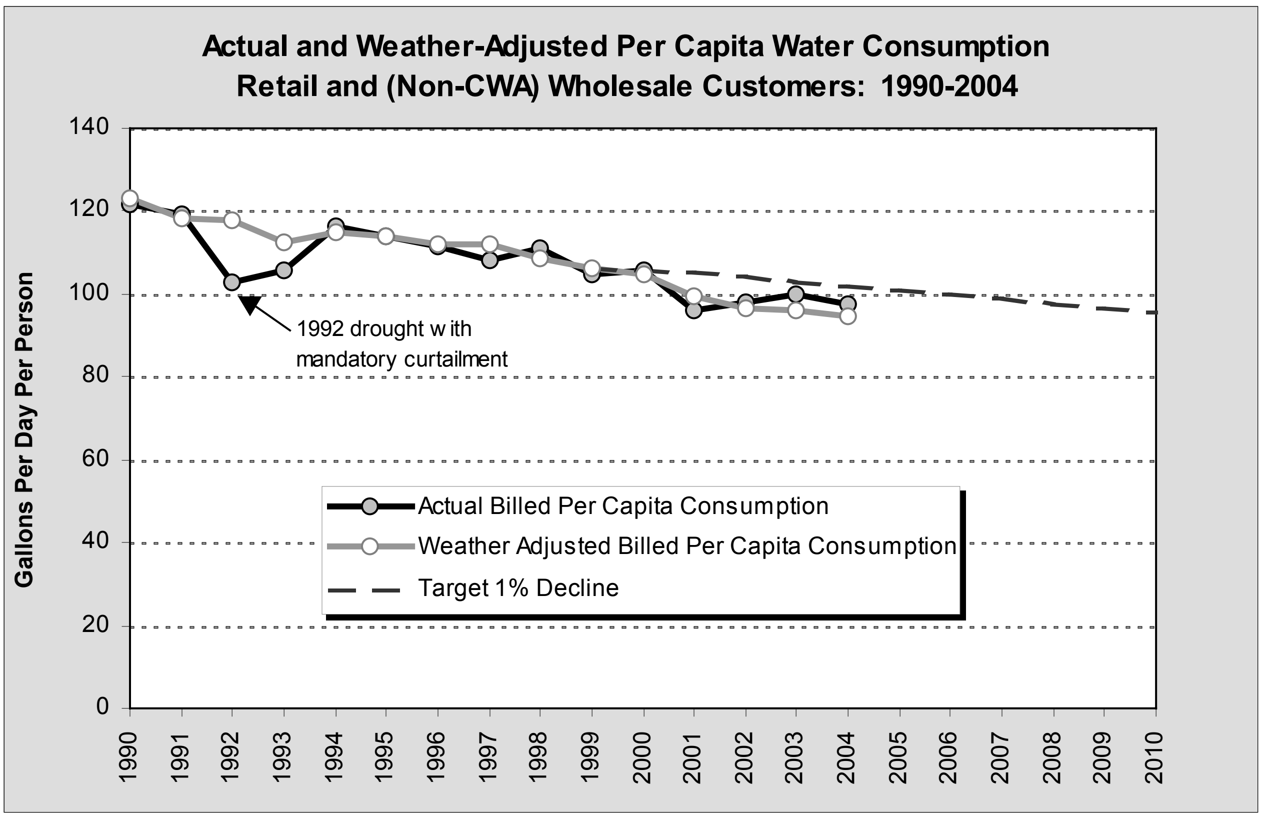
1. Summary of 2004

The decade-plus trend of excellent progress on regional water conservation continues. Regional per capita use is continuing to decline when normalized for variation in weather conditions. Chart 1 shows how a combination of factors, including the 1% Program, have affected per capita use since 1990. The strong dip seen in the chart in 1992 was due to a mandatory lawn watering ban in that drought year. Voluntary curtailment of water use associated with a second drought contributed to another notable decline in water use in 2001. More detail about Chart 1 is provided in Chapter 4.

Chart 1: Billed Per Capita Water Use — 1% Program Utilities

Annual Average



This report reviews annual progress of the regional 1% Water Conservation Program (1% Program). This document is the fourth of an annual series of reports designed to inform and guide the program toward its objectives. The regional 1% Water Conservation Program (1% Program) was initiated in 2000 and is sponsored by the Saving Water Partnership (SWP). This Partnership includes the City of Seattle and a group of 17 utilities purchasing wholesale water from the City of Seattle. The City of Seattle administers the 1% Program in collaboration with these utilities, under terms of long-term water supply contracts.

For this review, the 'region' refers to all customers served by the Seattle Public Utilities (SPU) water supply system who participated in the 1% Program in 2004. Cascade Water Alliance (CWA) utilities who were part of the program from 2000-2003, left the 1% Program in 2004 and 1% Program savings targets were reduced accordingly.

The long-term goal of the 1% Program is to keep water demand by the end of 2010 at the same level as it was in 1999, despite growth in population and economic activity. To achieve this goal, based on the forecasted growth rates at the time of Program initiation, three specific target objectives were developed to monitor progress:

- Reduce annual per capita consumption 1% per year from 2000 to 2010;
- Achieve a total programmatic conservation savings as adjusted following the departure of CWA utilities of 14.5 million gallons per day (MGD) peak season savings (11.0 MGD annual average) in the ten years from 2000 to 2010;
- Achieve annual programmatic conservation savings targets. The target was 1.2 MGD peak season savings (0.9 MGD annual average) in 2004.

Since ramp-up of the program in year 2000, savings goals and accomplishments have been expressed as gallons per day of peak season water reductions. Peak season savings have the greatest value to the program sponsors in deferring expensive new capital projects. However, water demand forecasting and long-range supply planning are done using annual average units of water consumption. As a result, reporting conservation savings as peak savings has often been confusing and difficult to compare to the more traditional average annual numbers. To avoid confusion, “ballpark” conversions between peak and annual average savings are shown in parentheses in this report. These conversions reflect the fact that the various types of programs produce savings that are distributed throughout the year in different patterns (e.g., only in peak season, uniformly throughout the year, or in another pattern).

In 2004, the region continued to make good cumulative progress in reducing per capita water demands. Total cumulative regional water savings of the 1% Program since its inception is very close to target. Per capita demands continue to track lower than target, due to a combination of 1% Program savings, changing demographics and economy, and other long-term water savings produced from rates, codes, water system efficiencies, and Seattle’s low-income water conservation programs.

In 2004 the 1% Program achieved savings somewhat below target because savings from behavior message campaigns fell below expectations. Hardware replacement savings were close to but slightly below target. However, weather-adjusted peak season consumption for customers continued to decline, consistent with the expectations of the 1% Program.

The year 2004 experienced an early, exceptionally warm and dry spring and summer with high peak season irrigation water demands. A pattern of warm dry weather began in April and continued through most of the summer before ending abruptly on August 21. The result has been peak season consumption looking much like 2003, except that it was not as high and it began earlier and ended earlier. As in 2003, a strong summer water supply reduced the need for an expensive, highly visible summer education message, possibly resulting in a lapse of customer attention to conservation. Public awareness of the need for conservation was not emphasized in 2004, however, a highly visible campaign about the negative impacts of overwatering lawns did take place, with an emphasis on both summer watering and recruitment of residential customers to make changes to their in-ground irrigation systems.

While the focus of this report is the 1% Program, efforts other than 1% will be discussed in order to describe total savings in the water system. Based on consumption analysis, 1% Program efforts helped customers implement equipment replacement and conservation behaviors that produced 0.9 million gallons per day (MGD) in new long-term peak season savings (0.7 MGD in annual average savings) in 2004, 76% of the 1% Program target of 1.2 million gallons of peak savings per day (78% of the target annual average savings):

- The cumulative 1% Program (years 2000 to 2004) has now achieved 40% (or 5.8 MGD) of the 2010 peak season savings target of 14.5 MGD (or 4.4 MGD of the 2010 annual average savings target of 11.0 MGD), very close to the revised cumulative five-year target;
- Cumulative cost of the Program to date is $17.6 million, or $3.02 million per MGD of peak season savings;
- 0.76 MGD of the 2004 1% peak season savings (0.65 MGD of annual average savings) was from new fixtures and equipment;
- The remaining 0.15 MGD of peak season savings (0.05 MGD of annual average savings) was generated by new permanent conservation behaviors

The Regional 1% Program

The 1% Program was created in 1999 and expanded to include the entire Seattle service region in 2000. The 1% Program is based on conservation measures identified in the *Conservation Potential Assessment* (CPA, Seattle Public Utilities, 1998) as cost effective (i.e., less than or equal to Seattle's avoided cost of new supply). These measures have been incorporated into the 1% Program and are designed to reduce personal and business water consumption in the regional service area by 1% each year through 2010. When the program was conceived a total peak season savings target of 18 MGD (13.6 MGD annual average) was set that included Cascade Water Alliance utilities. This savings target roughly corresponded to the forecasted growth in water demand in the service region over this same time period. Achieving the 1% target was intended to hold water demand in the Seattle service region at the end of 2010 to approximately the same level as in 1999. Since the departure of the five Cascade Water Alliance (CWA) utilities at the end of 2003, the total savings target has been adjusted to 14.5 MGD of peak season savings (11.0 MGD annual average savings). CWA's block contract with Seattle takes into account conservation savings for CWA, so the reduction would produce the same net savings target of 18 MGD peak season savings by the end of 2010.

The 1% target was selected to achieve a number of objectives, including:

- *Keeping up with demand.* If each person and business in the region became 10% more water efficient over the next ten years, the region will save approximately 14.5 million gallons of drinking water per day in the peak season (11.0 MGD of annual average gallons).
- *Resource stewardship and endangered species protection.* Leveling out the impact of growth on the region's water supplies means there is less need for additional river diversions, preserving more water for salmon, other aquatic life, recreation, water quality, and other important purposes. The federal Endangered Species Act (ESA) listing of the Chinook salmon has added emphasis to these goals for governmental agencies whose operations may have impacts on the Chinook.
- *Cost-effective extension of existing supplies.* The measures identified in the 1% Program are less costly on a per unit basis than developing most traditional new sources of water supply. This benefits customers by keeping rates lower than they would be if a new source of supply were added to the system to meet demand in lieu of reducing demand through conservation.

- *Customer service.* Conservation provides a direct benefit to participating customers by giving them more control over their individual water bills. Participation in conservation measures has other benefits including lower wastewater, electric, and gas utility bills, convenience, labor savings, and in some cases like clothes washing, improved performance.
- *Reliability.* Developing traditional new water supply sources has lengthy regulatory approval processes. Conservation programs can be implemented quickly by utilities without permits, approvals, or revisions to comprehensive plans. Furthermore, because these programmatic savings are largely technology based, savings can be obtained with certainty.

A *Ten Year Water Conservation Program Plan* (Seattle Public Utilities, 2002) was completed in 2002, detailing program budgets, savings targets and implementation strategies through 2010. The regional program began in 2000. The first two years were ramp-up years for program measures, staffing, and funding. Accordingly, the savings targets for 2000 and 2001 were lower than 2002-2010.

2004 Goals and Strategies

The 1.71 MGD target shown in the *Ten Year Water Conservation Program Plan* (Seattle Public Utilities, 2002) was adjusted to 1.2 MGD peak season savings (0.9 MGD annual average), in early 2004 to reflect budget availability and the departure of Cascade Water Alliance utilities from the 1% Program. The targets for subsequent years identified in the *Ten Year Water Conservation Program Plan* have also been adjusted. The adjusted targets are shown in Table 3 (page 9).

The 1% Program fixture and equipment rebate programs for residential and commercial customers expanded upon 2003 efforts and customer contacts. Rebates were re-tooled in some instances, new incentives were introduced, and new utility partnerships were formed to leverage resources and increase services to customers. 1% Program outreach and technical assistance was expanded for large and small commercial customers, and for vendors and contractors.

Marketing strategies to increase rebates and long-term conservation behaviors focused on target recruitment of different types of customers for specific conservation programs. These strategies employed mass media, direct mailings, new program materials, new web and hotline resources, seminars and workshops, agency and trade association partnerships and a host of targeted promotions.

2004 Program Performance

Total 1% Program long-term savings remain very close to target in relation to the *Ten Year Water Conservation Program Plan* (Seattle Public Utilities, 2002). Table 1 shows estimated long-term savings in 2004, with more detailed analysis provided in Chapter 4. New water savings achieved in 2004 include both long-term savings and transitory, or temporary savings. **Long-term** savings include both the direct and indirect impacts from implementation of the 1% Program – these savings are the focus of this report. Long-term savings in addition to 1% Program savings also come from higher water rates and plumbing fixture codes. **Transitory** savings are short-term in duration and come from above-normal utility system savings (non-revenue water reductions), from temporary drought curtailment actions and the residual effects of these actions, and from changes in economic activity in the regional service area. All long-term savings are included in Seattle Public Utilities' demand forecast, whereas transitory savings are not.

Table 1: New Water Savings Achieved in 2004 (in MGD)

	New Long-Term Customer Savings						**Other Savings**		**Total**
	1% Conservation Program		1% Program	Rates	Code	Seattle Low Income	Economy	System	
	Hardware	Behavior	Total						
Residential Indoor	**0.27**[1]		**0.27**	0.1	0.5	0.03			
Residential Landscape	**0.01**	**0.15**	**0.16**	0.1					
Commercial Non-Landscape	**0.48**		**0.48**	0.1	0.3				
Commercial Landscape	**<0.1**	**<0.1**	**<0.1**	0.1					
Other Savings								-4.6[3]	**-4.6**
2004 Total 1% Program Peak Season Savings	**0.76**	**0.15**	**0.91**						**0.91**
2004 Total Annual Avg Savings[2]	**0.65**	**0.05**	**0.70**	**0.4**	**0.8**	**0.03**	**0.0**	**-4.6**	**-2.67**

[1] 1% Program sector savings are reported as peak season savings.
[2] See text on page 2, and in Chapter 2, page 13 for conversion of peak season savings into annual average numbers.
[3] Much of the higher than usual non-revenue water use was believed to be due to reservoir overflowing for water quality purposes.

Also shown in Table 1, but not part of the 1% Program, are savings for rates, codes, Seattle low-income projects, transitory economy-related savings, and system non-revenue water savings. Table 2 shows 1% Program performance relative to expenditures, savings goals and targets for each customer sector, by hardware (equipment), and by behavioral incentives and outreach efforts.

Hardware Incentive Savings include new fixtures and equipment upgrades that were supported with program incentives, as well as accelerated fixtures (beyond rates and code) that were upgraded without rebates. Based on program records, these savings are estimated to be .76 MGD peak season, (or 0.65 MGD annual average) in 2004.

Behavioral Incentives and Outreach Savings include permanent conservation achieved with and without incentives from changes in customer water-using behaviors. These savings are estimated to be 0.15 peak season (or 0.05 MGD annual average) in 2004. These estimates are explained in greater detail in Chapter 4.

Table 2: 2004 Performance

PROGRAM SECTOR	EXPENDITURES ($1,000)	2004 WATER SAVINGS Peak Season[1] (1,000 GPD)	
		Goal	Conservation Achieved
Residential Indoor	**$1,258**	**520**	**271**
Behavioral & Outreach	130		0
Hardware Incentives	1,128		271
Res. Landscape	**$442**	**290**	**156**
Behavioral & Outreach	232		150
Hardware Incentives	210		6
Comm Process & Domestic	**$1,298**	**340**	**484**
Hardware Incentives	1,298		484
Comm Landscape	**$249**	**50**	**0.5**
Behavioral & Outreach			<1
Hardware Incentives	249		0.5
CPA and Research	**$172**		
Youth Education, Annual Report, 684-SAVE, Savingwater.org, Administration	**$182**		
Totals	**$3,601**	**1,200**	**912**
Behavioral & Outreach	544		150
Hardware Incentives and CPA	3,057		762

[1]For annual average savings see description in text above.

Sector Highlights

Residential indoor

- The residential indoor sector achieved strong water savings in 2004. The WashWise program continued at a brisk pace, processing nearly 6,400 rebates for efficient clothes washers.
- The Multifamily Toilet program served 143 buildings, replacing more than 4,000 inefficient fixtures. Staff designed a new incentive for the Multifamily Toilet program that will offer customers a choice of a higher rebate or free toilet in 2005.
- Evaluation of toilet flapper replacement incentives was also completed in 2004, documenting savings from 2003 pilot program efforts and providing valuable information for future program design.

Residential landscape

- This sector developed a new message campaign and expanded on existing messages and promotions. The residential landscape sector developed new supporting materials with specific and highly relevant information to enable customers to make wise choices to save water. The new 'Overwatering' message campaign was highly visible, appearing on buses and airing on the radio during the summer.
- Staff combined partnerships with nine area nurseries, five widely known garden writers, and newspaper and radio advertising to create a 'Plant Right For Your Site' campaign. This campaign focused on plant selection and reinforced the *Better Way to Beautiful* campaign from last year and introduced a new brochure, *The Plant List*, to an enthusiastic audience.
- Another milestone for the landscape sector was development of an agreement with the non-profit Irrigation Water Management Society, which set the stage for development of a web site with real-time evapotranspiration rate data and an irrigation calculator, which customers can use to determine how to set their irrigation systems to deliver the right amount of water for current weather conditions.
- In addition, the Northwest Natural Yard Days promotion was expanded to include a month of compost sales at discounted prices in September. Retailers offered discounted prices on compost, and the SWP promoted the sales.

Commercial, industrial and institutional

- Facilities implemented more than 70 financial incentive projects in 2004. A focus on medical sterilizers contributed to this success, as did a commercial sprayhead retrofit program. Significant incentive projects included the University of Washington (campus toilet retrofit, laundry water recycling system and cooling tower study), King County Metro Bus Maintenance Facility (water-cooled air compressors), Seattle Police Department (water reuse) and two car wash water reclaim systems in wholesale service areas.
- Significant outreach and technical assistance to the business community included a direct mailing to 800 small businesses and completion of more than 20 facility audits and assistance visits at commercial facilities such as Bunge Foods, Trident Seafoods, Fairmont Olympic Hotel, Alaska Airlines, Cabrini Medical Tower, King County South Transit Base, and the Washington State Trade and Convention Center.
- Promotional and workshop presentations were made to facilities managers and targeted trade group audiences.
- Articles were published in several newsletters, and water conservation remained a main feature on the Resource Venture's website. The SWP collaborates with the Resource Venture, a non-profit affiliate of the Greater Seattle Chamber of Commerce, to conduct outreach to businesses.
- A small number of conservation projects were completed by facilities without financial incentives as a direct result of the 1% Program's information and outreach to businesses.

Commercial landscape

- This sector emphasized customer irrigation efficiency audits and customized rebate projects for large commercial landscapes.
- In 2004 workshops were conducted for landscape and irrigation professionals, property managers and other irrigation customers to educate them about the costs of poorly managed systems, efficiency opportunities, and how to qualify for financial incentives. Low customer recruitment resulted in low program participation and low water savings achieved. At year's end, the program was assessed to determine a more cost-effective approach for achieving savings in this sector. The new approach will encourage and enable contractors

to provide auditing services and to pursue the Irrigation Association Auditor certification, thereby improving professional irrigation skills.

Youth education activities provided education and customer recruitment support for measurable savings achieved by the residential indoor and landscape conservation programs. Accomplishments included:

- Development of a revised home water savings kit.
- Creation of a TV advertisement for the interactive ‘Waterbusters’ on-line educational tool.
- Revised web page.
- Distribution of materials to school groups.
- Water education event sponsorship.

The Seattle Water System Wholesale Customer Conservation Technical Forum met throughout the year to discuss the implementation of Residential Indoor, Landscape, Marketing, Commercial/Industrial/Institutional, and Education programs.

1% Program Total Savings to Date

The *Ten Year Water Conservation Program Plan* (Seattle Public Utilities, 2002) savings goal is to save 18 million gallons per day of peak season demand (13.6 MGD of annual average) by the end of 2010. The savings is to come from both the City of Seattle and the wholesale customers of Seattle who participate in the regional Saving Water Partnership (SWP). On January 1, 2004, five Seattle wholesale water utilities left the SWP as part of Seattle’s new contract with the Cascade Water Alliance (CWA). Program savings from these CWA utilities prior to January 1, 2004, were counted in the 2003 Annual Report. The savings yet to be obtained from the remaining SWP Utilities has been adjusted, resulting in a savings goal of 14.5 million gallons per day (11.0 MGD annual average) for the regional 1% Program by the end of 2010. Table 3 on the next page shows the cumulative 1% Program savings to date, and the savings targets for years 2005-2010. This table is laid out similarly to the long-term savings table presented in the *Ten Year Water Conservation Program Plan* (Seattle Public Utilities, 2002).

Table 3: 1% Conservation Program Savings to Date (1,000 GPD peak)

	2000-01 "Ramp-Up" 2-Year Total	2002	2003	2004	2005	2006	2007	2008	2009	2010
Residential Indoor	1,150	386	349	272						
Residential Landscape	400	304	103	157						
Commercial Domestic, Process, Landscape	1,250	525	452	474						
Actual Annual Savings	***2,800***	***1,215***	***904***	***912***						
Target Annual Savings*	2,100	1,120	1,500	1,200*	1,200	1,500	1,500	1,500	1,480	1,434
Actual Savings Cumulative	***2,800***	***4,015***	***4,919***	***5,831***						
Target Savings Cumulative	2,100	3,220	4,720	5,920*	7,120	8,620	10,120	11,620	13,100	14,534

*2004 target and years thereafter adjusted 27% to reflect withdrawal of Cascade Water Alliance utilities from 1% Program. See text for description of conversion to annual average savings.

Looking Ahead

In March of 2005, Seattle Mayor Greg Nickels declared a water shortage advisory, activating the first stage of Seattle Public Utilities' Water Shortage Contingency Plan. Water shortage conditions may create challenges for program implementation such as staff reassignments to shortage-related priorities and may add a level of difficulty to determining 1% Program savings for 2005. Analysis of 2005 water consumption may need to distinguish long-term savings attributable to the 1% Program from transitory savings that were brought about by the shortage but that will erode over time, similar to the situation in 2001. Also in 2005, the regional Conservation Potential Assessment update will be finalized, assisting the 1% Program with program targeting and design.

The 2005 1% Program will continue to build on the success of ongoing program implementation and will try new approaches in several programs:

- National research results about toilet performance will enable a narrowing of rebate eligibility for both the Multifamily Toilet Rebate Program and the Water Smart Technology program, and establish a foundation for the launch of a single family toilet replacement program.
- Limited customer testing of residential showerhead replacement will take place.
- A messaging campaign encouraging residents to wash full loads of clothes will be developed.

- Experience with residential irrigation system rebates will lead to expansion of this effort in 2005 with an increased focus on landscape contractors and equipment vendors.
- Launch of a web site that contains real-time evapotranspiration data and an irrigation calculator will support residential irrigation system rebates.
- The commercial program will continue to focus on targeted savings where there is readily available cost-effective technology and a significant customer base, such as dental vacuum pumps. This targeted approach proved very successful with the pre-rinse sprayhead and the medical sterilizer programs in 2004.
- The program will continue to emphasize assistance to both small businesses and the largest commercial customers who made important conservation progress in 2004.

Although not part of or funded by the 1% Program, Seattle Public Utilities continues to implement a Seattle Direct Service Water Conservation Program to accelerate water savings and assist low income residents inside the city limits. In many ways this Program complements the 1% Program, since greater incentives and more community based marketing can be accomplished, resulting in greater savings. During Phase One 11,027 low-income housing units in Seattle were upgraded with efficient plumbing products. Phase Two will begin in 2005 and target approximately 18,000 additional low-income units through 2010. The goal in 2005 is to reach nearly 8,000 homeowner/utility assistance recipient households with details of free or reduced cost conservation assistance. Program partners currently include community based non-profit Senior Services of Seattle King County, Seattle Human Services Department, and other local community based organizations.

Ongoing Performance Monitoring

The 1% Program regional ten-year conservation goal requires significant conservation investments through the year 2010. Carefully tracking and evaluating program performance through efforts such as those included in this report will help meet the 1% goal in a timely and cost-effective manner. Monitoring program performance will ensure that resources are put to their best use and that the programs are managed for highest efficiency. This information will also help identify the need for mid-course corrections and fine-tuning adjustments as the program proceeds toward the goal.

2. Program Design

Regional 1% Program and 10-year Goal

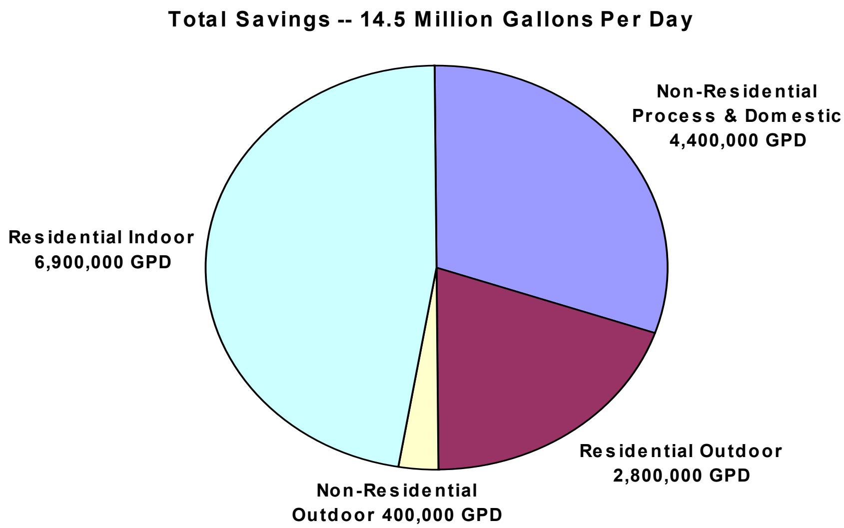
The Saving Water Partnership has an established goal of reducing per capita water use in the regional service area by 1% every year through 2010. When combined with new codes, price impacts and system savings, this goal will result in decreases in total water demand through the year 2010 despite a forecasted 10% growth in regional population over this same time frame. Consequently, water withdrawn from the Tolt and Cedar River supply sources will be no greater in 2010 than they are today, providing significant environmental benefits for fish and other riparian resources. More detailed objectives and strategies for the 10-year program and beyond are presented in the *Ten Year Conservation Program Plan* (Seattle Public Utilities, 2002).

Water system demand reduction comes from several sources: savings from water rates and plumbing codes, conservation programs, and other savings such as the impact of the economy on water use, and utility non-revenue water use. Between 2000 and 2010, savings from rates and plumbing codes are expected to reach 11 MGD annual average savings, and savings from the 1% Program will achieve an additional 14.5 MGD of peak season savings (11.0 MGD annual average). Although Cascade Water Alliance (CWA) utilities are no longer participating in the regional 1% Water Conservation Program, it is assumed that CWA will undertake demand management activities of their own to produce their share of the total Seattle water system savings needed to achieve the 2010 1% target. This report focuses on the 1% Program component of the total conservation picture. Unless otherwise stated, all references to conservation in this report are to those arising from 1% Program implementation.

In 1998, SPU completed a detailed econometric analysis of water conservation potential, the *Conservation Potential Assessment* (CPA, Seattle Public Utilities, 1998; updated in 2004). The CPA provides a rigorous analysis of the cost, volume, and reliability of conservation opportunities available within Seattle's wholesale and direct service areas. The CPA ensures that the 1% Program focuses on the most cost-effective conservation opportunities.

Chart 2 on the next page shows how the savings targets are to be achieved by various customer sectors.

Chart 2: 2010 Peak Season[1] Savings Targets by Sector[2]



[1] See Table 4 on page 13 for annual average saving targets by sector.
[2] Overall messaging and schools elements are considered supports for other elements and do not have savings targets tied directly to them.

Conservation savings will result from improvements in water use efficiency in residential, commercial, industrial, institutional and landscape customer sectors. The 1% Program will implement conservation programs to improve customer water use efficiency through strategies that integrate information, education, incentives, codes and regulations.

10-Year Measures and Strategies

Programs promoting and encouraging the use of efficient water-using equipment, behavior, and technology are the backbone of the 1% Program implementation strategy. Extensive public information and education outreach supports specific targeted program elements.

Since the early 1990's, the SWP has implemented aggressive conservation programs. The effect of these programs during the 1990's is quantified in Chapter 4. Many of these programs continue to be implemented and have been expanded, including: Water Smart Technology commercial/industrial/institutional incentives, Water Efficient Irrigation Program incentives for commercial customers, WashWise water-efficient washing machine rebates for residential customers, and Natural Lawn & Garden techniques for residential landscapes. In addition, new targeted hardware and behavior programs are being implemented for residential landscape and residential indoor uses. These programs are discussed in more detail in Chapter 3.

The initial years of the program have emphasized primarily getting savings from the expansion of ongoing programs, and ramping-up new programs. In 2004, program ramp-up lead to full scale implementation of irrigation system efficiency upgrade incentives for residential landscapes. Major savings over the life of the program will come from residential domestic use programs, more efficient residential landscaping, and commercial/ industrial cooling and process improvements. Table 4 below shows where specific savings will come from and how the programs will achieve them. For further information on the long-term conservation program plans, see the *Ten Year Water Conservation Program Plan* (Seattle Public Utilities, 2002).

Savings in Table 4 are shown in peak season and annual average. Each customer sector has a unique pattern of annual water usage. Water use in the residential and commercial landscape sectors is heavily peak-season oriented, as landscapes are watered mainly during the hot summer months. Some commercial process water uses increase during the summer months, while others may partially increase and others stay constant year-round. Examples of water uses that increase during the peak season include hotel rooms, other tourism-related businesses, canning and bottling, and cooling. Examples of water uses that remain constant year-round include office building restrooms, laboratories, and commercial and industrial process water. While some residential indoor water uses such as showering and laundry tend to increase during the summer months, the increase is not significant enough to differentiate peak season usage from year-round use.

Table 4: 10-year Conservation Program Savings, Measures and Strategies

Sector	Types of Measures	Types of Strategies
Residential Indoor **Peak Savings: 6.90 MGD** by 2010 Ann Avg Savings: 6.90 MGD by 2010 =12% of annual average residential indoor water use	▪ Replace toilets, faucets, showers (single family & multifamily) ▪ Fix leaks ▪ Change behaviors (flushes, faucet use, showers, full loads)	▪ Incentives and promotion to accelerate code replacement ▪ Behavior messaging
Residential Landscape **Peak Savings: 2.80 MGD** by 2010 Ann Avg Savings: 0.93 MGD by 2010 =16% of annual average residential landscape water use	▪ Reduce lawn watering ▪ Improve Irrigation performance ▪ Change lawn & garden practices	▪ Direct & indirect media outreach ▪ Technical materials ▪ Irrigation efficiency incentives ▪ Landscape industry partnerships
Commercial/Process/Domestic **Peak Savings: 4.40 MGD** by 2010 Ann Avg Savings: 3.04 MGD by 2010 =10% of annual average commercial process and domestic water use	▪ Upgrade toilets and equipment for cooling, process other uses ▪ Improve cooling performance	▪ Technical assistance ▪ Financial incentives
Commercial Landscape **Peak Savings: 0.40 MGD** by 2010 Ann Avg Savings: 0.13 MGD by 2010 =19% of annual average commercial landscape water use	▪ Upgrade equipment (irrigation controls) ▪ Improve scheduling & maintenance	▪ Assessments and technical assistance ▪ Financial incentives

Supporting Elements

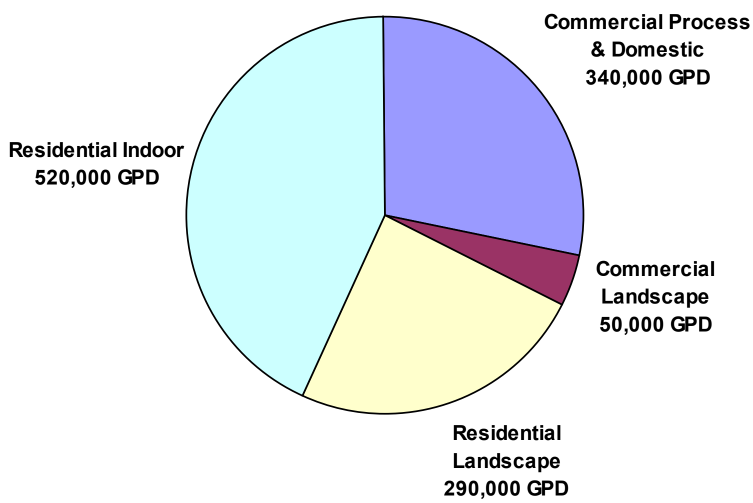
Sector	Types of Measures	Types of Strategies
Youth Education Supports water savings in other sectors	▪ Conservation awareness and personal responsibility	▪ Educator training & resources ▪ Classroom and take-home materials ▪ Watershed tours ▪ Interactive web site
Overall Messaging Supports water savings in other sectors	▪ Conservation awareness, personal responsibility, and residential and commercial measures	▪ Targeted marketing

2004 Program and Goals

An overall peak season savings target of 1.2 million gallons per day (MGD) was set for 2004, based on a total program budget of $3.6 million. For all sectors, new conservation efforts fell into two categories: 1) hardware incentives – primarily financial incentives to replace fixtures or equipment; 2) behavioral incentives and outreach – assistance to change behaviors or upgrade equipment, usually without financial incentives. This year established incentive programs built new savings based on past success, new residential landscape advertising was introduced, assistance and outreach services were expanded and ground was broken on new, future savings programs.

Chart 3 shows the 2004 savings targets planned for various customer sectors.

Chart 3: 2004 Peak Season Savings Targets by Sector



2004 Measures and Strategies

2004 presented special challenges and associated solutions in all of the major customer sectors:

Residential indoor water use. Rebates for clothes washers were lowered in recognition of increasing market share of water efficient machines. To ensure that the market share of these machines continues to increase, marketing efforts were expanded to compensate for the lower rebate.

Residential outdoor water use. Rebates for residential irrigation system efficiency improvements were offered for the second year. An early irrigation season made customer recruitment a challenge for this program. Partnerships continued with retailers, garden writers and the landscape industry. Overcoming customer barriers to water-saving practices, and quantifying savings from these behavioral practices, continue to be a challenge in this sector.

Commercial process, domestic, and landscape water use. Recruiting sufficient customer participation to meet the ambitious savings target for this sector is an ongoing challenge. Two targeted programs - a pre-rinse sprayhead retrofit program focused on restaurants, and a targeted program with a bonus incentive to stimulate retrofit of medical sterilizers, achieved excellent results.

Table 5 shows in detail the different conservation measures and strategies implemented during 2004 within the different customer sectors and supportive elements in youth education and overall messaging.

Table 5: 2004 Conservation Measures and Strategies

Types of Measures	Types of Strategies
RESIDENTIAL INDOOR (2004 Target = 520,000GPD Peak Season Savings)	
▪ Replace washing machines ▪ Replace toilets & faucets (single family & multifamily) ▪ Fix leaks ▪ Change behaviors (flushes, faucet use, shower time, full loads)	▪ WashWise rebates ▪ Double Your Savings rebates ▪ Multifamily toilet rebates ▪ Target building owner and operator associations ▪ Behavior messaging ▪ Collaboration with energy utilities ▪ Promotion through media, mailing ▪ Promotion of results of Maximum Performance Testing of Popular Toilet Models conducted by Veritec Consulting (Veritec, 2004)
RESIDENTIAL LANDSCAPE (2004 Target = 290,000 GPD Peak Season Savings)	
▪ Improve watering efficiency ➢ Irrigation system performance ➢ Landscape watering behaviors ➢ Practices that affect watering (e.g. mulch and soil prep)	▪ Irrigation system efficiency rebates ▪ Aesthetic-oriented media campaign ▪ Regional sales event ▪ Retailer partnerships (nurseries & home & garden centers) ▪ Technical materials ▪ Target high peak users
COMMERCIAL PROCESS/DOMESTIC (2004 Target = 340,000 GPD Peak Season Savings)	
▪ Upgrade toilets and other domestic water use fixtures ▪ Upgrade efficiency of equipment for cooling, process other industrial uses ▪ Improve cooling performance ▪ Upgrade efficiency of specific water consuming medical and lab equipment ▪ Replace pre-rinse spray heads	▪ Target small businesses ▪ Target restaurants and other users of inefficient pre-rinse spray heads ▪ Recognize outstanding projects through BEST awards program ▪ Outreach to chambers of commerce and other business groups through Resource Venture ▪ Technical assistance, assessments, workshops ▪ Financial incentives (custom projects & standard rebates) ▪ Possible bonus incentive to increase participation ▪ Targeted promotion through vendors, trade groups, agencies ▪ Recruit large customers ▪ Perform end-use metering wherever possible to build cost-effective conservation recommendations
COMMERCIAL LANDSCAPE (2004 Target = 50,000 GPD Peak Season Savings)	
▪ Upgrade irrigation equipment (controls, rain sensors, drip) ▪ Improve scheduling & maintenance	▪ Assessments, workshops and technical assistance ▪ Financial incentives (custom projects and set rebates) ▪ Targeted recruiting and promotion ▪ Begin transforming market by establishing and building vendor and contractor relationships

Supporting Elements

Types of Measures	Types of Strategies
YOUTH EDUCATION (Supports savings in other sectors)	
▪ Conservation awareness and residential measures	▪ Educator training and resources ▪ Classroom and take-home materials ▪ Educational TV PSA for kids ▪ Interactive activities
OVERALL MESSAGING (Supports savings in other sectors)	
▪ Conservation awareness supporting recruitment of residential and commercial customers	▪ Targeted marketing ▪ Collaboration with Puget Sound regional water utilities ▪ Festivals

3. Performance by Sector

The commercial customer sector exceeded their expected hardware-related savings in 2004, but other sectors fell below both hardware and behavior-related savings targets because of continued low behavior-related savings as described in Chapter 1.

Highlights:

- Commercial sector water savings were again very strong in 2004. The Water Smart Technology program targeted to commercial process and domestic water conservation exceeded its expected savings in 2004. The Water Efficient Irrigation Program targeted to commercial irrigation did not meet its savings goal.
- Residential indoor sector water conservation savings were also strong again in 2004. WashWise rebates exceeded their goal, but Multifamily Toilet rebates and behavior savings did not meet performance targets, so that the sector achieved significant savings but did not meet sector savings targets. Program costs are expected to decrease in future years as the hardware rebate programs evolve and as confidence in the new toilets and washers increases among customers.
- The residential landscape sector continued a rebate program and rolled out a behavior change campaign targeted to high peak water users, both key components of achieving the long-term goal. Barriers to changing the summer watering practices of these customers are significant and the second year of this program improved over the first year's performance, but did not produce significant savings. Despite a highly visible summer message that addressed overwatering, behavioral savings could not be tangibly demonstrated. An effort is underway to enable the program to better quantify behavioral savings.

Residential Indoor Use

Program Description

The residential indoor sector focuses on the indoor water use of single and multifamily customers. Water conservation efforts result from both fixture upgrades and behavioral changes. The program provides customers with direct financial incentives (rebates), technical assistance, and education. Program information is provided to customers through targeted and regional advertising, point-of-purchase materials at retailers, and direct contact with customers.

The Multifamily Toilet Rebate and other rebates were advertised regularly in the top-read publications for property owners and managers

2004 Goals and Strategy

For 2004, residential indoor conservation services were tasked with achieving 520,000 gallons per day (GPD) of new peak season savings. These savings were to be achieved through fixture replacement and behavioral changes. Fixture upgrades focused on toilets, clothes washers, showerheads and bathroom faucet aerators. While some residential indoor water uses such as showering and laundry tend to increase during the summer months, the increase is not significant enough to warrant using a differential between peak season and year-round savings when counting savings.

Program strategies concentrated on boosting ongoing rebate programs, testing a pilot conservation program, and educating customers about long-term behavior changes. Specific elements included:

- **Washing machine rebates** – The program offered rebates of $50, $75, or $100 to customers for the purchase of qualified efficient clothes washers. Such an approach was intended to educate consumers that washers are not just efficient/inefficient, but offer a range of efficiency levels.

- **Toilet rebates** – The Multifamily Toilet Rebate Program grew from its solid foundation set over the two previous years. A key goal of the program is to work with property owners and managers to replace toilets that would not have otherwise been replaced.

- **Showerheads and bathroom faucet aerators** – Customers who participated in the Multifamily Toilet Rebate Program were eligible to receive these products included in their rebate. These items provided additional water savings in living units as part of the toilet installation "package." The showerheads and aerators have been well received by residents.

Apartment buildings can replace their inefficient showerheads as part of the Multifamily Toilet Rebate Program

- **Outreach** – The WashWise program put major emphasis on advertising in 2004 to keep program participation high in spite of reduced rebate levels. Bus advertising and regional newspaper ads promoted the benefits of resource-efficient machines. Efforts to promote the Multifamily Toilet Rebate continued through articles, case studies, and ads in trade journals. Presentations were made at events sponsored by apartment and condominium owner associations.

2004 PERFORMANCE

Residential indoor conservation produced an estimated 271,500 GPD in new long-term peak season savings. The hardware elements of the program continued to capture savings through thousands of program participants.

Table 6: 2004 Residential Indoor Peak Season Water Savings

Type	Major focus	Peak Savings (GPD)
Outreach & education	Toilets, leaks, behaviors	0
Rebates & promotion	Washing machines, toilets, faucet aerators	271,500
	TOTAL	271,500

Resource efficient clothes washers rebated and installed in the SWP service territory remained a strong source of savings in 2004. The SWP continued to partner with Seattle City Light for customer rebates in Seattle City Light's service area. Clothes washers rebated through the program totaled 6,397 for the year. The water savings attributed to the installation of these machines is an estimated 106,830 GPD of peak season savings. Thirty-nine percent of the rebates were from wholesale service areas, which indicates higher per capita rebate participation for water districts outside of SPU's service territory. An additional 7,000 GPD of peak season savings, the equivalent of 500 efficient washing machine installations, has been attributed to this program. Significant increases in the market share of efficient machines since the WashWise program began indicate that consumers are being influenced to purchase efficient machines, even if they don't apply for a rebate.

WashWise rebates were promoted on Metro buses throughout the regional service area

The program continued to offer tiered rebates, providing greater incentives to customers who purchased higher-efficiency machines. This approach appeared effective, with the greatest number of machines purchased in the highest tier of efficiency. Manufacturers have also increased their offerings of machines in the highest tier of efficiency. According to many local retailers, sales of all rebate-eligible machines now make up around 50% of their total washing machine sales.

Table 7: 2004 Residential Fixture Rebates

Rebated Fixtures	Fixture Targets	Fixture Totals	Peak Season Savings (GPD)
Multifamily Toilets*	7,100	4,141	146,400
Washing Machines	3,600	6,397	113,800
Toilet Flapper Pilot (2003)	600	1,200	9,000
Toilet Recycling Support	300	100	2,300
		TOTAL	271,500

*Savings includes installation of showerheads, aerators and leaks repaired during toilet installation.

The multifamily toilet replacement program helped multifamily building owners and property management firms replace toilets in 143 buildings. Since the program's inception in late 2001, the program has served over 640 participating buildings and rebated over 15,000 toilets.

A total of 4,141 toilets were replaced through the program in 2004, totaling 144,900 GPD of peak season savings. An additional savings of 1,500 GPD of peak season savings, equal to 41 toilets or one percent of program accomplishments was credited to this program to reflect the program's educational effect on property managers who are replacing their fixtures without applying for a rebate. Participation levels below the target of 7,100 fixtures was disappointing but not surprising, given the assumption that many "early-adopters" had already participated in the program. The program continued to have strong participation in wholesale service areas, primarily a reflection of the King County Housing Authority completing the replacement of all old toilets in their housing portfolio. In addition, more than 114 tons of toilets were recycled through the program.

The toilet flapper replacement pilot program that took place in Northshore Utility District in 2003 was evaluated and found to have reduced participants' water consumption by 4.2%, or eight gallons per household per day, on average. The evaluation found that higher savings were achieved from customers with homes more than 10 years old. The level of savings was not sufficient to warrant implementation of a full-scale flapper program in 2005, but a program may be developed that would offer replacement flappers to regional residents with high winter water consumption and who live in older homes.


A common type of toilet flapper

Toilet recycling support for single family residents took place in the form of offering a subsidy of $5 per toilet to participating cities that coordinate city-sponsored recycling events annually. The 1% Program offered the incentive to enable cities to collect toilets for recycling at no cost to the customer. 274 toilets were collected through seven city-sponsored events. In addition, toilets were accepted for recycling year-round at no charge at Seattle's South Recycling and Disposal Station.

Program messages and materials included articles, fact sheets and advertising about conservation behaviors and incentives. Methods included print and bus advertising, press releases, public festivals and events, the savingwater.org web-site, and phone hotline information requests.

LOOKING AHEAD

The residential indoor program will continue to emphasize the WashWise and Multifamily Toilet programs in 2005. Now that the WashWise program has offered tiered rebates for two years, a trend is emerging that shows an increase in the higher efficiency machines. Customers are purchasing higher efficiency machines, and manufacturers are offering more products that are pushing the upper limits of efficiency. The rebate structure in 2005 provides a significantly higher incentive to customers who purchase the most efficient "Three Star" machines. This continues the program's movement toward an exit strategy that provides the greatest incentive to the most efficient machines, and eventually to a program that will be based on customer education rather than incentives. A promotion will be considered for late spring to celebrate the 50,000th WashWise rebate.

As of the end of 2004, the Multifamily Toilet Replacement Program (MTRP) was revamped to increase program participation. The program now offers an $80 per toilet rebate, or a free toilet option. The rebate was increased to stimulate greater participation before use of ratio utility billing systems (RUBS) – various systems for allocating water utility costs directly to tenants – becomes widespread. Once these billing systems are implemented, property owners are less motivated to conserve water. The rebate was also increased to provide more conservation assistance to non-subsidized low-income rental housing units, as mandated in Seattle by city ordinance. For this second reason, a percentage of the MTRP costs in SPU's service territory are being funded by Seattle's low-income program and not funded by wholesale partners. A market penetration study will be conducted in 2005 to determine the remaining potential for toilet replacement in this sector.

Planning is underway to offer a pilot showerhead/bath aerator program to Highline Water District residential water customers. If cost-effective water savings are calculated, such an effort could be expanded throughout the SWP service territory.

An educational effort will launch early in 2005, called FlushStar™. This SWP-driven effort will provide a list of toilets that are recommended to residents based on the results of independent toilet testing. Since mid-2004, all toilets rebated through the Multifamily Toilet Replacement Program have been required to be FlushStar™ qualified products. The FlushStar™ program in 2005 may be supplemented with a time-limited single-family toilet rebate program.

An additional educational effort is planned to capture savings from people making changes in everyday behaviors. An advertising and outreach campaign is scheduled to take place in fall of 2005 to increase the number of households washing full loads of clothes.

Residential Landscape Use

PROGRAM DESCRIPTION

This customer sector targets water used for single family landscapes. The long-term goal, over ten or more years, is to build a new customer ethic with respect to landscapes, replacing traditional and resource-intensive practices with those that are more resource-efficient and more closely follow a natural model. The primary target audience is high peak water users: customers who use significant quantities of water in the landscape. The important secondary audience is users who may not use as much water but who actively garden. The Natural Lawn & Garden (NLG*)* is the unifying concept that conveys key messages about healthy landscapes that require fewer resources, such as water and chemicals. It is an integrated approach, addressing water supply, solid waste reduction and surface water quality and quantity issues and is supported with funding from Seattle and King County solid waste and drainage utility funding. This holistic approach has created efficiencies by leveraging resources from other utilities and agencies and has been well received by landscape professionals and customers. Program efforts focus on outreach and education, program incentives, ecological landscape management, and evaluation.

The key “what” message of this program is summarized in five steps to establishing and maintaining a healthy and beautiful natural lawn and garden.

1. Build healthy soil
2. Plant right for your site
3. Practice smart watering
4. Think twice before using pesticides
5. Practice natural lawn care.

Ways to implement the five steps listed above are detailed in a series of publications called the natural lawn and garden guides:

- Growing Healthy Soil
- Choosing the Right Plants
- Smart Watering
- Natural Pest, Weed & Disease Control
- Composting at Home
- Natural Lawn Care
- Natural Yard Care (summary)
- The Plant List (draft completed in fall, 2004)

2004 GOALS AND STRATEGY

Residential landscape conservation was targeted to reduce long-term water use by 290,000 gallons per day (GPD) in 2004. The strategy focused on four areas:

- **Awareness building** – Raising awareness is the first step toward achieving changes toward new, efficient behaviors. A highly visible advertising campaign about the costs of overwatering was implemented to build interest among the general public in how to water landscapes efficiently.

- **Education** – The program offered technical assistance, materials and training to assist customers in changing their behaviors. An advertising campaign with the tag line “Plant Right for Your Site,” and a new brochure called *The Plant List*, encouraged customers to choose plants suited to the site where they would be planted. This idea of “right plant, right place” was further supported with a series of classes. Alliances with local garden columnists resulted in additional publication of the “plant right for your site” message in newspapers, and in securing highly respected garden writers as hosts and teachers of the classes. The Natural Lawn and Garden Hotline answered customer questions about all aspects of resource-efficient gardening, Although not funded by the 1% Program, 17 classes focused on landscape design and maintenance were offered to professionals such as landscape architects, designers, builders, turf and landscape installation and maintenance contractors.

- **Behavior change using incentives** – Two efforts made use of financial incentives to encourage customers to practice resource-efficient behaviors in their landscapes. The Water Efficient Irrigation Rebate (WEIR) provided an incentive to encourage people to upgrade their in-ground irrigation systems. Northwest Natural Yard Days was a highly visible promotion of resource-efficient products sold at discount prices in many nurseries and box stores in the spring and fall.

- **Research and evaluation** – Research and evaluation ensure that program resources are put to their best use. In 2004, research on woody mulch products, a survey on mulching practices, and a survey on use of the natural lawn and garden guides were conducted to further refine recommendations to customers.

2004 Performance
Residential landscape savings totaled 156,500 gallons per day of peak season savings, achieving 54% of the target of 290,000 gpd of peak season savings. An early irrigation season, a delay in marketing of the rebate program, and difficulty in attributing savings to behavioral changes have in part contributed to savings falling below target.

Table 8: 2004 Residential Landscape Peak Season Savings

Type	Major focus	Peak Savings (GPD)
Behavioral incentives & outreach	Radio and print ads, nursery partnerships, retailer partnerships, compost, water timers, soaker hoses and educational materials	150,000
Hardware incentives & promotion	Automatic irrigation system hardware retrofits	6,500
	TOTAL	156,500

"Overwatering…Soaks You, Drowns Plants, Drains Resources" campaign
Developed as a comprehensive public awareness approach to behavioral and equipment changes, the "Overwatering" campaign utilized radio, internet banner, bus, and print ads throughout the summer. With three different messages, customers learned about the negative impacts of overwatering and the resources available to use water more efficiently. The messages focused on the financial, plant health, and environmental issues of overwatering, and included graphic images depicting each of the scenarios. In addition, the campaign directed customers to savingwater.org and 684-SAVE for information on irrigation sprinkler rebates and watering tips.

This ad campaign encouraged people to think about how they water their landscapes, and why they might want to change the way they do it

A radio ad aired during peak listening periods on two stations, KOMO AM 1000 and 570 KVI AM. The ad featured two men light-heartedly discussing the financial and environmental impacts of their neighbor's overwatering problem. The *Seattle Times, Seattle PI, King County Journal*, and community papers, bus, and radio and newspaper websites rotated one of the three messages weekly.

"Plant Right for Your Site" Campaign
The goal of this campaign was to encourage customers to choose the "right plant for the right place." Plant selection is a highly misunderstood concept by the gardening public. From surveys, we have found that most gardeners choose plants for aesthetic

Choosing the right plant gives you less yard work and more time to enjoy your yard reasons without regard to whether their plants will thrive in their existing sun, soil and water conditions. This can result in excessive use of water, fertilizers and pesticides. However, gardeners are strongly influenced by nurseries and local garden writers. Therefore, in Spring 2004, SWP partnered with nine area nurseries and five of the Puget Sound's most widely known garden columnists to teach and host classes. The columnists taught classes at the nurseries from March 27th through May 1st (peak plant sale period). In total, 207 people attended the classes. Of these attendees, 162 completed class evaluations. The evaluations revealed that 75% of those responding were going to try matching the right plants for their gardens. In addition, 10 nurseries helped to promote the classes and proper plant selection through cooperative SWP-nursery advertising in *Pacific NW Magazine*, *Seattle Home + Garden*, *NW Garden News* and KIRO radio during Ciscoe Morris's gardening show.

Proper plant selection was presented in a fresh light through a full-page ad in an October issue of Pacific Northwest Magazine, entitled "Pull on your galoshes and plant for dry summers ahead." The goals of the ad were to educate gardeners on why fall is the best time to plant and to use the following resources with our dry summers in mind: request the new *Plant List* and other Natural Lawn & Garden guides available through the Natural Lawn & Garden Hotline; visit savingwater.org website and attend the class, "Under the Seattle Sun…Drought Resistant Gardening Inspired by Tuscany." Following the ad, the Hotline received 200 requests for *The Plant List* and 97 people attended the class taught by gardening columnist Marianne Binetti. 89% of the attendees returned evaluations, with 91% saying they would try plants suggested during the class.

Development of *The Plant List*

The Plant List was developed as a key tool to support customers in selecting the right plant for the right place in their landscapes. The newest addition to the family of Natural Lawn & Garden Guides was developed during the second half of 2004, with a draft completed in time for an October waterwise gardening class. *The Plant List* was developed with the valuable assistance of the Great Plant Picks horticultural education program. The list consists of almost 400 plants, organized into four categories: Wet Winter/Dry Summer Plants, Moisture-Loving Plants, Favorite Pacific Northwest Native Plants, and Drought-Tolerant Plants. *The Plant List* will be finalized as a 14 page, full color brochure in early 2005.

"The Plant List" helps people choose the right plant for the right place

Alliances with local garden columnists were initiated in 2003 and showed numerous results in 2004. Columnists understood our goals and programs and enthusiastically partnered with us to teach the classes described earlier. In addition, five of the *Seattle Times* and *Seattle P.I.* journalists wrote articles about watering less in the garden. Two of these titles were "Curb your watering habit for healthy grass" and "How to stop wasting water with irrigation systems."

Natural Lawn & Garden Hotline

The Natural Lawn & Garden Hotline had nearly 7,500 public contacts in 2004, answering over 13,000 questions from the gardening public. Approximately 30% of the calls received came from King County residents outside of Seattle plus another 10% from gardeners living outside

Table 9: 2004 Landscape Customer Outreach

Contacts	Targets	Actual
Naturals guides	60,000	44,720
Public class attendees	300	304
Attendees at training for professionals	400	365
Natural lawn & garden hotline questions answered	12,000	13,000

King County. The Hotline number was seen more than ever - in addition to the SWP using it, it was also used by suburban cities, various media outlets and even gardening businesses. The Hotline was promoted through business cards and magnets, print ads in landscape industry publications and radio ads on the Ciscoe Morris show on KIRO radio. The Hotline was also a point of contact for Northwest Natural Yard Days, irrigation contractors and evaluation of the "Naturals" brochures.

Natural Landscapes – 2004 Professional Education
While funded by SPU's Solid Waste and Drainage utilities and not by the 1% Program, this professional education and outreach work complements ongoing public education and market transformation campaigns in the landscape area, and includes a strong landscape water conservation focus. In 2004, 17 classes and full day workshops attracted 365 professionals, including: architects/landscape architects/designers/project managers; builders & contractors; engineers & consultants (stormwater, erosion control, civil, etc.); realtors/development sales staff; and turf & landscape installation & maintenance contractors. Classes for these audiences focused on landscape design and maintenance choices, with a particular emphasis on soil preparation, mulching, and appropriate plant selection.

Water Efficient Irrigation Rebate Program
Now in its second year, the objective of the Water Efficient Irrigation Rebate Program (WEIR) is to increase the efficiency of residential automatic irrigation systems through customer rebates. The mostly vendor driven program doubled the number of rebates for irrigation controllers and rain sensor upgrades in 2004 compared to the first year of the program, even with a reduced service area.

Focusing on landscape and irrigation contractors as a vehicle for marketing the program, WEIR sent an irrigation newsletter and provided training opportunities for contractors to learn about the rebates, important irrigation efficiency information, and industry news. The program also offered contractors who attended the training the opportunity to be posted in a section of www.savingwater.org. which lists contractors who can perform efficient irrigation retrofits. This information was also distributed through the Natural Lawn and Garden Hotline when customers called 684-SAVE and were directed to the hotline with questions about the rebate program.

Ciscoe Morris, a popular local gardening expert, served as spokesperson for Natural Yard Days

Half of the customers who received rebates in 2004 were in wholesale service areas. 88% of customers installed rain sensors and 71% upgraded their controllers. Of the 57 customers who upgraded their controllers, eight installed evapotranspiration controllers. 73% of the customers learned about the rebates from their contractor. Others found out from direct-mail, newspaper, and radio. Two irrigation contractors were responsible for 60% of the rebates received from customers. $17,850 was paid in rebates, with an average rebate amount of $220.

Northwest Natural Yard Days

2004 was the seventh year for Northwest Natural Yard Days. The campaign continues to emphasize the five steps to natural yard care outlined in the Natural Yard Care brochure. For the first time, in 2004 the campaign was carried out in two seasons, spring and fall. The fall campaign discounted compost and organic fertilizers. Local radio and TV gardening personality Ciscoe Morris was again the spokesperson for the campaign. Ciscoe appeared in two 30-second TV spots and one 10-second spot, as well as a radio ad, print ads, a pullout supplement to the *Seattle Times/P-I* Pacific Magazine, and in-store banners, shelf talkers and near life size silhouettes. In addition, the program kick-off generated an extended spot on KCPQ-TV and a story in the Seattle Times. The program's direct education focus shifted from store customers to retail staff at 23 stores - 139 staff received training in the spring and 130 were trained in the fall. Though compost sales rose only moderately, sales of soaker hoses and water timers went up substantially.

Table 10: 2004 NW Natural Yard Days Sales Results

Product	Number of items sold
Electric Mowers	1,486
Push Mowers	1,741
Weed Puller	2,678
Soaker Hoses	5,657
Insecticidal Soap	2,545
Water Timers	1,354
Bags of Compost2	94,318
Bags of Organic Fertilizer	6,255
Overall Items Sold	**116,034**

Mulch research

In 2004, SPU contracted with Howard Stenn to conduct research on documented benefits or harm associated with the use of various woody mulches in landscapes. The purpose of the research was to determine whether bark mulch was a good product to add to the Northwest Natural Yard Days retail promotion. In prior years, SPU primarily recommended wood chips from arborist work as a woody mulch product. While this product is adequate, many residents were frustrated with the lack of a predictable schedule for availability and delivery of the material.

The literature review and interviews with landscape professionals found that there is no evidence of growth inhibition in woody landscape plants due to the use of commonly available bark mulch products. Surface crusting (and related water-shedding) and nitrogen immobilization can sometimes be a problem with using certain types of woody mulches. Disease transmission by arborist chips from diseased plants is not a documented phenomenon.

As a result of the research bark mulch was added to the discounted products offered by retailers during the Northwest Natural Yard Days promotion.

Mulch intercept survey

SWP has undertaken many programs to encourage gardeners to mulch. Among other benefits, mulching helps soil retain moisture, meaning that gardeners don't need to water as often. However, SWP has learned from previous surveys that although customers mulch, they may or may not water less. In an effort to gauge whether or not customers make this connection and to what extent they would be motivated to mulch if they knew they could use less water, SWP conducted a customer intercept survey at four large retailers (box stores such as Home Depot and Lowe's) and three nurseries. 520 responses were collected. Most customers (71%) thought that mulching in the fall would help them save water in the summer. And most customers (62%) claim to water mulched beds less than unmulched beds. While this survey had a small sample size and relied on self-reported behavior, the responses showed that customers were making the intended connection between mulching and watering.

Natural lawn & garden guides survey
To help determine whether customers who receive copies of the Naturals guides find them useful, a postage-paid postcard was sent with four questions to a total of 347 customers during the summer of 2004. These were customers who had been sent guides after calling the Natural Lawn & Garden Hotline. In total, 89 postcards were returned, or 26% of the total. Comments were generally favorable. Respondents said that they changed their practices most often in the following areas, based on reading the guides:

- Improving mulching and composting practices
- Reducing water use through scheduling changes
- Improvements to natural lawn care practices
- Reducing pesticide and weed and feed use

To obtain data from customers over the course of an entire year, the survey will continue through spring of 2005.

LOOKING AHEAD
In 2005, the SWP will research the feasibility of working with housing developers on establishing limited-to no-irrigation landscapes. Successes from 2004 will be reinforced in the coming year. A key objective is to continue to leverage resources through strong partnerships with a variety of actors, including housing developers, nurseries, garden writers and landscape and irrigation professionals. Activities were:

- Forming new community partnerships with garden tours, plant sales, and large garden clubs to distribute educational materials at community events with high gardener attendance.
- Establishing partnerships with libraries and book stores to capture the interest of gardeners who read. The SWP will approach libraries and bookstores with a new bookmark to promote *The Plant List* and explore opportunities to display *The Plant List* in gardening book promotions. Potentially host classes at libraries in an effort to connect with gardeners at a neighborhood level.
- Rewriting the Soaker Hose fact sheet to appeal more to beginner gardeners.
- Assessing the Naturals guides to determine if re-designs and re-writing would add value and appeal to new gardeners.
- Promoting the new evapotranspiration website at iwms.org, which will post daily ET, irrigation scheduling calculators, and a water budget calculator.
- Repeating the ‘Overwatering’ campaign, including a direct mail to high peak season water users.
- Publishing two newsletters and conduct two landscape and irrigation contractor trainings to promote the rebate program.
- Developing and implementing a plan to enable the landscape program to better quantify savings made from customers changing their water-using behaviors.

Commercial Process and Domestic Use

PROGRAM DESCRIPTION
The Water Smart Technology program provides technical assistance and financial incentives to reduce water use in commercial, industrial and institutional facilities. Conservation opportunities include replacing toilets and urinals, converting ice machines and refrigeration equipment from water cooling to air cooling, other types of pass-through cooling, installing high efficiency commercial

Water reclamation system at Fred Hutchinson Cancer Research Center clothes washers, upgrading air compressors and other medical equipment, process water recycling and reuse, cooling tower improvements, and other water use efficiency technologies. Program staff and consultants provide efficiency solutions through on-site assessments and metering, technical review, product evaluation, fact sheets, and case studies. Program financial incentives provide standard rebates, custom incentives of up to 50% of the installed costs of any cost-effective conservation measure, and special incentives of up to 100% of installed cost for targeted measures. Most program participants have a simple payback period of less than two years on their investment.

2004 GOALS AND STRATEGY

The Water Smart Technology Program had a water savings target of 340,000 GPD of peak season savings for 2004, including savings produced from customer information and outreach activities.

Program delivery and outreach focused on four strategies:

- Promotion through service and equipment vendors;
- Partnerships with trade groups, electric utilities, agencies and other service providers;
- Targeted recruiting of select business categories, including large customers, hospitality, medical facilities, and schools and institutions; and
- Workshops designed to address selected end uses.

These strategies and priorities are described in the *Commercial Delivery Strategy* (Seattle Public Utilities, 2001).

2004 PERFORMANCE

The Water Smart Technology Program exceeded its savings target by 42% in 2004. Improvements at commercial facilities produced estimated long-term water savings of 483,700 GPD of peak season savings.

Table 11: 2004 Commercial Process and Domestic Peak Season Savings

Type	Major Focus	Peak Savings GPD
Rebates & administration	Toilets, cooling, process, technical assistance	483,700
	TOTAL	483,700

Significant outreach and assistance was provided by the Resource Venture and contributed to these savings. The Resource Venture is a non-profit affiliate of the Greater Seattle Chamber of Commerce that is under contract to the SWP and SPU to provide resource conservation outreach to the business community.

2004 program accomplishments included:

- Completed or making significant progress on major incentive projects at the University of Washington (campus toilet retrofit is now approximately 75% complete and a study evaluating water treatment options for UW's 20+ cooling towers is in progress), Westin Hotel (complete toilet replacement - North Tower), Children’s Hospital medical air compressor, Consolidated Laundry installing a water reclaim system, and Highline School District multi-school bathroom retrofits.
- Targeted program focus and special program incentive on medical sterilizers brought in estimated savings of 45,000 GPD of peak season savings. The interest and success encouraged an extension of the special program incentive through March 1, 2005.

- Assisted customers with long-term conservation planning, including the Port of Seattle, University of Washington, and several King County facilities.
- Adopted the FlushStar Toilet list for the Water Smart Technology Program.
- Held third annual Businesses for an Environmentally Sustainable Tomorrow (BEST) awards ceremony, recognizing businesses for their environmentally beneficial accomplishments including water and energy conservation. The awards are sponsored by a partnership of the SWP, the Resource Venture, the Greater Seattle Chamber of Commerce and Seattle City Light. The awards draw attention to businesses' success in resource conservation.

Table 12: 2004 Commercial Incentive Projects

Process and Domestic Measures	Projects	Peak Savings GPD
Bathroom measures	36	135,698
Refrig./ Ice Machines/ Cooling	15	36,439
Medical Equipment	7	58,357
Washing Machines/Laundry Sys	4	51,569
Process Water	9	33,488
Laundrywise	NA	3,843
Sprayheads	NA	152,260
2004 Total	71	471,654
2004 Target	*75*	
Non-incentive Projects	Projects	GPD
Non-incentive projects	6	12,033

- The Resource Venture conducted eight presentations for facilities managers and targeted trade group audiences on water conservation programs and services, and conducted 12 water conservation assistance visits. Articles were published in several newsletters, and water conservation is a main feature on the Resource Venture website.
- Sponsored two hospitality industry workshops providing technical information tailored specifically to water conservation opportunities in that sector.
- Sponsored a vendor/contractor workshop to promote a special Water Smart Technology Program Incentive and to increase participation in the WST Program.
- The Efficient Pre-rinse Sprayhead Program partnership with Puget Sound Energy was highly effective for all of 2004. Over 2,000 heads were installed in SWP territory. This success was rewarded with agreement to install an additional 750 heads above the original goal of 3,000. This program involves the direct replacement of inefficient pre-rinse sprayheads in food service settings at no cost to the participating customer. New, highly efficient sprayheads produce significant water and energy (hot water) savings.

More than 2,000 efficient sprayheads are saving over 150,000 gallons per day in restaurants throughout the service area

- Developed a program partnership with Puget Sound Energy to offer a significant rebate increase for coin-op clothes washers installed in commercial laundromats.
- Completed a direct mail promotion to 800 small business customers that had requested information through a 2003 direct mail campaign.
- SWP staff outreach activities included conducting more than 20 audits and assistance visits at commercial facilities such as Bunge Foods, Trident Seafoods Four Seasons Hotel, Alaska Airlines, Cabrini Medical Tower, King County South Transit Base, Ash Grove Cement, Westfarm Foods, Arctic Ice Cream, and the Washington State Trade and Convention Center. Made promotional and workshop presentations to business organizations such as BOMA (Building Operators and Managers Association), numerous local chambers of commerce, and the Medical Industry Roundtable.
- Extended the Resource Venture contract to the end of 2005. More emphasis was placed on core services and easy to obtain and effective educational materials.

LOOKING AHEAD
With the extension of the sprayhead program and continuing to target medical sterilizers, as well as two large projects lined up for early 2005, Nucor Steel and the Shoreline School District, the Water Smart Technology Program is well positioned to achieve target savings in 2005. The program will continue to support a broad spectrum of cost-effective conservation measures through technical assistance and incentives. New targets providing potential opportunities for specific end-use savings are dental vacuum pumps and continuing with coin-op clothes washers that got a late start in 2004. Consideration will also be given to updating the commercial toilet incentive to match the multi-family offer of either a free toilet or $80 rebate for a FlushStar toilet. Outreach recruitment will continue utilizing the Resource Venture for targeted business sectors including hotels and restaurants, medical, and institutional facilities. A special emphasis will be given to sprayhead program participants. A new commercial assistance brochure will be completed by the end of the second quarter, and evaluation of the Sprayhead Program, now due to be completed by the second half of 2005, will occur late in the year.

Commercial Landscape and Irrigation Use

PROGRAM DESCRIPTION
The Water Efficient Irrigation Program (WEIP) provides irrigation conservation services to commercial and multifamily customers in the form of free irrigation audits, water use analysis, and financial incentives to encourage irrigation system capital improvements that save water. It differs from the residential program (Water Efficient Irrigation Rebates, or WEIR), in that it provides a more customized service, since commercial/multifamily irrigated properties tend to be larger and therefore the potential for water savings is greater.

2004 GOALS AND STRATEGY
New commercial landscape efficiencies produced 500 gallons per day (GPD) peak season savings in 2004, 1% of the expected hardware savings of 50,000 GPD in peak season savings. In 2004, changes in program staffing led to a delay in recruiting customers for the program, and impacted the overall success of WEIP. Most outreach efforts focused on recruitment for irrigation audits. Only six customers submitted applications for irrigation incentives and all were for standard rebates.


Efficient irrigation systems deliver water uniformly

2004 strategy paralleled the strategy used in 2003. The program emphasized customer landscape assessments and audits. A professional irrigation auditor reviewed the performance of participating customers' irrigation systems and made recommendations for improving efficiency. The following promotional efforts took place:

- Workshops for landscape and irrigation professionals, property managers and other irrigation customers to educate them about the costs of poorly managed systems, efficiency opportunities, and how to qualify for financial incentives.
- Standard rebates for the installation of rain sensors, conservation controllers and evapotranspiration (ET) controllers.
- Promotion and technical assistance through sector targeting conducted by the Resource Venture.

- Partnerships with landscape and irrigation professionals to help them understand the business opportunities associated with water conservation and to increase awareness of WEIP incentives for customers.

2004 PERFORMANCE

Program accomplishments included:

- Conducted 36 irrigation system audits and provided specific efficiency recommendations to property owners/managers.
- Provided rebates to one medical research facility, one office park, and four multifamily customers, for a total of six sites. Rebated measures included four rain sensors, four conservation controllers and four reprogrammed irrigation schedules.

Table 13: 2004 Commercial Landscape Peak Season Savings

Type	Major focus	Estimated GPD Peak
Outreach and education	Audits, rain sensor promotion	Not determined
Rebates & administration	Irrigation upgrades, rain sensor rebates	500
	TOTAL	500

A comprehensive review of commercial programs and savings can be found in *Impact and Process Evaluation: 2001 Commercial Water Conservation Programs* (Seattle Public Utilities, 2002).

LOOKING AHEAD

The Water Efficient Irrigation Program is undergoing major changes. An assessment of the program revealed the need for a more cost-effective approach to water savings for the commercial and multifamily sectors. The two existing central program initiatives, audits and customized incentives, appeared to be a comprehensive solution to improving the irrigation systems of commercial customers. The audit identifies a system's inadequacies, and the financial incentives provide the encouragement a customer needs to make improvements. But a closer look revealed problems, hidden costs, and conflicts that proved detrimental to the program's success and its ability to create long-term water savings.

Table 14: 2004 Commercial Landscape Assistance

Technical assistance	2004
Audited sites	36
Rebated measures*	
Schedule & weather controls	4
System performance	4
Install rain sensor	4
Rebate projects	
Total Measures	12
Target	*50*

*Projects have multiple measures

According to an analysis of historic project data, of the 244 audits provided between 1995 and 2004, only 38 led to incentive projects. Follow-up with customers revealed that even the simplest recommendations were not being implemented.

Another concern with providing free irrigation audits performed by SWP consultants was that the service discouraged contractors from performing audits for their customers. Programmatic efforts would be better served by encouraging contractors to provide auditing services directly and to pursue the Irrigation Association Auditor Certification. Restructuring the auditing portion of the program to support all contractors to provide an auditing service will be more in line with SWP efforts to improve professional irrigation skills.

The Market Transformation Approach

Changes to the program support market transformation by encouraging irrigation contractors to utilize all program tools to increase their customers' water efficiency. Changes will increase their knowledge of irrigation technologies and practices that save water, and make it easier for them to provide conservation and SWP rebate services to their customers. SWP staff anticipates that contractors will be more likely to support conservation if it positively improves their bottom-line. The residential rebate program has successfully established that this type of partnership is viable with contractors.

The Water Efficient Irrigation Program will continue to promote financial incentives and support events that promote the design, installation and maintenance of efficient irrigation systems. In 2005, the program will sponsor two Irrigation Association trainings for landscape and irrigation professionals. Contractors will learn about the program changes through direct mail pieces and the free trainings (required for contractor listing on savingwater.org). The program will also continue to reach customers through Resource Venture outreach.

The new program will offer contractors and commercial properties the following incentives and services:

Technical Support
- Irrigation Scheduling Calculator
- Water Budget and Water Budget Calculator
- Before and After Irrigation Schedules
- Inspection of Valves and Heads
- Assessment Forms
- Assessment Recommendation for Rebates

Standard Rebates
- Rain Sensor
- Conservation Controller
- Evapotranspiration (ET) Controller

Potential New Standard Rebates
- Central Control System
- Flow Sensors
- Pressure Regulating Valves
- Double-Check Valve Heads to prevent the system from leaking after the water is shut off

Resources
- Smart Water Application Technologies (SWAT) Website – Irrigation System Information – www.irrigation.org/SWAT
- Irrigation Water Management Society Website – Daily ET – www.iwms.org
- Demo Sites

General Customer Outreach and Messaging

PROGRAM DESCRIPTION

The purpose of general messaging efforts is to continue building and reinforcing a water conservation ethic among all Saving Water Partnership customers. In 2004 the messaging efforts combined general messages with program specific outreach. The approach worked well by allowing the SWP to better leverage promotional dollars, reaching a large number of people at a reasonable cost.

2004 GOALS AND STRATEGIES

Outreach efforts focused on developing messages that both encouraged water conservation and directed customers to specific programs. It was determined that focusing on individual programs instead of general messaging was the best way to achieve actual water savings with customers. Advertising such as the "Overwatering Soaks You" campaign included a general message with a program specific promotion. The ad campaign promoted rebates for in-ground lawn sprinkler systems, but also carried a general message that overwatering was bad – not good – for the lawn.

Banner ads like this one appeared on selected radio station web sites and linked directly to information about irrigation system rebates on the 1% Program web site, www.savingwater.org

Radio and print advertising played a key role in 2004 outreach efforts. Radio served as the linchpin for driving messages to the greatest number of customers while being reinforced by print advertisements in *The Seattle Times*, *Seattle PI* and targeted community papers reaching SWP wholesale water customers.

Transit ads, which proved to be an extremely successful vehicle for the WashWise campaign, continued to also serve an important role in customer outreach.

Anchoring all the advertising was a completely remodeled Savingwater.org web site. The site has seen a three-fold jump in visitors since the remodel, which was accomplished after extensive research and usability. Savingwater.org serves as the main contact point in all SWP advertising.

2004 PERFORMANCE

A newly remodeled **Savingwater.org** web site allowed the SWP to better track advertising response rates and helped the programs access overall market outreach success. During the "Overwatering Soaks You" campaign, for example, staff were able to directly track visitors from banner ads and links on radio station home pages. During these periods, upwards of 70 percent of visitors to savingwater.org would arrive from advertised links; a major success by any measure.

Broadcast radio advertising served as a major venue for outreach in 2004. The SWP was able to negotiate an excellent ad package with Fisher Broadcasting (KOMO AM, KING FM, KPLZ FM and KVI AM radio stations) that allowed the program to reach the greatest number of area customers for the lowest ad dollar. The ad package also included Mariner Baseball coverage on KOMO AM radio. Listenership for Mariner broadcasts is nearly 50 percent of the SWP customer base, and even with a poor year for the Mariners, listenership did not waver.

The WashWise program developed a **co-op ad campaign**. Fisher developed a washer give-away contest and recruited area appliance dealers to donate the washers in exchange for name recognition at the end of the ads. All washers had to meet the WashWise approved ratings requirements.

Print advertising focused on *The Seattle Times* and *Seattle PI*, as well as community papers that could best reach the targeted audience. Both the "Overwatering Soaks You" and Wash Wise campaigns made use of the outstanding reach of *The Seattle Times* and *PI*. Even in specific wholesale water districts, more people subscribed to and read the *Times* and *PI*, than read the community papers.

In addition to newspaper advertising, landscape messages were advertised in Sunset Magazine. Since the addition of the Inside Seattle section, the program was able to target 20,000 avid gardeners with outdoor watering messages during the spring, summer and fall.

Transit ads on the sides of King County Metro buses served both the WashWise program and "Overwatering Soaks You" campaigns very well in 2004. The SWP was able to negotiate a new long-term contract with Titan, the company that manages Metro Bus advertising, that will allow the program to take advantage of excellent rates and customer reach in 2005.

LOOKING AHEAD IN 2005

The Saving Water Partnership will continue to promote an overall conservation ethic, specific behavior changes and rebate programs. The SWP's advertising reach and success continues to improve with each passing year. The newly negotiated contracts with Fisher Broadcasting and Titan, plus ongoing contracts with *The Seattle Times* and *PI* give the SWP the best ad rates and customer reach the water conservation program has ever had. The new year will bring with it several milestones and events that merit promotion. The first major milestone will be the celebration of the 50,000th rebate for the WashWise program. It is estimated that that rebate will occur in late spring. Landscape messages will continue to be advertised, and a residential indoor campaign encouraging customers to wash full loads of clothes will be developed.

Youth Education

Close to 1,000 people visited the 1% Program booth at Issaquah Salmon Days

PROGRAM DESCRIPTION

Raising the awareness level of school-based audiences about the importance of valuing and conserving water is a goal of the SWP. Resources and program materials for students, teachers and other associated educational groups are developed through partnerships with respective school districts. Materials and services are developed to directly meet the needs of schools and youth organizations.

2004 GOALS AND STRATEGY

Activities developed for youth education support measurable savings achieved by the residential indoor and landscape conservation programs. In 2004, youth education strategies included:

- Making on-line resources for kids and educators easier to access
- Developing advertisements to encourage use of the on-line resources
- Refining services and products that have been successful in the past
- Revising the Water Matters teacher training workshop and evaluating whether to combine this workshop with existing teacher training offered by Seattle Public Utilities staff at the Cedar River Watershed
- Continuing to provide field trips to the Cedar River Watershed upon request.

2004 PERFORMANCE

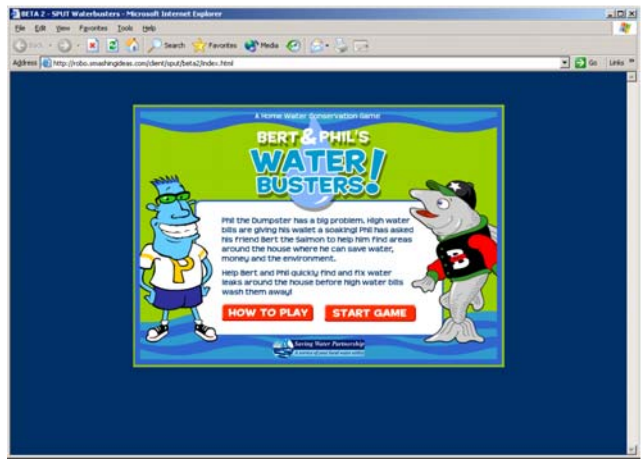
Accomplishments in the area of youth education included development of a revised Home Water Conservation Kit, Waterbusters promotional ad, revised web page, distribution of existing materials to school groups, and water event sponsorship and participation.

Table 15: 2004 Youth Education Resources

Activity	Target	Totals
Conservation kits	2,000	2,000
Posters distributed	100	150
Water timers distributed	300	500
Activity books distributed	300	300

A revised **Regional Home Water Saver Kit** was produced and distributed. The new version includes a revised description of the rationale for water conservation and list of current SWP members. Kits were distributed as part of school programs and event giveaways.

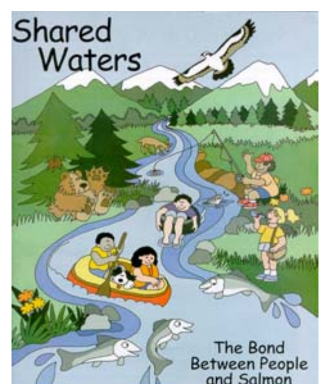
A **Waterbusters ad** was created featuring Bert the Salmon and his sidekick, Phil Dumpster, to promote the on-line interactive conservation game. The ad depicts Phil playing the game on a laptop computer while floating on an inner tube in a living room filled with water. As he continues to solve the challenges, the water level recedes. Viewers are encouraged to go to the Savingwater.org website and play the game. The web site received more than 10,000 visits, most of them within one hour of the time the ads aired. The ads aired during youth-oriented programming on KCPQ 13 and WB22 from June to September.



Phil Dumpster gets help reducing his water use from Bert the Salmon

The **youth education web page** was revised as part of the overall Savingwater.org website remodel. New information and links were included as well as revised text so that student and educator groups could more easily navigate the site.

Resources were distributed to educators and student groups. Included were copies of the Regional Water System poster, Bert the Salmon bookmarks promoting the Waterbusters game, Shared Waters student activity books, Five Minute Shower timers and the above-mentioned Home Water Conservation Kits.



Shared Waters is a student activity book that explains the importance of protecting water resources

The Saving Water Partnership was involved with the **H2O 2004 Festival, The Sammamish Watershed Festival** and, for the second year, **Issaquah Salmon Days**. Home Water Conservation kits, Regional Water System posters, Bert the Salmon bookmarks and *Shared Waters* activity books were distributed to children attending the events.

LOOKING AHEAD

- It has been more than 20 years since the first regional youth education programs were offered. An evaluation of the effectiveness of these efforts is planned to provide future program guidance.
- The popular Waterbusters Game will undergo a revision to include more challenges and features.

- The Waterbusters promotional ad will again be aired during summer and early fall months.
- The revised Shared Waters student activity books will be produced and available for distribution.
- A revised Water System poster will be produced to reflect the departure of CWA utilities from the 1% Program and distributed along with other available resources.
- Sponsorship and participation in selected water-related community events will again take place.

Evaluation and Monitoring

PROGRAM DESCRIPTION
Each conservation program plan contains a feedback loop for monitoring progress and evaluating costs and savings. Ongoing program evaluation is essential for designing and managing effective programs, monitoring results, and achieving conservation goals in a timely and cost-effective manner. Monitoring, program service delivery evaluation, and program impact evaluation all ensure that resources are put to their best use, that programs are managed for optimum results, and that effective adjustments are made as program implementation proceeds.

Program evaluation includes accurate tracking of program statistics, resources and activities. Service delivery evaluation reviews participant satisfaction with the process of participating in a program, non-participant awareness of the program and barriers to participating, and opportunities for program improvement. Impact evaluation examines program results, accuracy of initial program estimates, and satisfaction with the new products installed and/or new behavior changes undertaken.

The *Conservation Potential Assessment* (CPA, Seattle Public Utilities, 1998) is an overarching conservation tool that guides effective program implementation by identifying potential conservation opportunities and estimating costs. As programs are implemented, the cost and savings assumptions of the CPA are tested, refined, and either validated or modified. A major update of the CPA will be finalized in 2005.

2004 GOALS AND STRATEGY
Evaluation efforts in 2004 focussed on five major areas to support comprehensive review and improvement of conservation services:

- **Complete the 2003 Annual Report** of 1% Program savings and accomplishments.
- **Improve tracking and reporting** to facilitate regular monitoring and coordination of conservation efforts. Maintain and utilize a database of retail and wholesale customer data on a voluntary basis (Wholesale Customer Billing and Research Database). Enhance database tools for both wholesale and direct service customers.
- **Implement residential customer surveys and product research to evaluate the largest water saving opportunities**: indoor water use (end use metering and indoor behaviors) and mulch research. Responses are key to the design of cost-effective measures to reach these targeted customers. An end-use metering study of random homes took place in 2003, followed by surveys of water use behaviors, appliances, and fixtures. The analysis of this monitoring data was completed in 2004. It represents the first major quantification of the market share of the largest water uses in most homes. Learning how efficient these are,

and the rate of change to efficiency is critical to the design of retrofit programs. Mulch research helped document benefits and effectiveness of woody mulches in landscapes.

- **Upgrade the Conservation Potential Assessment model** to allow more dynamic modeling by program managers of program costs, alternatives, and savings potential.
- **Identify customer barriers to conservation** so that greater participation can be obtained**.** During 2004, a regional survey and two focus groups were conducted to identify barriers to adopting residential indoor behaviors such as washing full loads of clothes, taking shorter showers and fixing leaks. Better information will lead to ways to overcome these barriers and thus achieve greater overall adoption of measures. In addition, a postcard survey of recipients of the *Naturals* guides provided information on which landscape-related water-saving behaviors were being adopted most often by customers.

2004 ACCOMPLISHMENTS

SWP staff and consultants designed and implemented new evaluation tools in 2004 to improve program performance and reporting, including:

- Issued the 2003 Annual Report for the 1% Program, containing an improved analysis of system water consumption.
- Made upgrades to the Conservation Potential Assessment model to make it more user friendly and expand interactive capabilities, and completed a report on the updates.
- Conducted a detailed barrier analysis of residential indoor measures.
- Developed a new database to track savings of Multifamily Toilet Rebate participants over time.

Residential indoor behaviors: A regional survey and two focus groups of homeowners and renters were held to establish a baseline and to identify barriers to adopting residential indoor behaviors such as washing full loads of clothes, taking shorter showers and fixing leaks. The research will inform coming behavior message campaigns and will serve as a baseline to measure the success of the campaigns. Some interesting findings from the research include:

- Customers think they are washing full loads, but are actually filling the machine 25-30% under capacity.
- Less than half of survey respondents said they checked their toilets for leaks in the past two years.
- There is potential for customers to save water, but in general it will be challenging to interest people in changing their behaviors.

Flapper replacement: Also in 2004, the toilet flapper replacement pilot program that took place in Northshore Utility District in 2003 was evaluated. This pilot was a field test of savings and customer participation in a not-too-glamorous toilet maintenance activity that is a common source of water leakage. The pilot was found to reduce participants' consumption by 4% on average. The evaluation found that higher savings were achieved from customers with homes more than 10 years old. The level of savings was not sufficient to warrant implementation of a full-scale flapper program in 2005, but a program may be developed that would offer replacement flappers to regional residents with high winter water consumption and who live in older homes.

New multifamily database: Developed a database to track "rolling savings" of mutifamily toilet replacement participants. This database includes monthly and annual water use for participating buildings in SPU's service territory. The database will be expanded in the future to include wholesale customer consumption data. The data will enable the SWP to refine estimates of program savings.

Residential landscape behaviors: A postcard survey was mailed to customers who had received the *Naturals* guides. Respondents reported that they found the guides very helpful, and that they had changed a variety of practices. The practices most mentioned were watering/water use practices, mulching and pesticide usage. Integration of these findings continues, but has already played a major role in determining the focus of the program on ‘plant right for your site,’ including *The Plant List* and seminars dedicated to the topic of ‘right plant, right place.’

Natural Yard Care Neighborhoods: This program is based on a ‘social diffusion’ model and attempts to help people change to new, resource efficient landscaping practices by offering a series of workshops and incentives and assistance to a particular neighborhood. In 2002 and 2003 the 1% Program contributed funding to this program. In 2004 Seattle’s program was funded entirely by King County’s Local Hazardous Waste Management Program, without 1% funds. A participant survey was fielded in late 2003 and the results received in 2004. Highlights of the findings include:

- Significant increases in how knowledgeable people became about some of the topics covered in the workshops.
- For every practice taught in the workshops, at least some participants had begun new conservation behaviors.
- There was a strong correlation between the number of workshops attended and the number of people participants talked to about the practices.

Mulch research: This product research documented benefits and found no harm associated with the use of various woody mulches in landscapes. The research enabled SPU to add bark mulch to the list of products sold at discounted prices through the Northwest Natural Yard Days promotion. The additional recommended mulch product addressed customer frustrations with obtaining the one type of mulch SPU recommended in the past, arborist wood chips.

Mulch intercept survey: Previous surveys had shown that customers who were mulching were not necessarily watering less. Through this survey staff learned whether customers were making the connection between two behaviors: mulching and watering less. The survey found that most customers (71%) thought that mulching in the fall would help them save water in the summer. And most customers (62%) claim to water mulched beds less than unmulched beds.

LOOKING AHEAD

In 2005 methods will be developed to attempt to better quantify behavioral savings achieved through 1% Program efforts. In addition to the 2004 Annual Report, a variety of service delivery and program impact evaluations will be conducted in the residential and commercial sectors of the 1% Program, including:

- A water savings potential matrix will be developed for hardware and behavioral measures that save water in the landscape. This information will be used to gain a more comprehensive understanding of water savings from various actions.
- Residential irrigation hardware will be further evaluated to determine persistence of savings.
- Behavioral efforts such as distribution of the Natural Lawn and Garden guides, nursery partnerships, and compost discounts will be assessed from a perspective of multiple years of implementation.

- The Multifamily Toilet Rebate Program will conduct a market saturation study to assess savings potential for the program and will assess customer satisfaction and evaluate savings.
- A plan will be developed to better determine behavioral savings from the residential indoor sector.
- Research into overcoming barriers that prevent customers from participating in SWP programs will continue.
- Retailer feedback will also be solicited, in order to continue smooth delivery of collaborative programs, and in order to refine estimates of market share of efficient products.
- The Conservation Potential Assessment will continue to be updated in 2005 and in the ensuing years. It will provide estimates for savings potential and costs based on new research, technology improvements, survey and program data.

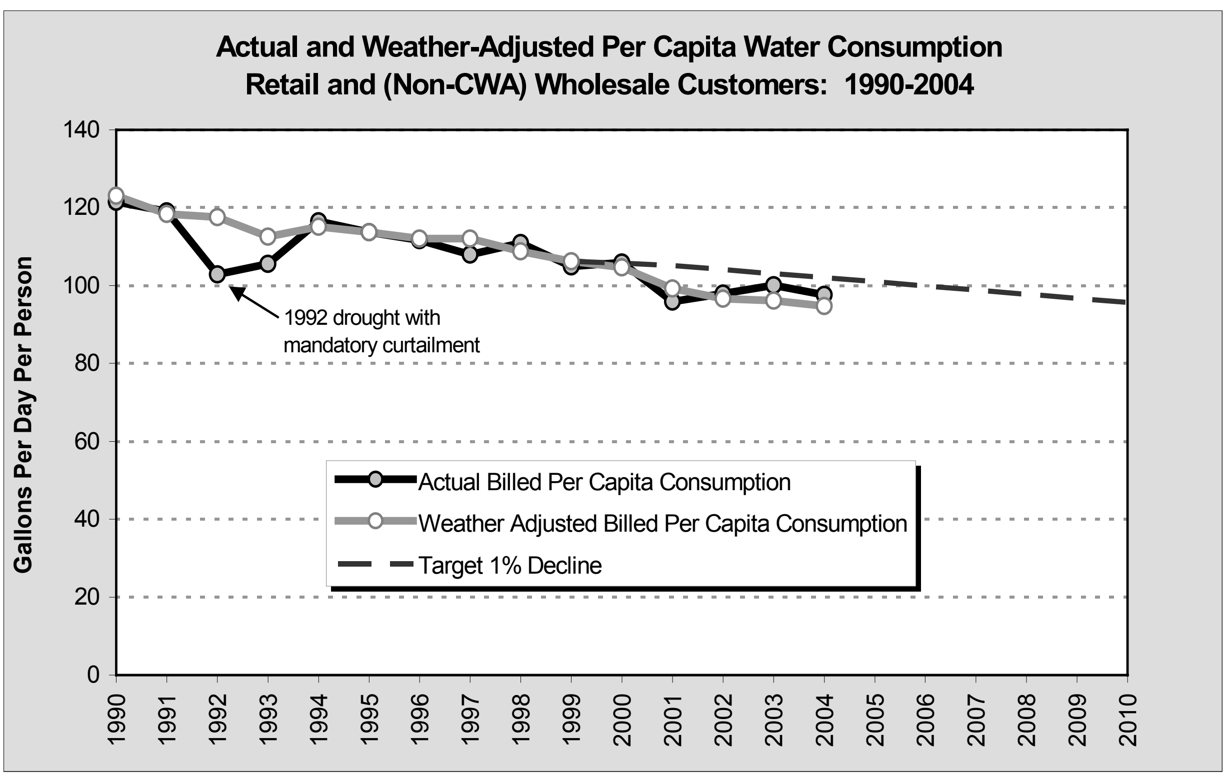
4. Consumption Analysis

Historical Data

Per capita water consumption has declined steadily since 1990, due to a number of factors including changes in the structure and level of water rates, the Washington State plumbing code, and a history of water conservation programs culminating in the current 1% Program. Another source of water savings over the past 14 years has been more efficient system operations, (reservoir overflowing and cleaning, main flushing, etc.). While the system efficiency improvements reduced *non-revenue* water by more than half, they do not affect billed water use by customers, which is the focus of this analysis.

The consistent downward trend in billed per capita water consumption is easily seen in Chart 4 and Table 15 below, especially after adjusting for summer weather. Much of the up and down variation in consumption from year to year is caused by different weather conditions in the summer months. The normal increase in water use during the peak season is reduced in cool wet summers and amplified by hot dry summer weather. Adjusting for summer weather is important in revealing the underlying trends in consumption. For example, the increase in actual consumption from 2002 to 2003 was due entirely to an extremely hot dry summer in 2003. It is estimated that 2003 per capita consumption would have actually dropped slightly from the prior year given normal summer weather.

Chart 4: Annual Average Billed Per Capita Water Use — Combined 1% Program Participating Utilities



The tables and charts in this section show average annual customer consumption for participating 1% Program utilities. The amount of water sold to wholesale customers and the number of people served have been changed from previous 1% Program annual reports to reflect the departure of Cascade Water Alliance utilities from the 1% Program. Also, the numbers do not include non-revenue water. In the 2001 and 2002 annual reports, the consumption analysis used regional average water demand numbers that included non-revenue water. The total demand trends were representative of customer water use. However, since the 1% Water Conservation Program focuses on reducing customer demands, and excludes non-revenue water reductions, reporting on total water system demand does not correctly capture the effects of the 1% Program. Therefore, the 2003 and 2004 reports have used actual billed consumption (billed water sales), rather than total regional water demand, in the consumption analysis. Although it doesn't make a significant difference in trends or conclusions, doing so produces actual savings numbers that are a little lower. Readers should note this minor difference if they compare the 2001 and 2002 annual reports with this report.

Table 16: Water Consumption Trends - SWP Utilities (Annual Average)

Year	Water Sold Retail in MGD	Water Sold Wholesale* in MGD	Total Water Sold in MGD*	Population Served* (thousands)	Gallons per Person per Day (GPD)	Weather Adjusted GPD
1998	71	42	113	1,019	111	109
1999	68	40	108	1,029	105	106
2000	69	40	109	1,031	106	105
2001	62	37	99	1,033	96	99
2002	63	38	101	1,034	98	97
2003	62	41	103	1,036	100	96
2004	61	39	100**	1,028**	98	95

* Excludes Cascade Water Alliance utilities
** Decline in population from 2003 to 2004 reflects the transfer of much of Coal Creek to Bellevue.

Total water sold to all customers (of participating utilities) over the past seven years has declined at an average rate of about 1.8% per year. Meanwhile, population increased by about 0.3% per year resulting in an annual decrease in consumption per capita of 2.1%. Normalizing the consumption figures for summer weather bumps the annual decline in per capita consumption down slightly to 2.3%, far exceeding the 1% per year annual goal for the 1% Program. However, less than half of the reduction in water use can be credited to the 1% Program. The bulk of the per capita reduction is estimated to have come from the impact of increased water rates and the water efficiency plumbing code. In addition, the recent economic slowdown is estimated to have contributed significantly to the decline since 2000.

Table 16 shows a breakdown of where the peak season savings came from in 2004. Savings attributed to the 1% Program are shown in the first three columns shaded in gray. Hardware savings are based on installation of water saving equipment with known and measured savings, and thus these numbers are fairly accurate. The behavior based residual savings are difficult to measure, and they are derived from the difference after accounting for all other savings. Allocation of behavior savings between the different customer sectors is based on program evaluation work that has been conducted over the past four years. The remaining columns show savings from sources other than the 1% Program, and as previously noted, these savings continue to be larger than the combined 1% numbers.

In 2004, total savings were overshadowed by an increase in non-revenue water use (or negative savings) of 4.6 MGD annual average use. The increase in non-revenue water use was due to increased reservoir overflowing for water quality reasons. Of the total estimated -2.67 MGD annual average savings, 0.7 MGD of annual average savings came from the 1% Program, 1.2 MGD of the total savings came from rates and codes and 0.03 MGD came from retrofit work with low income homeowners and housing providers in Seattle. Note that the low-income program applies only to the City of Seattle. It represents a small amount of additional savings that is neither credited to nor funded by the regional 1% Program.

Table 17: New Water Savings Achieved in 2004 (in MGD)

	New Long-Term Customer Savings						Other Savings		Total
	1% Conservation Program		1% Program	Rates	Code	Seattle Low Income	Economy	System	
	Hardware	Behavior	Total						
Residential Indoor	**0.27**[1]		**0.27**	0.1	0.5	0.03			
Residential Landscape	**0.01**	**0.15**	**0.16**	0.1					
Commercial Non-Landscape	**0.48**		**0.48**	0.1	0.3				
Commercial Landscape	**<0.1**	**<0.1**	**<0.1**	0.1					
Other Savings								-4.6[3]	**-4.6**
2004 Total 1% Program Peak Season Savings	**0.76**	**0.15**	**0.91**						**0.91**
2004 Total Annual Ave Savings[2]	**0.65**	**0.05**	**0.70**	**0.4**	**0.8**	**0.03**	**0.0**	**-4.6**	**-2.67**

[1] 1% Program sector savings are reported as peak season savings.
[2] See text in Chapter 1, page 2, and Chapter 2, page 13 for conversion of peak season savings into annual average numbers.
[3] Much of the higher than usual non-revenue water use was believed to be due to reservoir overflowing for water quality purposes.

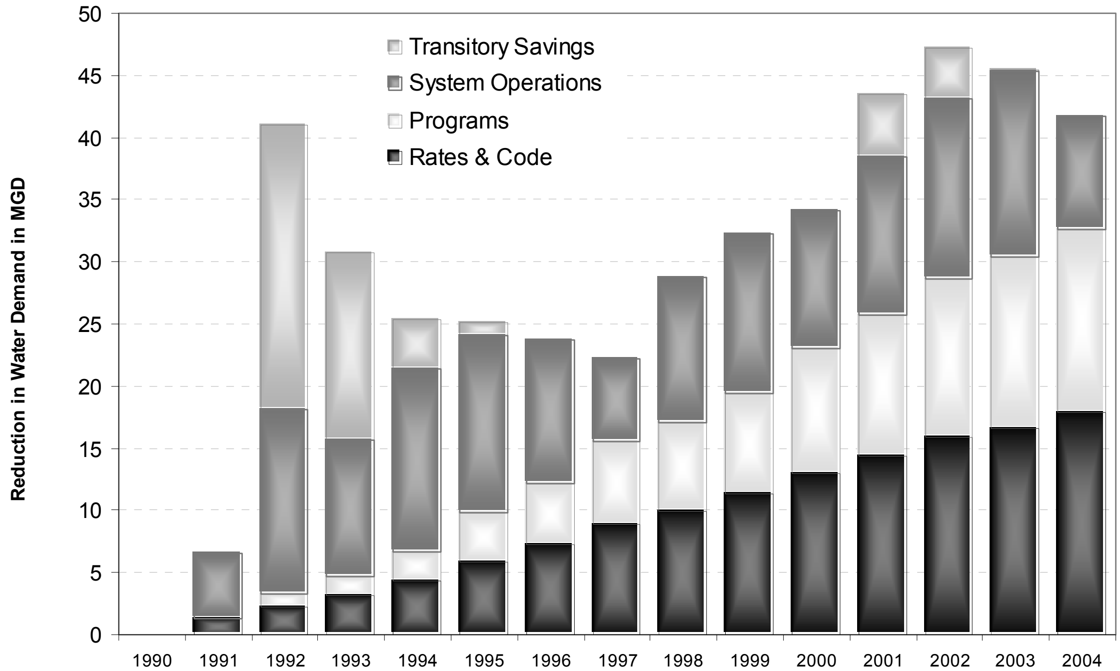
Cumulative Savings

Chart 5 depicts cumulative water savings since 1990. The chart is best used as a picture of historical progress, rather than as an absolute count of cumulative savings. The 1% Program savings shown are peak season savings, while the other three categories are all shown as annual average savings. These savings are planned to keep system demand essentially flat by offsetting increased demand due to population growth. Note the transitory savings (the top bar) seen in 1992-1995, and again in 2001 and 2002, disappear over time, since these savings are a result of sacrifice in response to a drought curtailment message, and are not derived from long-term water efficiency measures. Once customers believe that a drought is over, most of them return to their previous water using behaviors.

System savings (the third bar) are reductions in non-revenue water use. System savings come from a variety of sources such as reducing leaks and lining reservoirs, improved meter accuracy, and modifications to how water mains and reservoirs are flushed to maintain the highest water quality. System savings since 1990 have fluctuated from year to year, but average about 12 MGD annual average.

Long-term customer savings including rate and code effects, (the bottom and second bars) have grown steadily. Refinements in the method of calculating code savings resulted in a decrease in these cumulative savings compared to the figure reported in the 2003 Annual Report. Customer savings are derived from specific conservation measures and actions, and also include rate and code savings.

Chart 5: Cumulative Water Savings[1] Since 1990



[1]This chart provides historical progress rather than an absolute count of cumulative savings. 1% Program savings are shown as cumulative peak season savings, while rates, codes, system operations, and transitory savings are shown as annual average savings.

The savings breakout in Chart 5 was estimated as follows:

1. Rates – price elasticity parameters from SPU's econometric model forecast
2. Code – natural replacement of plumbing fixtures as forecast in SPU's Conservation Potential Assessment model. In 2004, refinements in the method of calculating code savings led to a new estimate of savings that is approximately 8MGD lower than the amount reported in prior years
3. 1% Program – see individual program estimates from Chapter 3 of this report
4. System – analysis of water operating system use
5. Transitory Savings – analysis of post-drought experience.

5. Rebate Program Activity by Water Provider

Tables 18 through 24 summarize rebate program activity in the SWP service area by water provider. Selected commercial/industrial projects are described in greater detail at the end of this chapter.

Table 18: WashWise High Efficiency Clothes Washer Rebates in 2004

Utility	Clothes Washer Rebates	% of Rebates in 2004	Total Rebates: Program to Date
Cedar River	175	2.7%	841
City of Bothell	91	1.4%	558
City of Duvall	47	0.7%	282
City of Mercer Island	169	2.6%	1,060
Coal Creek Utility District	92	1.4%	788
Highline	186	2.9%	1,203
Northshore	348	5.4%	2,216
Olympic View	17	0.3%	244
SPU	4,092	64.0%	26,482
Shoreline	170	2.7%	1,134
Soos Creek	297	4.6%	1,738
Water District #20	93	1.5%	467
Water District #45	8	0.1%	47
Water District #49	48	0.8%	306
Water District #90	48	2.3%	649
Water District #119	24	0.4%	142
Water District #125	34	0.5%	197
Woodinville	358	5.6%	2,025
Total	**6,397**	**100.0%**	**40,379**

Table 19: Multifamily Toilet Rebates in 2004

Utility	Toilets Rebated in 2004	% of Toilets Rebated in 2004	Total Toilets Rebated: Program to Date	Total Projects to Date
Cedar River			56	2
City of Bothell	129	3.1%	209	8
City of Mercer Island			9	1
Highline	326	7.9%	695	20
Northshore	107	2.6%	672	23
Olympic View	6	0.1%	74	3
Shoreline	490	11.8%	620	15
Soos Creek	165	4.0%	189	5
SPU	2,538	61.3%	9,696	515
Water District #20	212	5.1%	212	4
Water District #45			59	3
Water District #49	162	3.9%	262	9
Water District #125			208	4
Woodinville	6	0.1%	115	4
Total	**4,141**	**100%**	**13,076**	**616**

Table 20: Water Efficient Irrigation Residential Rebates in 2004

Water Utility	Estimated Peak Savings (GPD)	Rebate Measures	Rain Sensor	Tune-Up Signed
City of Mercer Island	25		Rain Sensor	Yes
City of Mercer Island	100	Cons. Controller	Rain Sensor	Yes
City of Mercer Island Total	**125**			
Olympic View Water & Sewer District	25		Rain Sensor	Yes
Olympic View Water & Sewer District	75	Cons. Controller		Yes
Olympic View Water & Sewer District	100	Cons. Controller	Rain Sensor	Yes
Olympic View Water & Sewer Dist. Total	**200**			
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	25		Rain Sensor	Yes
Seattle Public Utilities	75	Cons. Controller		Yes
Seattle Public Utilities	75	Cons. Controller		Yes
Seattle Public Utilities	75	Cons. Controller		Yes
Seattle Public Utilities	75	Cons. Controller		Yes
Seattle Public Utilities	75	Cons. Controller		Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	100	Cons. Controller	Rain Sensor	Yes
Seattle Public Utilities	200	ET Controller	Rain Sensor	Yes
Seattle Public Utilities	200	ET Controller	Rain Sensor	Yes
Seattle Public Utilities	200	ET Controller	Rain Sensor	Yes
Seattle Public Utilities	200	ET Controller	Rain Sensor	Yes
Seattle Public Utilities	200	ET Controller	Rain Sensor	Yes
Seattle Public Utilities Total	**3,400**			

Water Utility	Estimated Peak Savings (GPD)	Rebate Measures	Rain Sensor	Tune-Up Signed
Shoreline Water District	200	ET Controller	Rain Sensor	Yes
Shoreline Water District Total	**200**			
Water District No. 20	200	ET Controller	Rain Sensor	Yes
Water District No. 20 Total	**200**			
Water District No. 90	100	Cons. Controller	Rain Sensor	Yes
Water District No. 90	100	Cons. Controller	Rain Sensor	Yes
Water District No. 90	100	Cons. Controller	Rain Sensor	Yes
Water District No. 90 Total	**300**			
Woodinville Water District	25		Rain Sensor	Yes
Woodinville Water District	25		Rain Sensor	Yes
Woodinville Water District	25		Rain Sensor	Yes
Woodinville Water District	25		Rain Sensor	Yes
Woodinville Water District	25		Rain Sensor	Yes
Woodinville Water District	75	Cons. Controller		Yes
Woodinville Water District	75	Cons. Controller		Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	100	Cons. Controller	Rain Sensor	Yes
Woodinville Water District	200	ET Controller	Rain Sensor	Yes
Woodinville Water District Total	**2,075**			

Table 21: NW Natural Yard Days Sales Data 2004

Sales Items	Store Sales 2001	2002 Event & Store Sales	2003 Event & Store Sales[1]	2004 In-Store Sales Only[2]	Percent Increase 2003-2004
Electric Mowers	447	1,966	1,812	1,486	-18
Push Mowers[3]	246	811	325	1,741	536
Weed Puller	1,027	2,189	2,296	2,678	17
Soaker Hoses	632	2,073	1,787	5,657	317
Insecticidal Soap	163	799	2,264	2,545	12
Water Timers	343	1,077	695	1,354	95
Bags of Compost[2]	14,496	41,039	81,651	94,318	15
Bags of Organic Fertilizer[2]	2,019	3,849	4,241	6,255	47
Overall Items Sold	**19,373**	**53,903**	**97,999**	**116,034**	**18**

Notes:

1 In 2003 and 2004 Northwest Natural Yard Days (NNYD) was a collaboration of the Saving Water Partnership, Seattle Public Utilities, King County Solid Waste, King County Hazardous Waste, the City of Tacoma, Puget Sound Clean Air Agency, Washington State Department of Ecology, Thurston County, and a number of suburban cities. In order to work more effectively with the "box stores", the promotion in those stores was extended to their Western Washington marketing areas, from Bellingham to Olympia. The sales figures listed in the 2003 1% Program Annual Report are from the larger, Western Washington area. The 2003 and 2004 sales figures reported above are from the Seattle/King County/Tacoma area.

2 In 2003 natural yard care products were promoted in the month of April. In 2004 the promotion ran through April and May. In addition, a promotion of compost and organic fertilizer took place in September 2004. 2004 sales, above, aggregate those three months.

3 Home Depot and Lowe's did not discount push mowers in 2003. Lowe's did sell 302 push mowers in 2003 (not included in the 325 listed above).

Table 22: Water Efficient Irrigation Commercial Audits in 2004

Utility	Name of Business/Company	Facility Name
Cedar River Water & Sewer District	City of Maple Valley Parks	Take-a-Break Park
Cedar River Water & Sewer District	Lake Wilderness Arboretum	Lake Wilderness Arboretum
Cedar River Water & Sewer District	Tahoma School District	Tahoma Junior High School
Cedar River Water & Sewer District	Senior Care Services	Fountain Court Assisted Living
Cedar River Water & Sewer District	Trammell Crow Residential	Pebble Cove Apartments
Cedar River Water & Sewer District	Fairway Village Condominium Association	Fairway Village Condominiums
City of Bothell	Seattle Times	Seattle Times, Bothell
City of Bothell	CWD Management Group	Riverfront Landing B & C
City of Bothell	Archstone Communities	Canyon Creek
City of Bothell	Allied Group	Heritage Park Apartments
Highline Water District	City of SeaTac	Valley Ridge Park
Highline Water District	City of Des Moines Parks	S J Underwood Park
Highline Water District	Allied Group	Windsor Heights Apartments
Highline Water District	Highline Water District Offices	Highline Water District Offices
Northshore Utility District	Saratoga Capital	Willow Glen Apartments
Seattle Public Utilities	Nitze-Stagen & Co, Inc	Lander Station
Seattle Public Utilities	Nitze-Stagen & Co, Inc	Starbucks Center
Seattle Public Utilities	Nitze-Stagen & Co, Inc	Frye Commerce Center
Seattle Public Utilities	Royal Richmond Condominium Assoication	Royal Richmond Condominiums
Seattle Public Utilities	City of Seattle Parks and Recreation	Judkins Park/Playfield (CE)
Seattle Public Utilities	Providence Mount Saint Vincent	Providence Mount Saint Vincent
Seattle Public Utilities	Northwest Hospital	Northwest Hospital
Seattle Public Utilities	Seattle Tennis Club	Seattle Tennis Club
Seattle Public Utilities	Capitol Hill Housing Improvement Program	Burke Gilman Gardens
Seattle Public Utilities	Indigo Real Estate	Shorewood Heights Apartments
Seattle Public Utilities	Seattle Conservation Corps	Terminal 18 Landscaping
Seattle Public Utilities	Lorig Management Services	Nordheim Court
Seattle Public Utilities	Lorig Management Services	Radford Court
Seattle Public Utilities	S-J Management LLC	Club at Bitterlake Apartments
Seattle Public Utilities	S-J Management LLC	Westhaven Apartments
Seattle Public Utilities	Historic Seattle	Good Shepherd Center
Soos Creek Water & Sewer District	Prometheus Properties	Mission Ridge Apartments
Water District No. 125	Allied Group	Empire Terrace Apartments
Water District No. 20	Kennedy High School	Kennedy High School
Woodinville Water District	SUHRCO Residential Properties	Redwood Village
Woodinville Water District	Fairfield Properties	Cascade Pines

Table 23: Water Efficient Irrigation Commercial Incentives in 2004

Utility	Business/Company	Facility Name	Estimated Peak Savings (GPD)	Install Rain Sensor	Irrigation Scheduling	Irrigation System Performance
City of Mercer Island	J.A.R. Investments	Lighthouse Properties	100	Yes	Yes	
Seattle Public Utilities	CondoManagements, Inc	Bay Villa HOA	25	Yes		
Seattle Public Utilities	Council House	Council House	75		Yes	Yes
Seattle Public Utilities	Maf-Jo Investments	Maf-Jo	100	Yes	Yes	Yes
Seattle Public Utilities	Arboretum Owner's Association	Arboretum Place Condos	100	Yes		Yes
Soos Creek Water & Sewer District	Euro Institute	Euro Institute	75		Yes	Yes

Table 24: Water Smart Technology Incentives in 2004

Utility	Business/Company	Facility Name	Final Peak Savings (GPD)	Measure Group Type
City of Bothell	Power Cleaners, Inc	Laundry Basket, The	144	Laundry Systems
City of Bothell	Ivar's Inc.	Ivar's Seafood Bar Bothell	510	Cooling/Refrigeration/Ice
Highline Water District	Highline School District 401	Chinook Middle School	1289	Bathroom
Highline Water District	Highline School District 401	Southern Heights	1115	Bathroom
Highline Water District	Highline School District 401	Olympic Elementary School	1263	Bathroom
Highline Water District	Highline School District 401	McMicken Heights Elementary	1219	Bathroom
Highline Water District	Highline School District 401	Manhattan Learning Center	1332	Bathroom
Highline Water District	Bright & Bold LLC	Orchard Plaza Maytag Inc.	1584	Washers
Water District No. 90	CKR Renton Retail Project	Hop In Grocery	5065	Custom Projects
Northshore Utility District	Frosty's Restaurant	Frosty's Restaurant	300	Cooling/Refrigeration/Ice
Seattle Public Utilities	Roosevelt Hotel	Roosevelt Hotel	1510	Bathroom
Seattle Public Utilities	Children's Hosp & Med Center	Children's Hosp & Med Center	11520	Custom Projects
Seattle Public Utilities	Children's Hosp & Med Center	Children's Hosp & Med Center	10000	Custom Projects
Seattle Public Utilities	Beso del Sol	Beso del Sol	800	Cooling/Refrigeration/Ice
Seattle Public Utilities	Virginia Mason Medical Center	Virginia Mason Medical Center	19400	Custom Projects
Seattle Public Utilities	University of Washington	UW - Multi-facility	31880	Bathroom
Seattle Public Utilities	University of Washington	UW - Multi-facility	12125	Custom Projects
Seattle Public Utilities	University of Washington	Haggett Hall Dormitory	7897	Cooling/Refrigeration/Ice
Seattle Public Utilities	University of Washington	Haggett Hall Dormitory	2660	Bathroom
Seattle Public Utilities	University of Washington	UW Medical Center	2437	Custom Projects
Seattle Public Utilities	University of Washington	Johnson Hall	8500	Cooling/Refrigeration/Ice
Seattle Public Utilities	UW Consolidated Laundry	UW Consolidated Laundry	45041	Laundry Systems
Seattle Public Utilities	Starwood Hotels & Resorts	Westin Hotel	6041	Bathroom
Seattle Public Utilities	Kidd Valley Restaurant	Kidd Valley Restaurant	300	Cooling/Refrigeration/Ice
Seattle Public Utilities	Seattle University	SU - Multi-facility	1071	Bathroom
Seattle Public Utilities	Seattle University	SU - Multi-facility	2575	Bathroom
Seattle Public Utilities	Highline School District 401	Cascade Middle School	1088	Bathroom

Utility	Business/Company	Facility Name	Final Peak Savings (GPD)	Measure Group Type
Seattle Public Utilities	Highline School District 401	Evergreen High School	3885	Bathroom
Seattle Public Utilities	Lorig Management Services	Hawthorne Hills Professional Center	245	Bathroom
Seattle Public Utilities	Market Place Offices	Market Place Offices	2000	Bathroom
Seattle Public Utilities	Port of Seattle	Seattle-Tacoma International Airport	70970	Bathroom
Seattle Public Utilities	Seattle Children's Home	Seattle Children's Home	2553	Cooling/Refrigeration/Ice
Seattle Public Utilities	Nitze-Stagen & Co, Inc	Starbucks Center	2160	Cooling/Refrigeration/Ice
Seattle Public Utilities	MacDonald Meat Company, LLC	MacDonald Meat Company	550	Custom Projects
Seattle Public Utilities	Al - Dearl Investment	Varons Building	70	Bathroom
Seattle Public Utilities	John Bennett	Ace Building	40	Bathroom
Seattle Public Utilities	John Bennett	Yi Building	60	Bathroom
Seattle Public Utilities	John Bennett	O'Neil Building	50	Bathroom
Seattle Public Utilities	John Bennett	Ritz Building	75	Bathroom
Seattle Public Utilities	John Bennett	Boysen Building	40	Bathroom
Seattle Public Utilities	John Bennett	Seaway Building	80	Bathroom
Seattle Public Utilities	John Bennett	Jukebox City Building	80	Bathroom
Seattle Public Utilities	North Seattle Dental	North Seattle Dental	40	Bathroom
Seattle Public Utilities	Park 90/5	Park 90-5 Police Support Facility	3387	Custom Projects
Seattle Public Utilities	Equity Office Properties	1100 2nd Ave Bldg.	814	Cooling/Refrigeration/Ice
Seattle Public Utilities	Prudential Signature Properties	Chardon Building	50	Bathroom
Seattle Public Utilities	Aurora Veterinary Hospital	Aurora Veterinary Hospital	113	Bathroom
Seattle Public Utilities	Chinatown Market Corp.	Chinatown Market	7500	Cooling/Refrigeration/Ice
Seattle Public Utilities	Ballard Baptist Church	Ballard Baptist Church	120	Bathroom
Seattle Public Utilities	Women's University Club	Women's University Club	1000	Custom Projects

Utility	Business/Company	Facility Name	Final Peak Savings (GPD)	Measure Group Type
Seattle Public Utilities	Kress Building	Kress Building	100	Bathroom
Seattle Public Utilities	Providence Mount Saint Vincent	Providence Mount Saint Vincent	4800	Laundry Systems
Seattle Public Utilities	Port of Seattle	Port of Seattle Maintenance Shop	1755	Cooling/Refrigeration/Ice
Seattle Public Utilities	O.S.F. International, Inc.	Old Spaghetti Factory	2000	Cooling/Refrigeration/Ice
Seattle Public Utilities	Tropic Isle, Inc.	The Islander Restaruant & Tiki Lounge	1500	Custom Projects
Seattle Public Utilities	Washington Biomedical Research Properties I	UW Medicine Lake Union @ 815 Mercer	360	Bathroom
Seattle Public Utilities	CC Slaughters North Ltd	CC Attles	750	Cooling/Refrigeration/Ice
Seattle Public Utilities	Julia's in Wallingford, Inc	Julia's in Wallingford	400	Cooling/Refrigeration/Ice
Seattle Public Utilities	Pig Iron Barbeque	Pig Iron Barbeque	200	Cooling/Refrigeration/Ice
Seattle Public Utilities	Seattle Surgery Center	Seattle Surgery Center	5000	Custom Projects
Seattle Public Utilities	Chinese Evangelical Church	Chinese Evangelical Church	200	Bathroom
Seattle Public Utilities	The Polyclinic	The Polyclinic	2500	Custom Projects
Seattle Public Utilities	Soules Properties	4301 Building	40	Bathroom
Seattle Public Utilities	Soules Properties	3212 Building	180	Bathroom
Soos Creek Water & Sewer District	Le Cruz Construction Company Inc.	H. P. Car Wash	2360	Custom Projects
Water District No. 125	King County - Metro Facilities	South Base Complex	5026	Custom Projects
Water District No. 20	Highline School District 401	Beverly Park @ Glendale Elementary	1663	Bathroom
Water District No. 20	Highline School District 401	Salmon Creek Elementary	863	Bathroom
Water District No. 49	Highline Community Hospital	Highline Community Hospital	7500	Custom Projects
Water District No. 49	Highline School District 401	Sylvestor Middle School	1331	Bathroom
Water District No. 49	Burien 76	Burien 76	2475	Custom Projects

Select Commercial Project Descriptions

Steam Sterilizer Water Conservation Kits - Six Locations

This project involved installation of water conserving trap cooling kits on older steam sterilizers in area hospitals and laboratories. These older sterilizers typically have a one to two gallons per minute (gpm) continuous flow of cold water going down the drain whenever the sterilizer is operational (often 24/7 in the case of hospitals) to ensure the temperature in the drain line remains below 140F. Installation of a kit incorporating a temperature sensor in the drain line can save approximately 90% of the water previously used. During 2004 the Water Smart Technology Program provided incentives for installation of 33 kits at six facilities including at two Highline Hospital locations (Water District 20 & Water District 49), Children's Hospital (Seattle), Virginia Mason Hospital (Seattle), Seattle Surgery Center (Seattle), and Polyclinic (Seattle). Total savings from these installations is estimated at approximately 45,000 GPD of peak season savings, or 22,000 CCF annually.

University of Washington Laundry – Water Recycling System

The University of Washington Consolidated Laundry (UWCL) performs complete laundry service for the UW Medical Center, other campus operations, and outside contracts. The quantity of goods processed is approximately 10 to 12 million pounds per year. Laundry operations by their nature consume significant quantities of water, electric, and natural gas resources. UWCL currently operates with two high-efficiency tunnel washers along with multiple washer extractors. Water use efficiency was about 2.5 gallons of water used per pound of laundered goods. The proposed water filtration/recycling system allowed UWCL to, cost effectively, reach close to the highest level of efficiency attainable with existing filtration technology. Successful implementation of this technology will become a case study for other large laundry facilities, demonstrating state of the art water efficiency.

Hop-in Grocery Car Wash – Water District 90 – Water Reclaim System

This project involved the installation of a car wash water reclaim system. This new construction project included a convenience store, gas station, retail center, and car wash. Savings were calculated when the new car wash facility was brought on line, by closely monitoring the numbers to verify car wash performance with both reclaim and no reclaim and number of daily washes.

HP Car Wash – Soos Creek Water & Sewer District – Water Reclaim System

The existing car wash facility consists of a touch-free station and four self-serve stations. A data-logger was installed to track water consumption in the car wash. This water reclaim project was undertaken as a pilot and research project. There were two main reasons for proceeding with this project:

- This is largely a self-serve facility. This was the first self-serve facility to install a reclaim system in the Saving Water Partnership service area and represents, if successful, the opportunity for water savings previously considered unobtainable.
- This is a relatively new technology to the United States and has the potential for significant market penetration due to its design utilizing aerobic bacteria in the water purification process, without the typical filtration and ozonation. No other systems of this type will be authorized until a thorough study of this system is completed.

Westin Hotel – Seattle – Toilet Replacement

The Westin Hotel will be retrofitting all their guestroom toilets in two phases, which will coincide with the hotel design of two distinctive circular towers. The South Tower was retrofitted in 2004, and the North Tower will follow in 2005. The Westin Hotel has undergone extensive analysis as part of the 2001 Hotel Demonstration Project and the toilet flush volume was thoroughly documented at 3.5 and 5 gallons per flush in the North and South Towers respectively. Significant toilet leaking was also discovered by submetering plumbing risers throughout the building. While this may not be a current issue, water savings as estimated in the hotel report for just the replacement toilets were up to 12,500 gallons per day (gpd) of peak season savings.

Seattle Police Department – Water Reuse

This was a City of Seattle project subject to and constructed under the City Leadership in Energy and Environmental Design (LEED) Policy for sustainability. The project involved a complete renovation of a building formerly occupied by Starbucks, into a facility that houses many City of Seattle Police functions; including photo lab, evidence holding, motorcycle patrols, and parking enforcement. The facility also offers police training room facilities, locker rooms, exercise equipment, and office space for high-ranking members.

The water conservation project made use of an opportunity to incorporate on-site drainage and stormwater management with domestic and landscape end uses not requiring potable water. This site has high groundwater levels that necessitate pumping water to the combined sewer system. The flow of water pumped varies from six to 60 gpm, but is continuous under all conditions and seasons. The project utilized this available water for on-site toilet flushing, vehicle washing, and landscape irrigation. Use of potable water supplied by the city was reduced significantly as estimated by the project mechanical design engineer.

Children's Hospital – Air Compressor

This project involved replacement of a water-cooled air compressor that provides medical air, is part of the fire suppression system, and air for pneumatic controls. The new system was all air-cooled and segregated systems. SPU performed one week of metering, which essentially validated water use by the air compressor system as reported in the water audit report. This project saved over 11,000 gpd of peak season savings. In addition, substantial energy savings also resulted, as the selected equipment was much more efficient than the equipment that was replaced.

King County-Metro Bus Maintenance Facility – WD #125 – Air Compressors

This project involved the replacement of two water-cooled air compressors with two air-cooled air compressors. The subject site is a KC-Metro bus maintenance facility and is located in the Water District #125 service area. Sub metering by motor loggers and point of discharge water meters was completed on both compressors. Over 5,000 gpd of peak season savings resulted from this project.

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Saving Water Partnership
www.savingwater.org
(206) 684-SAVE

Cedar River Water & Sewer District
City of Bothell
City of Duvall
City of Mercer Island
Coal Creek Utility District
Highline Water District
Northshore Utility District
Olympic View Water & Sewer District
Seattle Public Utilities
Shoreline Water District
Soos Creek Water & Sewer District
Water District No. 20
Water District No. 45
Water District No. 49
Water District No. 90
Water District No. 119
Water District No. 125
Woodinville Water District

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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

I. WATER RESOURCES

APPENDIX C

WATER RIGHTS EVALUATION

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Seattle Public Utilities
Water Rights Evaluation
June 2006

1. Introduction

Seattle currently utilizes surface water from the Cedar River and the South Fork Tolt River, and ground water from the Seattle Well Fields. The City holds various water rights for use of water from these sources. Also, the City has water rights applications on file with Ecology for potential future sources of supply. These sources include the North Fork Tolt River, the Snoqualmie Aquifer, and additional yield from the Seattle Well Fields. This appendix provides a description of these water rights and applications, and with Tables 1 through 3, provides the evaluation of water right adequacy outlined in the DOH planning guidelines.

2. Changes from 2001 WSP

Several significant events related to water rights have occurred since the 2001 Water System Plan:

- Through this Water System Plan, SPU is seeking to replace its place of use for the Cedar River and Lake Youngs claims to be the service area described in this plan as allowed by the 2003 Municipal Water Law.
- Ecology granted a certificate for the South Fork Tolt Reservoir on January 17, 2003, which establishes Seattle's right to store water at the reservoir.
- Seattle applied for a reservoir permit in June 2005 for the Aquifer Storage and Recovery (ASR) project at its two well fields and permits for use of the wells to replace its temporary permits.
- Ecology granted a 27-year extension to the City's diversion permit for the South Fork Tolt River on November 30, 2005.

3. Cedar River Supply System

The City relies on a combination of documented water right claims and permits for the Cedar River water supply system which allow for:

- Storage of water behind Masonry Dam
- Diversion of water from Chester Morse Lake and the Cedar River at the Landsburg Diversion Dam for municipal and industrial (M&I) use;
- Storage of water in Lake Youngs for M&I use;
- Pumping from the dead storage of Chester Morse Lake for M&I use;
- Diversion of water at Landsburg for use as recharge water for the Seattle Well Fields ASR Project; and
- Diversion of water from the Masonry Pool for the Sallal Pipeline.

Claim No. 068624 – Cedar River Storage and Diversion. In 1974, the City documented its pre-existing water claim for storage of up to 160,000 acre-feet, and diversion of up to 465 cfs (300 MGD) of Cedar River water. The claim has not been subjected to an adjudication process. Storage is accomplished by impounding water behind the Masonry Dam, located at river mile 35.6 in the municipal watershed approximately 30 miles east of Seattle. Water is released from storage either through valves and gates located on the dam, or through penstocks leading to the Cedar Falls Hydroelectric Plant. Flows used for power generation are returned to the river approximately 2 miles downstream of Masonry Dam. The City holds a water right certificate to use this water for power generation by Seattle City Light. Diversion of water for M&I purposes currently occurs at the Landsburg Diversion Dam, at river mile 21.9, and at the Masonry Dam for the Sallal Pipeline.

Through its Cedar River Watershed HCP, the City guaranteed instream flows in the river below Landsburg. As an additional part of the HCP commitments, the City dedicated one-third of this claim to instream flows for the 50-year duration of the HCP. This commits the City to keeping diversions below 200 MGD on an average annual basis (historic highest annual average diversion was about 144 MGD, while current use is around 100 MGD).

Subsequent to adoption of the HCP, the City has agreed to further limits on its annual diversions, in a comprehensive settlement agreement with the Muckleshoot Indian Tribe regarding the Cedar River Municipal Watershed. The City has agreed to dedicate that portion of its water right above 124 MGD to instream flows and to limit its annual diversions from the Cedar River, in perpetuity, to no more than 124 MGD in any single calendar year. Further, beginning in 2051, the City's annual diversions shall not exceed 114 MGD calculated on a 10-year rolling average.

The City has agreed to temporary limits on its annual diversions as follows:

> From the time the settlement agreement is approved by the federal court through December 31, 2020, the City's annual average diversions shall not exceed 105 MGD in any calendar year.
>
> From January 1, 2021 through December 31, 2030, the City's annual average diversions shall not exceed 110 MGD in any calendar year.
>
> From January 1, 2031 through December 31, 2050, the City's annual average diversions shall not exceed 110 MGD, calculated on a 10-year rolling average (and cannot exceed 124 MGD in any calendar year).

Claim No. 068623 – Lake Youngs Storage. Water diverted from the Cedar River at Landsburg enters a 10-mile long conveyance and is discharged into Lake Youngs for subsequent treatment and delivery to the transmission system. In 1974, the City documented its pre-existing water claim for storage of up to 33,770 acre-feet of Cedar River water in Lake Youngs. The claim has not been subjected to an adjudication process. The place of use for this claim is the same as for the Cedar River Claim No. 068624, described above.

Permit No. S1-25929 – Chester Morse Lake Pumping Plants. A substantial quantity of water in Chester Morse Lake is in "dead storage", water stored below the historic natural lake outlet and reserved for use during drought emergencies. The City has two barge-mounted pumping plants on the lake to access dead storage during drought emergencies. Because natural infilling of the outlet channel has reduced the gravity flow capacity of the channel, the plants can also be used to augment gravity flow during normal supply conditions before dead storage is tapped. Each plant has the capacity to pump up to 120 MGD of high quality water from Chester Morse Lake into Masonry Pool, where it is released for downstream uses (instream flows and M&I supply). Although the City believes the Cedar Claim covers use of the plants, Ecology required a separate permit, and issued a 15-year water right permit in 1992 with a Qi of 252 MGD. The permit is conditioned on the instream flows measured at Renton established in 1979 and codified in WAC 173-508. These differ from the instream flow requirements later adopted in the HCP, which would cause operational difficulties if both criteria needed to be met. The City is discussing ways to resolve this and other issues regarding use of the pumping plants with Ecology and other stakeholders. As a term permit, the current permit will not progress to certificate, but time extensions are allowed.

Permit No. S1-25330P – Aquifer Recharge Water. Development work on the well fields included an ASR demonstration project. Although the City believes the Cedar Claim covers using Cedar water for recharge, Ecology required a separate diversion permit for the demonstration project and any later recharge. A temporary permit was granted in August 1988 to divert up to 10 cubic feet per second of water from the Cedar River at Landsburg until completion of the demonstration project, at the time estimated to be in 1995. Ecology has since granted several short-term extensions, with the expiration date currently being February 22, 2007. The right is junior to minimum instream flow requirements set by the State in 1979, and diversion may take place only during the months of October through May.

After Ecology adopted a rule on ASR's in 2003, Seattle submitted an application for its project in June 2005 (discussed below), and included the observation that:

> *"With the ASR rule identifying a water claim as a legitimate source of recharge, and Ecology's ability to incorporate conditions like instream flows into the ASR reservoir permit itself, the 10 CFS permit will become superfluous. After Ecology issues the ASR reservoir permit, it should no longer require the 10 CFS permit for operation of the ASR project."*

4. South Fork Tolt River Supply System

The City has two separate water rights that pertain to the South Fork Tolt River water supply system which allow for:

- Storage of water in the South Fork Tolt Reservoir for M&I and hydropower use.
- Diversion of water at the South Fork Tolt Dam for M&I and hydropower use.

These water rights are described as follows:

Permit No. R-206 – South Fork Tolt Reservoir Storage. The City was originally issued a water right permit in 1957 to store up to 57,830 acre-feet of water in the South Fork Tolt Reservoir. Ecology issued a Certificate for the Reservoir on January 17, 2003.

Permit No. 10602 – South Fork Tolt Diversion. The City was originally issued a water right permit in 1957 to divert up to 181 MGD (Qi) and 168,000 acre feet annually at the South Fork Tolt Dam. A superseding permit was issued in 1997 adding hydropower as a permitted use, in addition to M&I. Addition of the hydropower facility to the South Fork Tolt system led to licensing under the FERC. The superseding water right permit is conditioned on the conditions of the FERC Project No. 2959 Settlement Agreement, including instream flows. In November 2000, the City documented the full use of the Qi allowed by the permit. On November 2, 2005, The City requested a 50-year extension to this permit, and Ecology granted a 27-year extension to November 30, 2032.

5. Seattle's Well Fields

The water rights for Seattle's Well Fields have remained in a preliminary status, even though development of the fields began in the early 1980's and production from the wells began in 1988. Currently, the water rights consist of a temporary permit for 4000 gpm at each well field. Because ASR was an integral part of the development, Ecology preferred to delay making final water rights decisions regarding the wells until promulgation of a rule on ASR, which did not happen until 2003. With its ASR application in June 2005, the City requested specific actions on well field rights, including:

- An ASR Reservoir permit for 1500 acre-feet.
- Riverton Well Field – a permit for Q_i of 6300 gpm based on temporary permit G1-24621 and application G1-24824.
- Boulevard Park Well Field – a permit for Q_i of 2900 gpm based on temporary permit G1-24619 and application G1-24825.
- Removal of the requirement for a separate permit to divert water from the Cedar for recharge, as discussed above under Cedar rights.

Temporary Permit Nos. G1-24619 and G1-24621– Boulevard Park and Riverton Well Fields. In an aquifer located immediately north of SeaTac Airport, the City currently operates three water supply wells with a combined capacity of approximately 10 MGD. Two wells are located near the City's Riverton Heights Reservoir in what is referred to as the Riverton Well Field, and draw water from a depth of about 330 feet. The Boulevard Park Well Field, currently with a single well, is located approximately one mile north of Riverton, and draws water from a depth of about 250 feet. Seattle submitted permit applications for the two fields in 1985, and Ecology issued temporary permits for pumping 4000 gpm at each well field in 1987.

Application Nos. G1-24824 and G1-24825 – Outstanding Well Field Applications. In anticipation of being able to develop more than 4000 gpm production capacity at each of the well fields, the City submitted applications for 4000 gpm of additional water rights at each well field in 1986.

Application No. R1-28168 – Seattle Well Fields ASR Project. Development of the well fields included a successful ASR demonstration project. Until Ecology promulgated an ASR permit rule in 2003, there was no mechanism for obtaining a reservoir permit for the project. As noted above, the City submitted an application for a 1500 acre-foot reservoir permit in June 2005.

6. Potential Future Water Supply Sources

Application No. S-4254 – North Fork Tolt River Diversion. The North Fork Tolt Diversion is a future water supply source option for Seattle and the region that has been identified in the past as a water supply option. Seattle filed a water rights application in 1936 for an instantaneous flow of 181 MGD, and an annual maximum volume of 203,000 acre feet. Seattle has requested processing of the application be held in abeyance for the time being, and Ecology has not processed this application to date.

Application No. G1-24620 – Possible Non-Potable Well at Glacier. In addition to the three water supply wells the City operates at its well fields, a production well at the nearby Glacier site was completed in 1986. It draws water from the deep aquifer at a depth of about 550 feet. Tests of the well indicated that the sustainable production rate over the planned use period would be about 700 to 900 gallons per minute. Water quality concerns, specifically the presence of hydrogen sulfide, led the City to abandon plans to develop this well as a potable supply.

Application Nos. G1-27384 and S1-27877 – Snoqualmie Aquifer Project. Study of the Snoqualmie Aquifer Project has been in progress since 1992 under the sponsorship of the East King County Regional Water Association (EKCRWA). Seattle is a partner in the project, and is a co-applicant with EKCRWA in the water rights process. As originally conceptualized, the project was to be developed as a conventional ground water supply. However, in late 1997, an alternative was proposed involving the conjunctive use of surface water and ground water.

A joint water right application (G1-27384) was filed with Ecology by EKCRWA and Seattle on January 19, 1994, to withdraw 60 MGD from the Upper Snoqualmie basin. This is equivalent to 92 cubic feet per second (cfs), or 67,200 acre-feet per year (AF/y).

The change in concept necessitated that an application be filed with Ecology for a surface water right. The surface right application (S1-22877) was submitted by EKCRWA and was assigned a priority date of January 29, 1998. The applicants are requesting a withdrawal of not more than 100 cfs for a regional water supply. The maximum quantity to be used annually is 72,000 acre-feet (AF/y).

Water Rights Evaluation
Table 1 - Existing Water Rights Status

Permit Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Existing Consumption		Current Water Right Status Excess (positive)/Deficiency (negative)	
					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)
Certificates										
1. R-206	City of Seattle Water Department	7/14/1936	South Fork Tolt Reservoir	Primary	N/A	Storage 57,830 acre feet	N/A	Storage 57,830 acre feet	N/A	Storage 0 acre feet
Permits										
1. S1-25929	City of Seattle Water Department	8/17/1990	Cedar River: Temporary Pumping Plant	Supplemental (Term Permit)	390 cfs (252 mgd)	N/A Note 1				
2. S1-25330P	City of Seattle Water Department	8/22/1988	Cedar River: Aquifer Storage and Recovery (ASR)	Primary	10 cfs (6.5 MGD) (Oct thru May)	4,800 acre feet (1,564 mg)	3.5 cfs (2.3 MGD) Note 3	1,170 acre feet Note 2	6.5 cfs (4.2 MGD)	3,630 acre feet
3. 10602	City of Seattle Water Department	7/14/1936	South Fork Tolt Diversion	Primary	280 cfs (181 MGD)	168,000 acre feet (150 MGD)	263 cfs (170 MGD) Note 5	58,251 acre feet (52 MGD) Note 4	17 cfs (11 MGD)	109,749 acre feet
Temporary Permits										
1. G1-24619	City of Seattle Water Department	3/7/1985	Boulevard Park Well Field	Primary	4000 gpm (5.8 MGD)	To be determined Note 6	2,900 gpm (4.18 MGD) Note 7	764 acre feet Note 8	1,110 gpm (1.6 MGD)	To be determined
2. G1-24621	City of Seattle Water Department	3/7/1985	Riverton Well Field	Primary	4000 gpm (5.8 MGD)	To be determined Note 9	6,300 gpm (9.07 MGD) Note 10	2,422 acre feet Note 11	-2,292 gpm (-3.3 MGD) Note 12	To be determined
Claims										
1. 068624	City of Seattle Water Department	1888	Cedar River and Chester Morse Lake	Primary	Note 17	336,650 acre feet (300 MGD) Note 13	350 cfs (226 MGD) Note 14	161,312 acre feet (144 MGD) Note 15	115 cfs (74 MGD)	175,338 acre feet (156 MGD) Note 13
2. 068623	City of Seattle Water Department	1926	Lake Youngs	Primary	N/A	Storage 33,770 acre feet	N/A	Storage 33,770 acre feet	N/A	Storage 0 acre feet
Interties - Note 18										
TOTAL - Note 16	*********	*****	*******	***********	Note 17	504,650 acre feet (450 MGD)	638 cfs (412 MGD) Note 16	222,749 acre feet (199 MGD) Note 16	Note 17	281,901 acre feet (251 MGD)

Notes:
1. Not included in water rights calculations; pumping plants operated only for testing or under conditions of extreme drought.
2. Maximum volume recharged to date: January 1993 to May 1993 during demonstration project; recharge period is October through May.
3. Per Integrated Water Resource Management System (IWRMS) average rate over 24 hours recorded 1/3/95.
4. Tolt Pipeline 24-hour volumes from IWRMS (1985-1999); highest occurred in 1994.
5. Flow diverted from South Fork Tolt River and measured by Seattle City Light at powerhouse on 6/3/1996.
6. With June 2005 ASR application, City requested Qi of 2900 and Qa of 1200 acre-feet at Boulevard Well Field, based on this permit and application G1-24825
7. Per Seattle Well Field, O&M Manual; Maximum range of normal operations.
8. Maximum well field use occurred between June and December 1992.
9, With June 2005 ASR application, City requested Qi of 6300 and Qa of 3200 acre-feet at Riverton Well Field, based on this permit and application G1-24824
10. Per Seattle Well Field, O&M Manual; Maximum range of normal operations.
11. Maximum well field use occurred between June and December 1992.
12. The installed pumping capacity exceeds the Qi specified in the existing temporary permit.
13. Agreement with Muckleshoot Indian Tribe (MIT) (June 2006) limits average annual diversion from Cedar to 105 MGD until 2020, 110 MGD from 2021 to 2030, and 124 MGD beginning in 2031.
14. Per IWRMS data 226 mgd was recorded 6/23/96 (7:00 am reading).
15. Landsburg diversion calendar year 1990: 144 mgd, 52,560 mg, 161,312 ac-ft.
16. Peak instantaneous and peak annual demand occurred at different times on individual sources, so sums do not represent system wide peaks. Emergency source, ASR recharge water diversion, and storage not included.
17. Cedar Claim and MIT agreement do not specify a Qi.
18. SPU does not use interties as a normal supply source

Wate Rights Evaluation
Table 2 - Pending Water Rights Status

Water Right Application	Name on Permit	Date Submitted	Source Name	Primary or Supplemental	Pending Water Rights	
					Maximum Instantaneous Flow Rate (Qi) Requested	Maximum Annual Volume (Qa) Requested
1. S-4254	City of Seattle Water Department	Filing date 07/14/36 being held in abeyance	North Fork Tolt River	Primary	280 cfs (181 MGD)	203,000 acre-feet
2. Gl-24620	East King County Regional Water Association and City of Seattle Water Department	1/19/1994	Snoqualmie Aquifer	Primary	41,600 gpm (60 MGD)	To be determined
3. S1-27877	East King County Regional Water Association and City of Seattle Public Utilities	1/29/1998	Snoqualmie River	Primary	100 cfs (65 MGD)	To be determined
4. G1-24620	City of Seattle Water Department	3/7/1985	Glacier Well	Irrigation or other non-potable use only	To be determined	To be determined
5. G1-24824 (Note 1)	City of Seattle Water Department	4/14/1986	Riverton Well Field: (Note 3)	Primary	4000 gpm (5.8 MGD)	To be determined
6. G1-24825 (Note 2)	City of Seattle Water Department	4/14/1986	Boulevard Park Well Field (Note 3)	Primary	4000 gpm (5.8 MGD)	To be determined
7. R1-28168	City of Seattle	6/29/2005	Seattle Well Fields ASR (Note 3)	Primary	N/A	1500 acre-feet

Notes:

1. With June 2005 ASR application, City requested Qi of 6300 and Qa of 3200 acre-feet at Riverton Well Field, based on this application and temporary permit G1-24621
2. With June 2005 ASR application, City requested Qi of 2900 and Qa of 1200 acre-feet at Boulevard Well Field, based on this application and temporary permit G1-24619
3. Since the last WSP update, the Highline Well Field has been renamed Seattle Well Fields (Riverton Well Field and Boulevard Park Well Field)

Water Rights Evaluation
Table 3 - Projected Water Rights Status

Permit Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Forecast Water Demand for 2030		Forecast 2030 Water Right Status Excess (+) / Deficiency (-)	
					Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
Certificates										
1. R-206	City of Seattle Water Department	7/14/1936	South Fork Tolt Reservoir	Primary	N/A	Storage 57,830 acre feet				
Permits										
1. S1-25929	City of Seattle Water Department	8/17/1990	Cedar River: Temporary Pumping Plant	Supplemental (Term Permit)	390 cfs (252 mgd)	N/A Note 1				
2. S1-25330P	City of Seattle Water Department	8/22/1988	Cedar River: Aquifer Storage and Recovery (ASR)	Primary	10 cfs (6.5 MGD) (Oct to May)	4,800 acre feet (1,564 mg)				
3. 10602	City of Seattle Water Department	7/14/1936	South Fork Tolt Diversion	Primary	280 cfs (181 MGD)	168,000 acre feet (150 MGD)				
Temporary Permits										
1. G1-24619	City of Seattle Water Department	3/7/1985	Boulevard Park Well Field	Primary	To be Determined - Note 2					
2. G1-24621	City of Seattle Water Department	3/7/1985	Riverton Well Field	Primary	To be Determined - Note 3					
Claims										
1. 068624	City of Seattle Water Department	1888	Cedar River and Chester Morse Lake	Primary	Note 5	336,650 acre feet (300 MGD) Note 4				
2. 068623	City of Seattle Water Department	1926	Lake Youngs	Primary	N/A	Storage 33,770 acre feet				
Interties - Note 7										
TOTAL - Note 8	*********	*****	*******	***********	Note 5	504,650 acre feet (450 MGD)	668 cfs - Note 6 (431 MGD)	144,800 acre feet (129 MGD)	Note 5	359,850 acre feet (321 MGD)

Notes:

1. Not included in water rights calculations; pumping plants operated only for testing or under conditions of extreme drought.
2. With June 2005 ASR application, City requested Qi of 2900 and Qa of 1200 acre-feet at Boulevard Well Field, based on this permit and application G1-24825
3, With June 2005 ASR application, City requested Qi of 6300 and Qa of 3200 acre-feet at Riverton Well Field, based on this permit and application G1-24824
4. Agreement with Muckleshoot Indian Tribe (June 2006) limits average annual diversion from Cedar to 105 MGD until 2020, 110 MGD from 2021 to 2030, and 124 MGD beginning in 2031.
5. Cedar Claim and MIT agreement do not specify a Qi.
6. Flow rate listed is maximum capacity of raw water pipelines.
7. SPU does not use, and does not project to use, interties for normal supply.
8. Emergency source, ASR recharge water diversion, and storage not included. Forecast demand not divided by source.

SEATTLE PUBLIC UTILITIES

2007 WATER SYSTEM PLAN

I. WATER RESOURCES

APPENDIX D

WATER SHORTAGE CONTINGENCY PLAN

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SEATTLE PUBLIC UTILITIES

WATER SHORTAGE CONTINGENCY PLAN

July 2006

**SUPPLEMENT TO THE SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN**

SEATTLE PUBLIC UTILITIES
WATER SHORTAGE CONTINGENCY PLAN
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SEATTLE PUBLIC UTILITIES
WATER SHORTAGE CONTINGENCY PLAN

SECTION I

INTRODUCTION

This plan provides guidelines for Seattle Public Utilities (SPU) to manage water supply and demand in the event of a supply problem. Such problems could include imminent supply disruptions resulting from a major pipeline failure as well as forecasted water supply shortages due to droughts. “Water shortage” as is discussed in this document means that SPU will not have the normal amount of water to provide to its customers. It is extremely improbable that SPU would ever run out of water. The stages noted in the plan will be implemented depending on the magnitude of the water shortage. This document supplements the *2007 Water System Plan*, and updates the April 2001 Water Shortage Contingency Plan (WSCP).

OBJECTIVE OF WSCP

The objective of the WSCP is to establish actions and procedures for managing water supply and demand during water shortages. The plan enables SPU to maintain essential public health and safety and minimize adverse impacts on economic activity, environmental resources and the region's lifestyle.

INTEGRATION INTO OTHER EMERGENCY PLANNING

A discussion of how SPU will respond to non-drought water emergencies, such as a major transmission pipeline break, is provided in Section 4 of this plan.

RELATIONSHIP TO WHOLESALE CUSTOMERS' WSCPS

There are approximately 1.45 million people living in the areas served by SPU and our wholesale water customers. SPU provides water to utilities in much of King County and a small part of Snohomish County. SPU has contracts with 21 wholesale customers, including the Cascade Water Alliance, which wholesales water to eight utilities in the region. Water supply disruptions affect Seattle, Seattle's wholesale customers, and their respective retail customers.

SPU’s wholesale contracts include a provision that wholesale customers will assist and support emergency curtailment measures required to manage demand during an emergency or shortage. This plan has been developed by SPU, in consultation with its wholesale customers and other participants, based on the premise that an effective demand management strategy must be regionally consistent. This is based on several considerations:

- Public support and cooperation is likely to be higher if actions are equitable, i.e., all water users are experiencing the same service level and degree of hardship.

- A unified message and approach is easier to understand and distribute through the media, which is key in communicating information to the public.

- Consistency makes it easier for Seattle to forecast demand reductions, which is essential to effectively manage the system during a water shortage.

SECTION 2

OVERVIEW OF DROUGHT MANAGEMENT STRATEGY

This Water Shortage Contingency Plan focuses on weather-related water shortages – generally referred to as "droughts." Droughts are naturally occurring unpredictable weather events of varying frequency, duration and severity. In the region served by the Seattle Regional Water System, available data indicate a very low probability of a multi-year drought, but the region has experienced short-term droughts.

This region is generally faced with a relatively dry summer period. In the Seattle area, only about 5 of our 37 inches of annual precipitation fall during the summer months (based on National Weather Service data for 30-year average at SeaTac Airport). The Seattle Regional Water System operates with an annual refill and drawdown cycle of its water supply storage reservoirs. Highly unusual weather events affect this cycle and can cause water shortages.

TYPES OF DROUGHTS BY SEASON

The types of droughts that affect the Seattle Regional Water System range from poor snowpack accumulation in the winter to delayed onset of rains in the fall. Since the nature of these droughts varies, Seattle's response will also vary. The types of droughts the system has experienced can be categorized by season as follows:

Winter/Spring Drought

Low snowpack is the primary issue with winter/spring droughts. While a below normal snowpack may not lead to poor water supply conditions if ample spring rains occur, caution is used in managing the water supply in these situations because rainfall is inherently difficult to forecast. Below normal snowpack can occur during a winter when mountain temperatures are warm, when precipitation is below average, when intense rainfall events melt off low to mid-elevation snow cover, or through a combination of these factors. Tracking El Niño events, which are typified in the Pacific Northwest by warmer and drier than average winter conditions, can alert water managers to the increased potential of a winter/spring drought. Seattle's use of the dynamic rule curve – varying reservoir storage targets based on real-time snowpack measurements and soil moisture estimates – in these types of droughts helps to ensure that our reservoirs are as close to full as possible at the start of the summer drawdown cycle.

When winter/spring drought conditions result in low water supply availability, water use restrictions may need to be imposed because the potential for water use reductions by customers is greater in the spring and summer, there is much uncertainty about impending summer weather which is so influential on demand, and weather forecasts of when the fall rains will begin are not reliable. These conditions generate uncertainty about whether water stored in the spring will be sufficient to meet demands until supplies are replenished in the fall. This can make the imposition of water use restrictions in the spring and summer necessary, despite the fact that in some years no water shortfall may ever really develop.

Summer/Fall Drought

In years in which reservoirs refill as normal in early summer, droughts can still develop over the summer and extend into the fall if summer demands are high and inflows to the reservoirs drop below normal levels for an extended period of time. These types of droughts require careful monitoring of summer demands and water supply. Unfortunately, it is not possible to accurately predict in advance the timing and amount of the fall rains. When these types of droughts become apparent, and are significant, Seattle will ask for curtailments and prepare to use emergency storage at Chester Morse Lake should it be needed later in the year (see below for details on the pumping plants at Chester Morse Lake).

Fall/Early Winter Drought

Fall is the time when demands for fish habitat needs are especially high and the ability for people to cut back on water is limited since little water is being used for landscape irrigation. These factors can make fall droughts particularly challenging. Droughts can occur in the fall, and extend into the early winter. When the normal rainy season develops later than normal, storage reservoirs can be depleted to minimum levels. For this reason, the emergency pumping plants at Chester Morse Lake are maintained and may be used if needed to allow use of "dead storage" below the lake's natural outlet. Other emergency supplies that may be activated in these types of droughts are discussed later in this WSCP.

Attachment A provides examples of past drought events that resulted in Seattle activating its Water Shortage Contingency Plan.

MANAGING INSTREAM FLOWS DURING WATER SHORTAGES

The management of stream flows downstream of Seattle's water storage and diversion facilities is a critical consideration in managing water resources during water shortages. In addition to meeting the needs of SPU's retail and wholesale customers, the Cedar and South Fork Tolt rivers are managed to protect instream resources. Seattle has ongoing formal and informal agreements with state, federal and local resource agencies, Indian Tribes and the U.S. Army Corps of Engineers that help guide how it manages streamflows. Streamflow management in the South Fork Tolt is governed by the South Fork Tolt River Settlement Agreement. Cedar River flows are governed by the Cedar River Instream Flow Agreement, a component of the Cedar River Watershed Habitat Conservation Plan (HCP). These agreements provide guaranteed flow regimes as well as adaptive features to ensure that water is released from Seattle's mountain storage reservoirs in a manner that provides beneficial conditions for salmon and other species downstream of the Seattle's reservoirs. During substantial portions of the year, total runoff into the Cedar River and South Fork Tolt basins can exceed the amount required to meet municipal demands and the guaranteed flow regime. This additional water is managed adaptively and in collaboration with the Cedar River Instream Flow

Commission and Tolt Fisheries Advisory Committee in an effort to further enhance conditions for instream resources. The protective provisions of the governing agreements are particularly important during droughts and associated periods of low stream flow.

The Cedar River also provides approximately half of the inflow to Lake Washington on an annual average basis. The U.S. Army Corps of Engineers manages Lake Washington lake levels as part of its Lake Washington Ship Canal Project (Hiram Chittenden Locks in Ballard) which connects Lake Washington to the saltwater of Puget Sound. Their management objectives include providing water flows at the Locks for navigation, fish passage, and control of the salt water intrusion caused by operation of the Locks.

DROUGHT MANAGEMENT STRATEGY

Seattle's strategy for dealing with the hydrologic uncertainty associated with drought management involves several components:

- Monitoring current conditions,
- Forecasting,
- Communication,
- Operational Adjustments,
- Curtailment Actions, and
- Alternative Water Supplies.

During years in which precipitation is significantly below normal, Seattle expands and utilizes these management strategies as explained below.

Monitoring Current Conditions

To deal with hydrologic uncertainty in real-time and in longer term planning horizons, Seattle's water resource management team uses a number of available informational and data gathering sources. Seattle contracts with the U.S. Geological Survey (USGS) to provide continuous streamflow monitoring and data collection services. Strategic placement of USGS stream gauging stations provides real-time information for understanding the hydrologic state of the water supply and river systems. Seattle also contracts with the Natural Resources Conservation Service (NRCS) to provide real-time snow monitoring and weather data collection services.

Forecasting

Through the National Oceanic and Atmospheric Administration (NOAA), Seattle regularly monitors daily weather forecasts (National Weather Service Seattle Forecasting Office), mid-range weather forecasts (National Centers for Environmental Prediction), 30- and 90-day and multi-season climate outlooks (Climate Prediction Center), and daily hydrometeorological forecasts (Northwest River Forecast Center in Portland, Oregon). The internet provides access to vast amounts of additional useful information to assist SPU in forecasting. For example, NOAA's web information on El Niño/La Niña provides a wealth of timely information on current and forecasted El Niño and La Niña conditions with enough lead time for water resource managers to prepare for such events.

Seattle uses a number of analytical tools for forecasting hydrologic conditions as they relate to water supply and fisheries including:

- Streamflow forecasts prepared by the USGS and NRCS.
- Weather, climate and river forecasts from NOAA.
- In-house reservoir management and streamflow forecasts using a computer model known as the Seattle Forecast Model, or SEAFM. This model is regularly updated with hourly meteorological and hydrological data, and simulates the current state of the watershed (including snowpack, soil moisture, aquifer storage, and streamflows) and water supply system. The model is used to analyze and assess various future reservoir operating scenarios, both in real time and in near- and long-term operational planning, based on probabilistic analysis of over 70 years of historic weather; and
- Seattle's Conjunctive Use Evaluation (CUE) model, which is a weekly time step simulation model used for calculating and evaluating the firm yield and reliability of Seattle's water supply system and potential future water supply projects. While not a forecast tool, per se, the model provides valuable insight into the hydrologic record.

Communication

SPU's Water Resources Management staff work closely with members of other city, local, state, federal and tribal resource agencies, including Seattle City Light, City of Renton, King County, Washington State Department of Ecology, Washington State Department of Fish and Wildlife, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Marine Fisheries Services, Muckleshoot Indian Tribe and Tulalip Tribes.

The interagency Cedar River Instream Flow Commission established by the Cedar River Watershed HCP, convenes in regularly scheduled meetings once per month throughout the year to oversee Seattle's instream flow management on the Cedar River. Additional meetings, in person or by conference call, are scheduled on an as needed basis, especially during periods of water shortages. The interagency Tolt Fisheries Advisory Committee, established by the South Fork Tolt River Settlement Agreement convenes on an as needed basis throughout the year and is the primary forum for interagency technical communications related to that river during water shortages.

In addition to the communications noted above, throughout this plan are references to communication to customers, stakeholders and the media. What is in this plan regarding communications is guidance. It may be appropriate to do more or less communication depending on the particular circumstances of the water shortage.

Operational Adjustments

Specific operational actions that will be made to reduce all non-essential water use are provided in Section 3 for each WSCP stage. Below is a discussion of how Seattle's water supply reservoirs are managed for people and fish during droughts.

Management of Water Supply for People and Fish

Operational flexibility is key, with operating plans changing as conditions and forecasts change. SPU has developed "dynamic rule curves" to operate its mountain reservoirs in the winter season. These rules set target reservoir levels that vary with watershed snowpack and soil moisture conditions. At times when there is little snowpack and low soil moisture, the reservoir target will be set higher than normal flood control levels, and vice versa. Dynamic reservoir rule curves are used to adjust operations to actual watershed conditions and to help manage risk and uncertainty. Also, periodic salmon and steelhead redd surveys are undertaken during seasonal fish spawning events that enable informed management decisions to be made that seek to ensure adequate flow levels are provided during critical fish incubation and emergence periods.

Curtailment Actions

Customers will be asked to take actions to curtail their use of water during a shortage. Those actions will depend on the stage of the WSCP being implemented at the time. Examples of potential water saving actions are noted in Section 3.

Criteria for Curtailment During a Water Shortage

There are several criteria for deciding which curtailment measures are appropriate to reduce demand during a water shortage:

- Timing: Can the measures or actions produce results in the necessary timeframe?

- Magnitude of savings: Will the measures or actions result in enough savings to make a meaningful difference; i.e., reduce demand to the level the impaired water system can handle?

- Season: Are the actions or measures relevant to the time of year; i.e., banning lawn watering during the summer irrigation season vs. during non-irrigation season?

- Costs: How severe are the cost implications of the measure to the customer, including local business and industry, relative to the need for action? Note: While there could be costs to certain customers, which would be considered, particular actions still may be necessary for public health and safety reasons.

Exit Strategy for WSCP Stages

As soon as actual and forecasted supply conditions substantially improve, SPU will either inform the public of the return to normal use of water, or inform them that the utility is moving from one stage to a lesser stage of this plan. This latter process would occur until there was a return to normal operations. Stages could be skipped in this process as conditions and forecasts warrant.

Alternative Water Supplies

Depending on the nature and timing of a water shortage, alternative or emergency water supplies may be useful to supplement existing supplies. SPU has several options available:

- Chester Morse Lake "Dead Storage" – Seattle's primary storage reservoir has a natural, gravity fed outlet. When inflows to the reservoir are low, its water surface elevation can fall below the natural outlet, but still contain a substantial amount of high-quality water in what is called "dead storage." In 1987, Seattle installed the first of two emergency pump stations to pump the water over the natural outlet and into the river, thereby augmenting both instream flows and water availability for customer use. The second Morse Lake Pumping Plant was installed in 1992. These pumping plants allow use of dead storage during drought emergencies.

- Interties - Since water supply problems will not affect all water suppliers in the region to the same extent, it is sometimes feasible for SPU and its wholesale customers to obtain water from other providers through interties.

- Reclaimed water - Reclaimed water is highly-treated effluent that may be used instead of potable water for irrigation, street washing, construction purposes, etc., in order to reduce demand for potable water and lessen the impact of shortages on the community. Currently there are some significant constraints on the use of reclaimed water during a shortage, e.g., lack of availability, cost and safety of trucking or piping water over long distances. It is important to note, however, that if reclaimed water becomes more widely available in the region and becomes less expensive it may become prudent for SPU to draw on it as a limited back-up supply during water shortages, for non-potable uses only. If reclaimed water is used it would be in adherence with applicable state regulations governing reclaimed water use.

A key assumption of this plan is that abundance, shortage and risk must be shared among all beneficiaries of the water resource. For example, critical minimum instream flow levels at locations specified in the Tolt and Cedar agreements referenced above are resorted to only after human water consumption is curtailed. All of the tools, information sources and communications outlined above, are needed for coordinating and making decisions related to real-time operations.

WATER SHORTAGE CONTINGENCY PLAN PRINCIPLES

SPU has learned a great deal over the years about how best to operate the utility during drought events, while minimizing impacts to customers and instream resources. This knowledge is reflected in this Water Shortage Contingency Plan, and articulated in the following principles:

- Given clear, timely and specific information on supply conditions and the necessary actions to forestall worsening conditions, customers prefer the opportunity to meet targeted demand reduction levels through **voluntary** compliance measures. The decision to move to mandatory restrictions is more acceptable if the voluntary approach has been tried first but has not resulted in enough demand reduction to ensure public health, safety and adequate streamflows through the projected duration of the shortage.

- Each drought or other shortage situation has enough unique characteristics that a plan cannot specifically define all the scenarios and specific supply and demand management actions. The usefulness of a Water Shortage Contingency Plan lies in planning the range of supply and demand management actions in advance of the situation, and in defining the communication mechanisms by which decisions will be made during the event.

- Given the highly-effective long-term regional conservation program operated by SPU, it is important to distinguish between the short-term **curtailment** measures necessitated by a water supply problem, and the **conservation** measures SPU regularly promotes to its customers. Conservation focuses on long-term efficiencies which do not adversely affect customers' accustomed use of water, whereas curtailment measures involve short-term water use reductions that can create hardships.

- It is essential to closely monitor water quality during droughts and particularly during a warm weather drought. This applies to water quality in rivers as well as to the drinking water provided to customers. Water quality issues must be considered for drinking water and instream uses when supply management decisions are made. The Seattle water distribution system is designed to carry a large capacity of water during summer peak months. If demand is significantly lowered, water will not move through the system at the "design" rate. The slower moving water, coupled with higher summer temperatures will increase the likelihood that drinking water quality problems may arise.

SECTION 3

<u>PHASED CURTAILMENT PLAN</u>

OVERVIEW OF PLAN STAGES

This plan provides four stages of response based on increasing severity, as progressively more serious conditions warrant. This type of response would be appropriate for a drought or other long-range disruption. It is the role of the Mayor of Seattle to officially activate the WSCP, when necessary. The four response stages include a variety of communications, internal operations, and supply and demand management strategies as appropriate, and are characterized as follows:

- **Advisory Stage** - The public is informed as early as meaningful data are available that a water shortage may occur.

- **Voluntary Stage** - If supply conditions worsen, the plan moves to the Voluntary Stage which relies on voluntary cooperation and support of customers to meet target consumption goals. During this stage, specific voluntary actions are suggested for both residential and commercial customers.

- **Mandatory Stage** - If the Voluntary Stage does not result in the reduction needed, or supply conditions worsen, the Mandatory Stage would be implemented. This stage prohibits or limits certain actions, and may be accompanied by an enforcement plan which could include fines for repeated violation.

- **Emergency Curtailment** - This stage addresses the most severe need for demand reduction and includes a combination of mandatory measures and rate surcharges. This would be used as the last stage of a progressive situation, such as a drought of increasing severity, or to address an immediate crisis, such as a facility failure.

PREPARATION FOR IMPLEMENTING WSCP STAGES

Recommendations about implementing the WSCP are made to the SPU Director by the SPU Water Shortage Response Team formed at the direction of the Director. Suggested team membership is provided in Attachment B. The actual composition of the team may change at any time as requested by the Director. This team, involving key departmental staff, would meet as often as appropriate to consider many or all of the following factors in making its recommendations about entering into any stage of this WSCP and modifying its recommendations as conditions change:
- total supply availability, including groundwater, interties, and modified instream flow releases
- the rate of decline in total reservoir storage compared with typical rates
- short- and long-term weather and hydrologic forecasts

- computer modeling of streamflow and reservoir storage, for different weather and demand assumptions (see Attachment C for possible demand management scenarios)
- the trends and forecasts of the system's daily water demands
- recommendations from the Water Shortage Advisory Group (if it has already been formed, if not yet formed, move forward in creating this group, see Attachment B for suggested role of this group and membership)
- recommendations from the Cedar River Instream Flow Commission and the Tolt Fisheries Advisory Committee
- the estimated margin of safety provided by the demand reduction, compared with the level of risk assumed if no action is taken
- potential water quality issues
- increased operating costs of potential actions and the value of lost water sales revenue, compared with the increased margin of reliability (see Attachment D for estimated costs and revenue losses for different stages of the WSCP)
- consultation with elected officials, wholesale customer representatives, state resource agencies, the Army Corps of Engineers and Tribes
- the length of time between stage changes (abrupt starts and stops are to be avoided, at least two weeks between stages is best to allow time to prepare)
- current events
- customer response, and
- water use consumption goals to be achieved, which may be revised as needed.

An SPU staff member is to be identified by the SPU Director to lead the water shortage response effort before it is activated.

The SPU Director will communicate the nature and scope of WSCP stage measures and strategies to the Mayor and Seattle City Council prior to implementing the WSCP and receive their input. The Director will communicate regularly throughout the shortage with the Mayor and City Council.

Preparation Between Plan Stages

When SPU is considering moving from one stage of the plan to another the department evaluates the need for doing so using much of the same information as noted above. Prior to moving to different stages of the plan, SPU will plan to consult with key stakeholders. There are also a number of preparatory measures that need to occur prior to moving from one stage to another, including, but not limited to: modifying any communication materials including customer water saving measures for the given stage, and "Questions and Answers" for customer groups, the determination of any staffing reassignments needed, and estimated costs and plans for covering those costs.

ADVISORY STAGE

Objectives

- Prepare the Department, City, relevant agencies and water users for potential water shortage thereby allowing all parties adequate planning and coordination time.

- Undertake supply management actions that forestall or minimize the need for more stringent demand or supply management actions.

Triggers

As presented earlier, there are a variety of weather and other conditions that may cause concern about water availability and a potential water shortage. SPU will enter the "Advisory Stage" if supply conditions and supply forecasts raise significant concerns about the utility's ability to meet supply needs later in the year.

Public Message

"Potential exists for lower than normal supply; conditions **may** return to normal, or later on, we may need to reduce consumption. Continue to use water wisely to help ensure sufficient supply for people and fish. We'll keep you informed."

Communication Actions

- Step-up and/or alter message of ongoing media education effort about the water system, particularly relationship of weather patterns to supply and demand; provide up-to-date data and implications for water use, if known.

- Initiate report to wholesale customers and request that they trigger their WSCPs.

- Provide periodic updated information on supply and demand data to SPU's wholesale customers via SPU's web page, or other means.

- Meet with landscape industry representatives to inform them of current and projected conditions; develop partnership programs and informational materials on the shortage, consumption goals, etc. for distribution by industry and utilities. Use landscape industry newsletter to communicate with industry members. As appropriate, communicate essential information via email by using Resource Conservation's professional landscape industry database.

- Communicate with other special interests, e.g., large water users including parks, and major water using industries and provide periodic updated information to a variety of key customers (see Attachment E for a list of key contacts and Attachment F for potential Advisory Stage tips for saving water).

- Step-up communication and encourage cooperation of City departments and other public agencies, including: state and federal resource agencies, tribes, and other regional water suppliers, including the Cities of Everett and Tacoma, about water supply conditions and projections.

- Prepare and distribute public information materials explaining the Water Shortage Contingency Plan stages and communicate water use efficiency tips to customers (see Attachment F).

<u>Operating Actions</u>

- Increase data collection actions (i.e., streamflows, snowpack conditions, etc.) and monitoring weather forecasts.

- Increase SPU's computer modeling runs of projected supply, storage, demand and revenue scenarios.

- Identify and implement supply side management techniques to optimize existing sources.

- Assess current water main flushing and reservoir cleaning activities to determine whether they should be accelerated to be completed prior to the peak season or reduced to conserve supply; communicate strategy to wholesale customers.

- Assess water quality in reservoirs and distribution system to identify areas that may experience severe degradation with reduced consumption.

- Initiate planning and preparation for Voluntary Stage actions, including an assessment of potential staffing impacts, training needs, and communications strategies.

VOLUNTARY STAGE

Objectives

- Take necessary supply management actions to further stretch available supply.
- Maintain or reduce demand to meet target consumption levels by customer voluntary actions.
- Forestall or minimize need later for more stringent demand or supply management actions.
- Minimize the disruption to customers' lives and businesses while meeting target consumption goals.
- Maintain the highest drinking water quality standards throughout the shortage.

Triggers

The "Voluntary Stage" will be implemented when one or both of the following factors applies: 1) supply conditions have not improved, or have worsened, 2) demand levels need to be reduced given supply conditions.

Public Message

"Demand needs to be reduced by _____%. Customers are responsible for determining how they will meet that goal. We are relying on support and cooperation of all water users to stretch the available water supply. If everyone cooperates, we may avoid imposing more stringent restrictions. In addition to meeting essential water needs of customers, meeting the needs of fish habitat and other environmental concerns is a priority."

Communication Actions

- Communicate regularly with wholesale customers, groups that may be especially impacted by the water shortage, tribes, and resource agencies.
- Continue to communicate with other City departments and other public agencies to inform them of conditions, and encourage their cooperation.
- Identify and communicate actions taken by City departments to meet the voluntary curtailment goal.
- Consult with the Water Shortage Advisory Group, throughout the shortage, to help develop public information messages and materials and to obtain feedback on utility shortage actions.
- Develop and initiate a strategic public information, media and advertising campaign appropriate to the severity of the problem and the goal for demand reductions. This

could include publishing consumption information in daily newspapers to communicate the goal and ways to reduce consumption.

- Establish routine timing for press releases (e.g., every Monday morning) that provide current status and outlook; present information in standardized format that becomes familiar to media and public.

- Provide recommendations for customer actions to reduce consumption. See Attachment G for a list of recommended actions for this stage. Encourage customers to visit the *savingwater.org* website for more details on reducing water use.

- Include drinking water quality information in public information so that if flushing is necessary, the public understands that it is essential for drinking water quality maintenance.

- Publicize the water supply conditions web page, which is updated regularly. Ensure the information provided covers the needs of all key interests: the public, news media and key customers.

- Continue and intensify coordination and communication with state and federal resource agencies and tribes about supply conditions, demand management actions and streamflow levels.

- Establish and promote "hotlines" or websites for customers to obtain additional water conservation information.

- Contact largest customers to request percentage reduction.

- Establish regular communication mechanism to keep Department employees up to date on goals, conditions, and actions, especially utility account representatives that are tracking costs associated with the water shortage.

- Respond to customer correspondence regarding the shortage as quickly as possible and acknowledge receipt of correspondence if information is not readily available.

Operating Actions

- Continue actions listed in the Advisory Stage.

- Increase drinking water quality monitoring.

- Communicate flushing restrictions based on contract type to wholesale customers; eliminate demand metering charges, if demand metering is in effect.

- Assess revenue implications and potential remedies, including reprioritizing current revenue, reprioritizing expenses, and potential withdrawals from the revenue stabilization fund.

Supply and Demand Management Actions

Based on the consumption goal, some or all of the following actions will be taken. **Those actions that are asterisked (*)** will be considered initially for implementation if demand reductions more than 10 percent are necessary, or later if voluntary measures are not delivering targeted savings.

Supply Actions

- Eliminate all operating system water uses determined to be non-essential to maintain drinking water quality such as pipeline flushing, reservoir overflows. Complete cleaning of any in-town reservoirs only as needed.

- Request that wholesale customers who have alternative sources use them.*****

- Request the Corps of Engineers to reduce flow requirements and modify use of the Chittenden (Ballard) Locks.*****

- Investigate using any existing interties to increase supply availability.*****

- Begin to ready the pumping plants on Chester Morse Lake.*****

- In coordination with state and federal resource agencies and tribes, review stream flow levels.

Demand Actions

- Restrict hydrant permits to essential purposes.*****

- Request that Fire Department limit training exercises that use water.

- Request that City and County agencies eliminate washing of fleet vehicles unless water recycling car washes are used.

- Attachment G provides many possible actions customers can take to reduce water use. The actual actions requested at the time will depend on the specific demand reduction goal and the possible savings that can be achieved at that time.

- Evaluate ability to accelerate or enhance or expand long-term conservation programs; implement as appropriate.

MANDATORY STAGE

Objectives

- Achieve targeted consumption reduction goals by restricting defined water uses.

- Ensure that adequate water supply will be available for the duration of the situation to protect public health and safety and to balance the need for stream flows for instream resources, including fish habitat.

- Minimize the disruption to customers' lives and businesses while meeting target consumption goals.

- Maintain the highest drinking water quality standards throughout the shortage.

- Promote equity among customers by establishing clear restrictions that affect all customers.

Triggers

The “Mandatory Stage” will be implemented if supply conditions have not improved, or the level of demand needs to be further reduced.

Public Message

"It is necessary to impose mandatory restrictions to reduce demand because the voluntary approach has not resulted in the necessary savings [*or* conditions have continued to get worse and even more savings are needed]. We are continuing to rely on the support and cooperation of the public to comply with these restrictions, but need the certainty and predictability of restricting certain water uses in order to ensure that throughout the duration of this shortage an adequate supply of water is maintained for public health and safety."

Communication Actions

- Inform the public about the nature and scope of the mandatory restrictions through a press conference, potentially paid advertising and other means. The enforcement mechanisms, rate surcharges (if the City determines that a surcharge should be implemented at this stage), target consumption goals, projections for how long restrictions will be in place and the reasons for imposing restrictions will also be identified, as will the possible consequences if goals are not met.

- Identify clearly any exemptions from restrictions.

- In communicating mandatory restrictions to the public, distinguish clearly between lawn/turf watering and watering gardens since lawns and turf can go dormant in the summer. The type and amount of watering allowed will be clearly defined.

- Urge customers who irrigate with private wells, reclaimed or recycled water to install signs to let the public know the type of water being used.

- Continue and enhance communication actions from the Advisory and Voluntary stages.

- Prepare plans to move into the fourth stage - Emergency Curtailment - and begin preparatory measures, as appropriate.

Operating Actions

- Continue appropriate actions from previous stages.

- Increase drinking water quality monitoring as necessary to ensure the water supply and demand management strategies will not result in unacceptable drinking water quality.

- Make reclaimed water available to tanker trucks for street cleaning, construction projects, landscape irrigation, dust control, etc., if practical.

Supply and Demand Management Actions

Supply Actions

- Commence emergency pumping of Chester Morse Lake when water levels are several feet above the rim of the natural lake and gravity flow is no longer sufficient, if needed.

- Continue intensive supply side management measures, including possible changes in instream flow releases in consultation and cooperation with the Corps of Engineers, Tribes, and state and federal resource agencies.

- If not already implemented, activate interties and any other alternative sources of supply, as feasible.

Demand Actions

- Finalize and implement procedures for exemptions from restrictions.

- Consider implementing rate surcharges to accelerate customer compliance with the restrictions, as authorized by the Director. These could potentially be implemented as outlined under the Emergency Stage of this plan.

- Adopt Council legislation on mandatory restrictions and on rate surcharges, if surcharges are to be implemented.

- Intensify communication of actions that customers should be taking that are identified in Attachment G, and modify if needed.

- If supply conditions continue to deteriorate and irrigation is still occurring, before moving to the Emergency Curtailment Stage, lawn watering will be restricted. Newly installed lawns may be watered according to certain guidelines, if procedures described in the section below are followed.

- Possible water restrictions are noted below. The nature of the restrictions used will depend on the severity and timing of the situation:

  - Prohibit all watering during the warmest hours of the day, for example between 10:00 a.m. and 7:00 p.m.

  - Limit all watering to a specific number of days per week or per month. This choice will depend on target consumption goals, the time of year and the extent to which watering is occurring, and how much demands have already decreased. For example, if demand has already been reduced by 15% through other measures, during July and August limiting turf watering to **two** days a week on a region-wide basis could further reduce average daily demand by as much as 15 million gallons. Limiting lawn or turf watering to **one** day a week could yield an additional average daily reduction of up to 15 to 20 million gallons.

  - Ban lawn watering (see exemptions section below), with other watering prohibited during the warmest hours of the day, for example, between 10:00 a.m. and 7:00 p.m. Note: This should be considered only when the less stringent measures noted above have been tried and found inadequate; it would be best to consult with utility and landscape partners before taking this action.

- Other possible restrictions are noted below. Again, the nature of the restrictions used will depend on the severity and timing of the situation:

  - Prohibit use of any ornamental fountain using drinking water for operation or make-up water.

  - Prohibit car washing except at commercial car wash facilities that recycle water.

  - Rescind hydrant permits.

  - Prohibit washing of sidewalks, streets, decks or driveways except as necessary for public health and safety.

  - Limit pressure-washing of buildings to situations that require it as part of scheduled building rehabilitation project (e.g., painting).

  - Prohibit water waste including untended hoses without shut-off nozzles, obvious leaks and water running to waste such as gutter flooding and sprinklers/irrigation whose spray pattern unnecessarily and significantly hits paved areas.

Possible Exemptions from Water Use Restrictions

Categories of possible exemptions include: new lawns, new landscapes, sport fields and golf courses, ball fields and play fields, use of water for dust control at construction areas and other areas to comply with air quality requirements. The exemptions noted in Attachment H are possibilities for SPU to consider in creating actual exemptions at the time of the event.

EMERGENCY CURTAILMENT STAGE

At this stage, SPU recognizes that a critical water situation exists and that, without additional significant curtailment actions, a shortage of water for public health and safety is imminent. This type of situation has never occurred in the Seattle water system's history.

This stage is characterized by two basic approaches. First, increasingly stringent water use restrictions are established. Secondly, significant rate surcharges are used to increase customer compliance. A surcharge is a key component to the success of this stage**.**

Objectives

Strive to meet the water use goals established for this stage, recognizing that customers' lives and businesses may be significantly impacted in order to achieve necessary water savings.

Triggers

The water savings needed to ensure sufficient water is available for public health and safety throughout the water shortage are not being achieved, or conditions have worsened, therefore, more stringent measures are needed.

Public Message

"We are in an emergency water supply situation and need the immediate assistance of the public to achieve necessary water savings. We are imposing additional water restrictions and a rate surcharge to achieve the savings because the mandatory approach has not resulted in sufficient savings [*or* conditions have continued to get worse], and we need to ensure water will be available for public health and safety throughout this shortage."

Communication Actions

- Continue and intensify all previous, applicable actions.
- Define the problem to the public as an emergency and institute formal procedures to declare a city emergency.
- Inform customers of the rate surcharge and how it will affect them. Provide information on an appeal process.
- Coordinate with police and fire departments requesting their assistance in enforcing prohibition of water waste, if authorized by the Director.
- Inform customers that taste and odor water quality problems may occur with system-wide reduced water consumption.
- Inform customers about possible pressure reductions and problems that may occur, if any, due to the emergency water supply situation.

- Define and communicate exemptions for medical facilities and other public health situations.

Operating Actions

- Continue actions listed in prior stages.

- Curtail fire line testing unless it can be shown to be essential to protect the immediate public health and safety.

- Further enhance drinking water quality monitoring actions.

Supply and Demand Management Actions

Supply Actions

- Continue actions listed in prior stages.

- Work with Army Corps of Engineers to substantially limit use of the Hiram Chittenden Locks.

Demand Actions

- Implement rate surcharges to accelerate customer compliance with the restrictions, as authorized by the Director. These could potentially be implemented as follows:

  Commercial Customers **-** Commercial, multifamily and industrial users would be asked to reduce water use by a set percentage of their consumption during the same period in the previous year. Emergency rate surcharges would be established to provide an additional incentive to reduce water use. It is SPU's intention to establish a two-tiered structure. This "variable block approach" would allow for two different surcharge rates: one on the first block and a higher rate on the second block. These "blocks" would be based on the individual customer's consumption during the same period in the previous year. For example, if we were to target desired consumption to be 85% of the previous year's consumption in that period, any consumption between 0% and 85% would be billed at one rate and any consumption over 85% would be billed at the second, much higher rate. In this way, the targeted reduction amount and resulting surcharges would be customized around each customer's water use patterns, while still resulting in a steep surcharge for consumption in excess of the target amount for each block.

  A billing system modification would be needed to allow SPU to accomplish this. If this has not been done by the time it may be needed, a simple across-the-board rate surcharge would be applied.

  Residential Customers **-** A three-tiered, increasingly steep rate structure would be implemented for residential customers (includes single-family dwellings and duplexes). While there are differences in household size, there is more similarity in residential domestic water use than there is in commercial water use.

Exemption from Rate Surcharge for Special Medical Needs - The utility will exempt customers with special medical needs such as home dialysis from a rate surcharge, provided individual customers notify the utility of such a need.

- Prohibit all lawn and sport field watering, with no exemptions.
- Require that all fire fighting agencies discontinue the use of water in training exercises until emergency is over.
- Rescind all hydrant permits.
- Require local parks departments to close down pools.

SECTION 4

NON-DROUGHT WATER EMERGENCY CURTAILMENT PLAN

INTRODUCTION

Although many of the demand reduction measures employed would be similar to those used during a progressive, weather-related shortage, non-drought water emergencies are unique because of a lack of preparation time and the urgency of immediate, potentially large-scale demand reductions. Each emergency scenario is different, but many could require major curtailment actions by customers. Also, unlike droughts, some emergencies may be very localized, requiring demand reduction for only a limited geographic area within the SPU service area.

In order to provide a frame of reference for future emergency situations, a short discussion of potential major water emergencies is provided here. This WSCP complements SPU's Emergency Response Plan. That plan is a supplement to the City of Seattle Disaster Readiness and Response Plan (City Disaster Plan) and would be implemented in immediate emergencies such as in the examples provided below. SPU's emergency plan defines decision-making authority in emergencies and creates specific emergency action plans for a number of systems, security, and management procedures, including information. Furthermore, if needed, SPU has emergency water provisioning equipment and plans for implementation as described in the "Emergency Drinking Water Distribution Plan." This plan would be implemented to provide water if customers in an area, or areas, were unable to receive water through normal means.

TYPES OF POTENTIAL NON-DROUGHT WATER EMERGENCIES

Major Transmission Pipeline Break

One potential water supply emergency is a major transmission line break from either the Tolt or the Cedar River supplies. The potential impact on customers would depend on the location of the break, the extent of damage, the amount of time needed for repair, the season it occurred, and how easily SPU could re-route water supply to customers in the affected area. Due to the redundancy in SPU's system, the two major pipeline failures that occurred since 1987 had fairly minor impacts on customers.

Temporary Treatment Plant Shut Down

Another type of supply emergency is a temporary shut down of either the Cedar or the Tolt water treatment plants. As with a transmission pipeline break, the potential impact on customers would depend on the time needed to return the plant to service and the time of year. An example of this was in 2003 when the Tolt Treatment Facility was shut down for about a week when a raw water inlet valve malfunctioned causing flooding of the plant. Because this event occurred during the winter when demands were low, all retail and most wholesale customers were provided water from the Cedar system without disruption; a few wholesale customers were supplied from water stored at the plant's clearwell.

Major River Flooding Leading to High Turbidity

If substantial flooding occurred on the Cedar River or South Fork Tolt River it could lead to high turbidity causing SPU to temporarily stop using that supply. For the Cedar, if major flooding occurred at the same time that Lake Youngs was at or below normal minimum operating levels, high turbidity could lead to a temporary shut down of that supply. In 1990 such an event occurred on the Cedar, when flooding exceeded the 100-year event. It should be noted that with the addition of filtration on the Tolt supply and the change in intake location on the Cedar supply, SPU's supply sources are much less vulnerable to impacts of turbidity than in the past.

SUPPLY AND DEMAND MANAGEMENT DURING NON-DROUGHT WATER EMERGENCIES

No single strategy can be created which will meet the needs of the department for all non-drought water emergency scenarios. Strategies for dealing with emergencies have been developed based on lessons learned from previous water utility events, and other utility experiences. The criteria listed in Section 1 of this WSCP create a framework for decision-making. The types of non-drought emergencies listed in this section initially require quick and immediate response. Once an assessment is made as to how long it will take to restore the system, the immediate response strategy may change if it appears that the repair process will be lengthy.

The strategy for most emergencies can be narrowed to measures having the most immediate impact on achieving water supply and consumption targets. All needed and available back up supplies would be activated during an emergency: interties, well-fields, off-loading wholesale customers who have other sources, etc.

Attachment A

Examples of Past Regional Drought Experiences

The droughts that the Seattle regional water system has experienced in recent history were very different types of droughts. While SPU has changed how it operates the system based on the lessons learned from the past, it is useful to be aware of these past drought events and the actions taken to successfully manage both supply and demand.

Summer/Fall Drought

In 1987, storage reservoirs were at normal levels on June 1, but the summer weather was unusually warm and dry. Higher than normal outdoor water use accelerated the drawdown of the storage reservoirs. To reduce demand, in early August lawn watering was restricted to no more than once every three days and customers were urged to voluntarily curtail other water uses. These actions reduced demand by approximately 10 percent. In early fall, an emergency pumping station was installed at the Chester Morse Lake reservoir to pump "dead storage" in case the reservoir level fell below the lake's natural outlet.

Throughout the fall, precipitation continued below normal; the water supply system was managed and adjusted to obtain the maximum supply available (e.g., relying on Lake Youngs more than normal). In November 1987 and January 1988, the Chester Morse reservoir was low enough to require pumping and it was not until February 1988 that rainfall began refilling the storage reservoirs.

Winter/Spring Drought

In 1992, the system experienced a very different type of drought. Because the winter was unusually warm, snowpack and flows into the storage reservoirs were at record low levels. In late February, it was evident that there was insufficient snowpack to fill the storage reservoirs and that the likelihood of recovery by June 1 due to rainfall was low. A number of measures were taken to maximize available supply (e.g., reducing system flushing, adjusting stream flow levels, etc.) and to reduce demand. In May, a number of mandatory curtailment actions were implemented in the Seattle service area, including a ban on lawn watering. This resulted in an average consumption reduction of 25 to 30 percent below normal throughout the summer. Tribes, state resource agencies and the Army Corps of Engineers played a significant role in cooperating to maximize available water supply. In addition, other measures were taken to increase available supply including initiating an intertie with Renton and accelerating the construction of a second pump plant for use of dead storage at Chester Morse Lake. The mandatory restrictions were rescinded in September as supply levels returned to normal with the onset of fall rains.

In 2005, SPU watersheds experienced the lowest snowpack in 60 years, one of the driest winters on record and warmer than normal winter temperatures. Water managers responded by activating the Advisory Stage of the WSCP, reducing system water use and maximizing the amount of water held in storage using the dynamic rule curve. As a result of this active management and nearly average rainfall in the spring, SPU was able to return to normal operations by summer that year.

Attachment B

Water Shortage Response Team and Water Shortage Advisory Group Memberships and Roles

Water Shortage Response Team

Purpose: SPU's internal team whose role is to evaluate conditions, advise the Director on supply and demand actions, and make assignments to SPU staff as needed to respond to the shortage.

Membership: The Team is appointed by the Director and may include the following members to fill the roles indicated; however, the actual composition may change at any time as requested by the Director:

- SPU Director – Overall direction on the response.
- Branch Directors – Input to Director for response.
- Lead for Shortage Response – Issue coordination, information gathering and dissemination, key support staff assignments, role clarification, and communication with broad array of interested parties.
- Drinking Water Division Director – Overall guidance on supply management, drinking water quality and operations, status of non-revenue water, issues related to potential alternative supplies, and opportunities for use of non-potable water.
- Cedar and Tolt Watershed Services Division Director – Provide guidance regarding watershed activities that may impact water supply.
- Water Resources Business Area Manager – Provide water supply condition reports, forecasts, demand pattern reports, operational needs, and modeling identification and oversight.
- Water Resources Management Staff Representative – Provide guidance regarding instream flows/fisheries, river analyses, river biological assessments, and coordinate with Cedar River Instream Flow Commission and Tolt Fisheries Advisory Committee.
- Resource Conservation Manager –Water use reduction measures management and messaging, cost estimates to achieve savings, and communication with landscapers, nurseries and large water users (commercial and residential).
- Communications Director and Staff Representative(s) – Messaging, customer relations, media relations, press releases, key contact for interagency Public Information Officers (PIOs), agency communication, and coordination with wholesale customers, cities of Everett and Tacoma and Central Puget Sound Water Suppliers' Forum.
- Finance Staff Representative – Cost estimates for supply alternatives, increased messaging needs and additional water use reduction measures, expected lost revenue estimates, budgets and charge number set-up for shortage-related activities, and process necessary to access revenue stabilization fund, if needed.

Note: If the Morse Lake Pumping Plants need to be readied for potential use, an additional staff member may participate in the Response Team to report on issues related to the plants.

Water Shortage Advisory Group

Purpose: To advise the SPU Water Shortage Response Team in defining messages and providing feedback on utility water shortage response actions and programs.

Membership: Group membership will be based on the type of water shortage and how widespread it is. The Director, or his/her designee, will send out invitations to potential members and agencies. The following is a list of potential members to be considered when forming the Group membership:

- Wholesale customer representative(s)
- State and federal resource agencies, such as the Army Corps of Engineers, Washington State Department of Ecology, etc.
- Landscape and/or nursery representative(s)
- Other potentially impacted industries and businesses (e.g., restaurants, hotels, car washes, etc.)
- Environmental representative
- Tribal representatives
- Water System Advisor committee representative
- Other City departments, such as Parks or Seattle City Light
- Other regional water suppliers, such as Tacoma Water or Everett Public Utilities
- SPU staff as appropriate.

Attachment C
Possible Demand Management Scenarios

Note: Information developed during spring 2005.

Scenarios	% Savings	Savings (in mgd)				Residential Indoor	Residential Outdoor	General Commercial	Commercial Outdoor
		Apr-May	Jun-July	Aug.	Sept-Oct				
Pre and Stage 1 Advisory	<1%	1	2	4	2	full clothes and dish washing machine loads, check and repair leaks	sweep driveways & sidewalks, water wisely, drought proof new plantings, top dress, aerate and grasscycle lawns, mulch all planting beds, use commercial car wash that recycles water	check and repair leaks, encourage employee suggestions, sweep driveways and sidewalks, voluntary City facility reductions	check systems and repair real time ET controllers, central controls for multi-control systems, rain shut-offs, soaker hose or drip alternatives, top dress, aerate, and grasscyle lawns, drought proof new plantings, mulch all planting beds
Stage 2 Voluntary Curtail-ment	5-10%	5	10	15	10	push above measures harder, 1 or more less minutes per shower, reduce toilet flushing, install efficient fixtures & appliances	push above measures harder, water only between 7 p.m and 10 a.m., allow lawn to go dormant, avoid draining hot tubs & pools, defer car washing, reduce landscape watering, water planting beds infrequently, new landscapes exempt	push above measures harder, mandatory City facility reductions, defer washing vehicles, inspect cooling towers, water at restaurants by request only, hotel linen change by request only, install efficient fixtures, cost-effectively invest in efficient technologies, use reclaimed water, if practical	push above measures harder, curtail fountain use, no make up water, suggest watering restrictions including time of day (new lawns exempt, sports fields partially exempt)

Scenarios (cont.)	% Savings	Savings (in mgd)				Residential Indoor	Residential Outdoor	General Commercial	Commercial Outdoor
		Apr-May	Jun-July	Aug.	Sept-Oct				
Stage 3 Mandatory Curtail-ment	10-20%	10	20	30	15	push above measures harder	push above measures harder, prohibit vehicle washing, prohibit sidewalk, driveway washing, watering restrictions including time and number of days, new landscapes still exempt, no pool or hot tub drain & filling, curtail power washing, no fountain make-up water	push above measures harder, prohibit vehicle washing, defer major uses if possible, use reclaimed water if practical	push above measures harder, prohibit sidewalk, driveway washing, ET limitations for auto irrigation use, prohibit fountain use, watering restrictions including time and number of days, sports fields may be partially exempt, new lawns may be partially exempt
Stage 4 Emergency Curtail-ment	>20%	20	30	40	20	push above measures harder	push above measures harder, lawn watering ban, new landscape watering restrictions/ban	push above measures harder, must use reclaimed water if practical	push above measures harder, lawn watering ban, no potable water for irrigation, new landscape watering restrictions/ban

Attachment D

Estimated Cumulative Costs and Revenue Losses for WSCP Stages (based on 2005 dollars)

Revenue & Cost Impacts	Stage 1 Advisory	Stage 2 Voluntary	Stage 3 Mandatory	Stage 4 Emergency
Revenue Loss	**$ 1,000,000**	**$ 5,000,000**	**$ 9,000,000**	**$ 13,000,000**
Cost	**$ 55,000**	**$ 1,485,500**	**$ 2,935,500**	**$ 3,285,500**
Demand Management				
customer outreach		250,000	650,000	650,000
customer incentives			950,000	950,000
enforcement			100,000	300,000
Cedar Pumping				
preparation		500,000	500,000	500,000
mobilization	30,000	354,500	354,500	354,500
pumping costs		81,000	81,000	81,000
Seattle wells	25,000	300,000	300,000	450,000
Total: Revenue loss & costs	**1,055,000**	**6,485,500**	**11,935,500**	**16,285,500**
Financial Tools Used to Mitigate Impacts (descriptions below table)				
Reprioritize Current Revenue	X	X	X	X
Reprioritize Expenses		X	X	X
Withdrawal from Revenue Stabilization Fund			X	X
Rate Surcharge			X*	X

Notes:

1) Estimates were created in spring of 2005 for 2005 event. Actual future costs would vary depending on the season, and specific actions taken in a given event. In 2005 SPU entered into Advisory Stage only.
2) Above are costs incurred for each stage. The costs for Stages 2 - 4 include the costs incurred in the previous stage(s). Estimated lost revenue follows the same approach.
3) Stage 4 revenue loss estimates here do not include funds that will be brought in by surcharges. Estimates for those surcharges have not been developed.

* The City may implement a rate surcharge in the Mandatory Stage.

Reprioritizing Current Revenue – This consists of reducing revenue contributions to the capital program and lowering the year end operating cash target. These are the most flexible resources to offset revenue and expenditure problems.

Reprioritize Expenses – Reducing planned operations and maintenance expenditures reduces demand on revenues or frees up money to meet unexpected needs.

Withdrawals from Revenue Stabilization Subfund – The City of Seattle has established a Revenue Stabilization Subfund for the water fund. The target balance is $9 million, which can serve as a source of revenue during moderate droughts. Withdrawals from the Subfund require Council approval.

Rate Surcharge – In emergency situations, rate surcharges send a strong signal to customers to reduce water use and also help to make-up revenues lost due to decreased demand.

Attachment E

CONTACT LIST FOR WATER SHORTAGE CONTINGENCY PLAN

A working list of contacts for easy reference in case of a drought or emergency should be developed and regularly updated by the Resource Conservation Section in consultation with others in the Department. In addition to the communication elements contained in the WSCP, the following will be contacted directly in the event of a drought or emergency to inform them and ask for their support and cooperation in reducing demand.

Customers
List of wholesale water customers
List of large irrigators, including those using alternate sources
List of large commercial and industrial customers

City of Seattle Contacts
Department Directors
Contacts for:
- Seattle Department of Parks and Recreation
- Seattle Transportation Department
- Seattle Center
- Fire Department
- Department of Executive Administration
- Fleets and Facilities

List of City owned, non-re-circulating and re-circulating fountains

Other public agencies with high visibility water use
State Department of Transportation
University of Washington
Army Corps of Engineers
King County Department of Natural Resources & Parks
Seattle Public Schools

Landscape Interests
King County Cooperative Extension
Washington State Nursery and Landscape Association
Irrigation Association
Washington Association of Landscape Professionals
American Society of Landscape Architects
Center for Urban Horticulture
Pacific Northwest Golf Course Superintendents' Association
Washington Irrigation Contractors Association
*Note: Resource Conservation maintains a database of over 400 landscape-related businesses and other contacts.

Business Groups
Seattle/King County Chamber of Commerce
Building Owners and Managers Association

Attachment F

POSSIBLE ADVISORY STAGE WATER CONSERVATION TIPS FOR CUSTOMERS

Conserve Inside

For most households, the vast majority of water is used indoors. Taking conservation actions and installing efficient fixtures help reduce your water use year-round. There are also ways to conserve water in outdoor uses and at work. Below are suggested actions:

- Fix leaking faucets and toilets.
- Wash only full loads in the dishwasher and clothes washer.
- Minimize faucet use when brushing your teeth, shaving and washing dishes.
- Don't pre-rinse dishes unless you need to. Most new dishwashers don't require pre-rinsing.
- Save luke warm water for watering plants, etc. while you wait for hot water in kitchens and showers.
- If you are buying a new toilet, look for a FlushStar model. Call us or visit us online if you have questions.
- If you are buying a new washing machine, WashWise rebates are available for qualified machines.

Conserve Outside

Make the most of the water you will use in the spring and summer:

- Aerate lawns in the spring to better absorb water.
- Mulch planting beds to decrease evaporation.
- Select the right plants for the right place – contact SPU or see our website for information.
- Tune-up and improve your irrigation system – rebates may be available.
- Wash your cars at locations that recycle their water.

Note: For more information on home water conservation tips for inside and out, visit www.savingwater.org or call 684-7283 (684-SAVE)

Conserve at Work

Businesses and institutions can reduce water use and lower utility costs by adopting conservation practices and replacing inefficient equipment or operations.

- Check for leaks.
- Use a broom, instead of a hose, to routinely clean driveways and sidewalks
- Turn off water-using equipment when not in use, including dishwashers, garbage disposals, and food troughs.
- Upgrade equipment efficiency – rebates may be available.
- Increase employee awareness of water conservation.
- Call (206) 343-8505 for technical assistance for work-related water-wise tips.

POSSIBLE VOLUNTARY STAGE CUSTOMER WATER SAVING ACTIONS

The following voluntary actions are being requested of all customers:

SET A GOAL: Such as use 10% less water
Most customers can easily save 10% by choosing several items from the menu of water saving actions below. If you routinely do outdoor watering, select those actions first. Set a goal to reduce your water use by 10% from the amount you used during the same billing period last year. Most utility bills contain your water consumption for each billing period. Much of the 10% can probably be achieved through conservation actions that are wise to do all the time. If that is not sufficient, then the special curtailment actions listed here can be implemented during the duration of the supply problem.

REDUCE OUTDOOR WATER USE

<u>Conservation Actions:</u>

- Avoid **watering** between 10 AM and 7 PM to reduce evaporation.
- **Stop obvious water waste** such as gutter flooding, sidewalk and street watering, and fix leaks.
- **Never leave a hose running,** always use a shut-off nozzle.
- **Use a broom** rather than a hose or pressure washer to clean sidewalks and driveways.

<u>Curtailment Actions</u>:

- **Reduce lawn watering** (twice a week or less if possible).
- **Let your lawn go dormant**. Customers who choose to not water their lawns should water deeply once each rainless month to keep grass roots alive. To avoid runoff when you water, if the water puddles, cycle your sprinkler on and off until water is absorbed.
- **Refrain from filling** empty pools and hot tubs.
- **Turn off water features** and fountains.
- **Wash vehicles only at car washes that recycle their water.**

REDUCE INDOOR WATER USE

<u>Conservation Actions</u>:

- **Install a water efficient FlushStar toilet.** These toilets have proven to perform well and give long-term water savings. Replacing a frequently used old toilet with a new efficient toilet can save most households up to $70 a year in utility bills *(based on data from 2005).* Check www.savingwater.org for FlushStar toilet models.
- **Install a high-efficiency clothes washer**. New washers are typically one-third more water efficient than old washers. Rebates are available from Seattle Public Utilities by calling (206) 684-SAVE.
- **Wash only full loads in the clothes washer and dishwasher,** or choose an appropriate load-size setting for the number of items in the washer.
- **Turn off the tap** while brushing your teeth, hand-washing dishes or shaving.
- **Fix leaky faucets and toilets**. Put several drops of food coloring in your toilet tank. After 20 minutes, if you have color in the bowl, you have a slow leak that over time can amount to a lot of water.

- **Install an efficient showerhead.** New showerheads work well and use much less water than old high-flow models.
- **Install an efficient faucet aerator.** Replace your older bathroom faucet nozzle (aerator) with one that uses one gallon per minute or less.

Curtailment Actions:
- **Spend one minute less in the shower.** Try to limit showers to five minutes or less.
- **Flush your toilet less often.** Toilet flushing is the largest water use inside the home. As the saying goes, "If it's yellow, let it mellow."

REDUCE WATER USE AT WORK
There are a wide variety of opportunities for businesses and agencies to reduce their water use and operating expenses.

Conservation Actions:
- **Check cooling towers.** Cooling towers - and the ways that they regulate water use – represent real opportunities for improving water efficiency.
- **Check for and fix leaks.** Toilet and urinal leaks are very common. Investigate obvious or suspected leaks.
- **Use a broom,** instead of a hose or pressure washer, to routinely clean driveways and sidewalks.
- **Turn off water-using equipment** when not in use, including open hoses, dishwashers, garbage disposals, and food troughs.
- **Check air conditioners, refrigerators, and ice machines.** If your company's air conditioners or refrigerators use water-cooled condensers, investigate air-cooled equipment for possible efficiencies. Rebates are available. Visit **www.savingwater.org**.
- **Install water-efficient toilets, urinals and faucets** in public and employee restrooms. Replacing old toilets, urinals, and faucet aerators with efficient ones can produce substantial savings. Rebates are available. Visit **www.savingwater.org**.
- **Reuse process water.** Water used in industrial and manufacturing processes should be reused as often as possible. Rebates are available. Visit **www.savingwater.org**.
- Hospitality businesses can offer guests the option of clean linens each day.
- **Increase employee awareness of water conservation** through management memos or newsletter messages. Install signs that encourage water conservation in restrooms or work areas where water is used. For additional work-related conservation tips, call (206) 343-8505.

Curtailment Actions:
- **Reduce outdoor watering** (twice a week or less if possible). Rebates are available for smart irrigation technologies. Visit **www.savingwater.org**.
- **Minimize vehicle washing**, defer or use a water recycling car wash.
- **Turn off** decorative water fountains.
- **Serve water only on request** at restaurants. Avoid thawing with running water.

For home water conservation tips, visit www.savingwater.org
or call (206) 684-7283 (684-SAVE)

Attachment H

POSSIBLE EXEMPTIONS FROM WATER USE RESTRICTIONS

New Lawns and Landscapes

If a lawn and/or landscape is installed prior to the date the watering restrictions were announced, and in the same calendar year, it may be watered for a limited duration on a daily basis for a specified number of days, e.g., 10 minutes per day for the first two weeks after its installation. After that period, some watering may still be allowed on a reduced basis. The watering may also be restricted to certain times of day. All details will be determined based on the time of year and severity of the shortage.

The utility will publicize the rules for exemptions to the lawn and landscape watering restrictions. The customer will need to contact the utility with name and address, stating that they meet the conditions and will be watering their lawn and/or landscape. This should be done in writing, either via email or other means. The utility reserves the right to spot check on site for compliance.

New lawns and landscapes may also be installed after the date of the restrictions. To receive a watering exemption the minimum requirements for soil preparation must be met and a signed affidavit provided to that effect. Minimum soil preparation consists of cultivating into the top six inches of existing soil at least two inches of organic soil amendment, such as composted yard waste. The same restrictions for watering as above would also apply.

For purposes of this exemption, "new lawn" refers to a lawn newly installed during the current year only. Overseeded or otherwise renovated lawns will not be exempt from the lawn watering restrictions.

Note: The utility will not guarantee continued watering. If the water supply situation worsens, any exemptions may be revoked. In the event that the shortage continues to worsen and the Emergency Curtailment Stage is activated, this exemption would be revoked.

Sports Fields and Golf Courses (greens and tees only)

Sports fields and golf courses (greens and tees only) can be watered according to an evapotranspiration (ET)-based schedule, provided at least the following:

- ☐ The irrigation system must be audited between 0 to 60 days prior to the effective date of the watering restrictions, by an Irrigation Association-certified Irrigation Auditor.
- ☐ The audit must find that the system's lowest quarter distribution uniformity is at least 70%.

- ☐ Watering is prohibited during the warmest time of day. Specific times will be announced by the utility.
- ☐ Water running to waste is to be avoided.

Other Exemptions

For purposes of dust control, water may be applied to construction areas or other areas needing to comply with air quality requirements**.** If reclaimed water is available, consider requiring or promoting that it be used for dust control, if practical.

Ballfields and playfields may be watered at the minimum rate necessary for dust control and safety purposes.

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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

I. WATER RESOURCES

APPENDIX E
RECLAIMED WATER OPPORTUNITIES

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FINAL TECHNICAL MEMORANDUM

SPU 2007 Water System Plan Update
128901

TECHNICAL MEMORANDUM
RECLAIMED WATER OPPORTUNITIES

Date: July 13, 2006

To: Julie Burman

From: Colleen O. Doten
Andrew Lee
Copy to: Judi Gladstone, Joan Kersnar

Seattle Public Utilities (SPU) is currently reviewing opportunities for reclaimed water projects in the development of its 2007 Water System Plan Update. Reclaimed water, or wastewater that is treated to a high level such that it can be safely used for irrigation, industrial, groundwater recharge, and/or other non-potable (e.g. toilet flushing) applications, is currently used in numerous cities across the United States and the world.

Despite the many environmental attributes to re-using treated municipal wastewater, few instances in the Seattle service area have been found where the unit cost of reclaimed water is less than the unit cost of providing drinking water.

This technical memorandum provides a summary of the following:

- Past reclaimed water studies and/or evaluations for the Seattle service area
- Applicable regulations and legislation
- Overview of reclaimed water markets nationwide and locally
- Identification of reclaimed water sources for the Seattle service area
- Identification of reclaimed water opportunities for the Seattle service area
- Evaluation of reclaimed water opportunities in Seattle service area
- Considerations for implementing reclaimed water projects

BACKGROUND

Numerous reclaimed water feasibility studies have been performed over the last 10 years in the Seattle area. SPU's most recent comprehensive study was performed in 2003, and was titled *SPU Wastewater Reclamation and Rainwater Harvesting Study* (2003 Study). In 1995, the Seattle Water Department evaluated the feasibility of reclaimed water opportunities in the Duwamish Corridor, in a study tilted *Recycled Water Demand Study, Duwamish Corridor*. At approximately the same time, King County's Department of Natural Resources (DNR), along with the Seattle Water Department and the City of Renton, performed a study of reclaimed water opportunities in the King County metropolitan area titled *Water Reclamation and Reuse: A Feasibility Study for the King County Metropolitan Area*. Most recently, King County has made provision in the design and construction of the Brightwater Plant and pipeline project to produce reclaimed water. Each of these studies and/or on-going projects is described briefly below.

SPU 2003 Wastewater Reclamation and Rainwater Harvesting Study (2003 Study)

In 2002, SPU compiled a list of over 90 potential reclaimed water and rainwater harvesting opportunities in the SPU service area and water purveyor area. Eleven (11) of the projects were selected for further evaluation. For the reclaimed water opportunities, project descriptions and preliminary cost estimates were developed for each alternative. The project descriptions included the reclaimed water source, the end user, and the facility size, location and components. The projects were evaluated based on five criteria: annualized cost[1], annual purchased water reduction[2], initial capital cost[3], political complexity[4], and partnering potential[5].

A summary of the evaluation is provided in Table 1.

Table 1
2003 Study Project Evaluation

Reclaimed Wastewater Facility Project Name	Annualized Cost per CCF	Annual Purchased Water Reduction (CCF)	Initial Capital Cost	Political Complexity	Partnering Potential
West Seattle Golf Course Reclaimed Wastewater Facility "A"	$9.73	26,579	$2,672,000	moderate	low
West Seattle Golf Course Reclaimed Wastewater Facility "B"	$14.34	31,048	$4,837,000	moderate	low
Birmingham Steel/West Seattle Golf Course	$1.88	137,416	$2,141,000	moderate	high

[1] Annualized cost per hundred cubic feet (ccf) is the annual cost, in year 2002 dollars, for a 20-year life of the facility, divided by the annual reduction of purchased potable water realized by the operation of the facility. This cost includes estimated capital, operation and maintenance, and major component replacement cost.
[2] Annual Purchased Water Reduction is the estimated amount of reclaimed water produced annually by the facility.
[3] Initial Capital Cost is the estimated design and construction costs. It includes project administration, property/easement acquisition, design fees, construction management fees and construction costs.
[4] Political Complexity is a subjective "non-cost based complexity which may hinder or constrain implementation of the facilities."
[5] Partnering Potential is a subjective "potential for joint participation by public or private entities as a means to share the cost as well at the benefits."

Reclaimed Wastewater Facility Project Name	Annualized Cost per CCF	Annual Purchased Water Reduction (CCF)	Initial Capital Cost	Political Complexity	Partnering Potential
Calvary Catholic Cemetery	$17.92	20,364	$4,247,000	high	moderate
Myrtle Edwards Park	$63.79	2,304	$1,230,100	high	low
Washington Park Arboretum	$26.26	9,366	$2,427,800	high	moderate
South Seattle Community College	$64.33	1,996	$1,204,600	moderate	low
South Transfer Station	$18.05	3,480	$249,500	low	high
Green Lake Wading Pool	$21.59	9,320	$2,310,200	low	low

The 2003 Study also noted that SPU was involved in five reclaimed water projects that were currently in the design and/or construction phase.

The 2003 Study concluded that only the Birmingham Steel/West Seattle Golf Course alternative had a unit cost of water that was low enough to be worthy of consideration for implementation. The other projects' unit costs of water were considered too high to justify the projects, except on basis of other merits such as ease of implementation or other unique circumstances. Soon after the 2003 Study was published, the ownership of the Birmingham Steel facility changed to Nucor Steel Seattle, Inc., and the new owner was less interested in pursuing a reclaimed water project. In addition, new legislation passed by the Seattle City Council led to difficulties in pursuing the use of reclaimed water on the West Seattle Golf Course. Due to these factors, the Birmingham Steel/West Seattle Golf Course alternative was not implemented.

Nucor Steel Seattle, Inc. currently purchases almost 0.5 million gallons per day (MGD) of potable water from SPU. They have additional water sources through stormwater and groundwater collection systems, and an on-site well with an approved water right. Even with these alternative sources, there is potential to use reclaimed water in a variety of their steel production processes due to the continued high volume of potable water use. Since Nucor took over the former Birmingham Steel Corp. facility, they have not been in a position, financially, to consider retrofits necessary for a reclaimed water project. Based on their installation of a stormwater collection reuse system at their steel scrapyard, Nucor has shown a willingness to implement innovative projects. If the economics are compelling, Nucor would give serious consideration to a project that would provide long term stability in both water supply and water rates.

1995 Recycled Water Demand Study, Duwamish Corridor

In 1995, the City of Seattle Water Department published the *Recycled Water Demand Study, Duwamish Corridor* (Seattle Water Department, 1995). The study examined future demand for recycled water for customers along the Duwamish Corridor in the cities of Seattle and Tukwila. "The study concluded that due to high cost, technical challenges, and only modest water savings, the development of a large recycled water treatment and distribution infrastructure was impractical at the time" (Seattle Public Utilities, 2003).

King County Reclaimed Water Studies

In 1995, King County, the City of Seattle Water Department and the City of Renton published a study titled *Water Reclamation and Reuse: A Feasibility Study for the King County Metropolitan Area* (King County Department of Natural Resources, Seattle Water and City of Renton, 1995). The study concluded that under most conditions, the present cost of reclaimed water service would be higher than the Seattle marginal cost for developing new potable supplies. A successful project would have to serve a reasonably large demand (at least one MGD) and be located adjacent to a source of secondary treated effluent. Site-specific reuse projects could be economically feasible in the near term, with the Duwamish Corridor having the greatest potential. The report also stated that the King County Renton Effluent Transfer System (RETS) 96-inch pipeline in the Duwamish Corridor has twelve taps in place for reclamation and reuse.

In 2000, King County published another study titled *Reclaimed Water Program Demonstration Phase - Identification of Potential Satellite Projects for Direct Non-Potable Uses* (King County DNR, 2000). This study recommended completing a feasibility study for a Sammamish Valley Reclaimed Water Production Facility. More recently, however, the decision to have the future Brightwater Treatment Plant produce reclaimed water, led to the abandonment of plans to construct the Sammamish Valley facility.

Brightwater Project

King County is currently designing and constructing the Brightwater Wastewater Treatment Plant. This facility will treat wastewater with membrane bioreactor technology, resulting in a high quality effluent. The County plans to make this reclaimed water available to reclaimed water users. The *Draft White Paper: Reclaimed Water Backbone Project, Version 3.0* (King County DNR, 2006) describes proposed conveyance facilities to deliver reclaimed water to potential users. The plan consists of three phases. The first phase includes the construction of two backbone pipeline segments, the South Segment (to Sammamish Valley) and the West Segment (to Ballinger Way Portal). This phase includes bringing the South Segment on-line. Phase II includes increasing pumping capacity at the Brightwater Plant and bringing the West Segment into service. Phase III consists of constructing a distribution system from both backbones. King County currently considers implementation of Phase III the responsibility of end-users. This includes the costs to fund, install, operate, and maintain the pumps and distribution system from King County's Phase II backbone system to the end-users' sites. The white paper provides a review of alternatives evaluated, demand estimates and anticipated costs.

REGULATIONS AND LEGISLATION

Regulations governing the use of reclaimed water have been established by the Washington State Department of Health and Department of Ecology (Ecology). Recently passed legislation requires Ecology to develop new reclaimed water rules by December 31, 2010. On a local level, the City of Seattle has passed its own legislation regarding the use of reclaimed water in its service area. The following section summarizes application regulations and legislation.

1997 Water Reclamation and Reuse Standards

In 1997, Washington State Departments of Health and Ecology published the Water Reclamation and Reuse Standards. These standards define four classes (A, B, C and D) of reclaimed water. The standards specify the required levels of treatment (oxidation, coagulation, filtration and disinfection), by class as shown in Table 2, and the required class for the end use as shown in Table 3.

Table 2
Reclaimed Water Treatment Standards

Reclaimed Water Class	Oxidation	Coagulation	Filtration	Disinfection	
				Total Coliform Density 7-day Median Value	Total Coliform Density Single Sample
A	Required	Required	Required	≤ 2.2/100 ml	23/100 ml
B	Required	Not Required	Not Required	≤ 2.2/100 ml	23/100 ml
C	Required	Not Required	Not Required	≤ 2.2/100 ml	240/100 ml
D	Required	Not Required	Not Required	≤ 240/100 ml	No standard

The standards include the following definitions.
Oxidized wastewater is "wastewater in which organic matter has been stabilized such that the biochemical oxygen demand does not exceed 30 mg/L and the total suspended solids do not exceed 30 mg/L, is nonputrescible, and contains dissolved oxygen."
Coagulated wastewater is "oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated prior to filtration by the addition of chemicals or by an equally effective method."
Filtered wastewater is "an oxidized, coagulated wastewater which has been passed through natural undisturbed soils or filter media, such as sand or anthracite, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 nephelometric turbidity units (NTU), determined monthly, and does not exceed 5 NTU at any time."
Disinfected wastewater is "wastewater in which pathogenic organisms have been destroyed by chemical, physical or biological means."

Table 3

Treatment and Quality Requirements for Reclaimed Water Use

Use	Type of Reclaimed Water Allowed			
	Class A	Class B	Class C	Class D
Irrigation of nonfood Crops				
Trees and Fodder, Fiber, and Seed Crops	YES	YES	YES	YES
Sod, Ornamental Plants for Commercial Use, and Pasture to Which Milking Cows or Goats Have Access	YES	YES	YES	NO
Irrigation of Food Crops				
Spray Irrigation				
All Food Crops	YES	NO	NO	NO
Food Crops Which Undergo Physical or Chemical Processing Sufficient to Destroy All Pathogenic Agents	YES	YES	YES	YES
Surface Irrigation				
Food Crops Where There is No Reclaimed Water Contact With Edible Portion of Crop	YES	YES	NO	NO
Root Crops	YES	NO	NO	NO
Orchards and Vineyards	YES	YES	YES	YES
Food Crops Which Undergo Physical or Chemical Processing Sufficient to Destroy All Pathogenic Agents	YES	YES	YES	YES
Landscape Irrigation				
Restricted Access Areas (e.g., Cemeteries and Freeway Landscapes)	YES	YES	YES	NO
Open Access Areas (e.g., Golf Courses, Parks, Playgrounds, Schoolyards, and Residential Landscapes)	YES	NO	NO	NO
Impoundments				
Landscape Impoundments	YES	YES	YES	NO
Restricted Recreational Impoundments	YES	YES	NO	NO
Nonrestricted Recreational Impoundments	YES	NO	NO	NO
Fish Hatchery Basins	YES	YES	NO	NO
Decorative Fountains	YES	NO	NO	NO
Flushing of Sanitary Sewers	YES	YES	YES	YES
Street Cleaning				
Street Sweeping, Brush Dampening	YES	YES	YES	NO
Street Washing, Spray	YES	NO	NO	NO
Washing of Corporation Yards, Lots, and Sidewalks	YES	YES	NO	NO
Dust Control (Dampening Unpaved Roads and Other Surfaces)	YES	YES	YES	NO
Dampening of Soil for Compaction (at Construction Sites, Landfills, etc.)	YES	YES	YES	NO

Treatment and Quality Requirements for Reclaimed Water Use (Cont.)

Use	Type of Reclaimed Water Allowed			
	Class A	Class B	Class C	Class D
Water Jetting for Consolidation of Backfill around Pipelines				
Pipelines for Reclaimed Water, Sewage, Storm Drainage, and Gas, and Conduits for Electricity	YES	YES	YES	NO
Fire Fighting and Protection				
Dumping from Aircraft	YES	YES	YES	NO
Hydrants or Sprinkler Systems in Buildings	YES	NO	NO	NO
Toilet and Urinal Flushing	YES	NO	NO	NO
Ship Ballast	YES	YES	YES	NO
Washing Aggregate and Making Concrete	YES	YES	YES	NO
Industrial Boiler Feed	YES	YES	YES	NO
Industrial Cooling				
Aerosols or Other Mist not Created	YES	YES	YES	NO
Aerosols or Other Mist Created (e.g., Use in Cooling Towers, Forced Air Evaporation, or Spraying)	YES	NO	NO	NO
Industrial Process				
Without Exposure of Workers	YES	YES	YES	NO
With Exposure of Workers	YES	NO	NO	NO

Source: Washington State Department of Ecology, 1997.

Engrossed Substitute House Bill 2884

In March 2006, the Engrossed Substitute House Bill (ESHB) 2884 was passed. ESHB 2884 requires Ecology to adopt new reclaimed water rules by December 31, 2010. The bill is meant to address the fact that the 1997 standards are outdated and do not reflect recent developments in wastewater treatment technologies. The new rules are to address all aspects of reclaimed water use and shall be developed with consultation from an advisory committee. The advisory committee shall consist of "a broad range of interested individuals representing the various stakeholders that utilize or are potentially impacted by the use of reclaimed water; the advisory committee must also contain individuals with technical expertise and knowledge of new advancements in technology." In addition, the bill shifts regulatory responsibility for reclaimed water to Ecology. The Department of Health may still have a regulatory role after the new rules are adopted.

City of Seattle Resolution Number 30454

In April 2002, the City of Seattle adopted Resolution Number 30454. This resolution provides additional requirements for some wastewater reuse projects, as described below:

> "4) In developing wastewater reuse projects and programs, SPU (and other City agencies when involved) shall consult with the Washington State departments of Health and Ecology and U.S. Environmental Protection Agency (EPA) and other appropriate agencies, recognizing that regulations regarding reused or reclaimed waste water and rainwater are still being developed and at this time may be unclear or ambiguous in their application.

5) SPU shall monitor closely scientific and regulatory developments (including but not limited to the U.S. EPA's most current revision of reused water quality standards) regarding the risks associated with heavy metals, chemicals, residual pharmaceuticals and endocrine disruptors (separately and in combination) that may be present even in highly processed wastewater, and shall avoid actions that may result in the release of these residual substances into freshwater streams and lakes where they may be harmful to aquatic life, or where they would pose any risks to human health. Until there is more scientific certainty about treatment effectiveness or soil adsorption of such residual compounds, SPU shall take the following steps before developing projects that result in the use of reclaimed wastewater for irrigating parks or golf courses through which salmon-bearing streams flow:

(a) Identify the source of reclaimed water to be used for the project;
(b) Identify the treatment technology to be used, treatment capabilities and current applications of that technology;
(c) Measure the levels of both regulated and unregulated contaminants in the reclaimed water after treatment; and
(d) Identify and evaluate the manner in which the reclaimed water will be applied for the irrigation project in question and develop a monitoring program to demonstrate and ensure the safety of these practices.
(e) Submit the proposed irrigation project to a peer review panel composed of water quality experts from the USGS Toxic Substances Hydrology Program, the Washington State Department of Health and either the US Environmental Protection Agency or the Washington State Department of Ecology for an independent evaluation and a recommendation on whether to proceed with the proposed irrigation project."

The full text of this resolution is provided in Appendix A. One of the immediate impacts of the resolution was to impede the progress of any reclaimed water projects serving parks or golf courses with salmon-spawning creeks running through them. As described in a later section, this includes Longfellow Creek, a salmon-spawning creek which runs through the West Seattle Golf Course, and Thornton Creek, a salmon-spawning creek which runs through Jackson Park Golf Course. Therefore, as prescribed in the legislation, SPU would be required to perform a number of steps before using reclaimed water on parks or golf courses. In addition, the resolution requires that a reclaimed water project be cost effective.

SURVEY OF RECLAIMED WATER MARKETS NATIONWIDE AND LOCALLY

According to the WateReuse Association, ninety percent of reuse in the United States takes place in Arizona, California, Florida and Texas. Many other states, however, recognize the need to consider reclaimed water as a water source (AWWA, 2004). A number of factors drive this need:

- Arid climates and lack of water resources;
- Drought;
- Water conservation as a regulatory requirement;
- Population growth and increasing demand;
- More stringent wastewater treatment requirements (i.e. for the protection of aquatic species);
- Technological advancements leading to reduced costs of reclaimed water; and
- Having a dependable nonpotable water source at a predictable cost.

Some of the obstacles that have been encountered when trying to implement reclaimed water projects are:

- Economic infeasibility;
- End user concerns with on-site conversion costs;
- Perception of potential health risks; and
- Gaining public acceptance.

There are other obstacles that projects have had to overcome. In some instances, dual piping for domestic use has been difficult to implement due to concerns about cross connections. Also, mosquito breeding grounds has been a concern for the design of reclaimed water infiltration ponds.

Allowable uses of reclaimed water are based on the quality of the effluent. Each state's standards determine the effluent quality requirements. Table 4 summarizes the use of reclaimed water in Arizona, California, Florida and Texas. Appendix B provides more detailed information on the use of reclaimed water in each of these states.

Table 4
Reclaimed Water Usage Summary for

State	Total Usage (MGD)	Drivers	Uses	Implementation Issues
Arizona	> 100	-Lack of water supply -Increasing demand -Requirements of Assured Water Supply rules -Arizona Department of Water Resources incentives	Agricultural irrigation Aquifer storage and recharge Golf course irrigation Industrial cooling Maintenance of wildlife areas Park irrigation Recreational (lakes and ponds) Turf irrigation Wetlands enhancement	-Retrofitting is not cost effective -Parks and green belts are sometimes far from sources -Increased TDS in effluent can require greater (relative to portable water) application for turf irrigation
California	450	-Lack of water supply -Increasing demand -Salt water intrusion due to groundwater pumping	Agricultural irrigation (47%) Landscape irrigation (21%) Industrial use (5%) Groundwater recharge (9%) Seawater barriers (5%) Wildlife habitat or misc. (4%) Geysers/energy production (< 1%) Other or mixed type (3%)	-Public safety concerns -Concerns that water would only be supplied to low income neighborhoods

Table 4
Reclaimed Water Usage Summary for

State	Total Usage (MGD)	Drivers	Uses	Implementation Issues
Florida	630	-Reducing effluent and nutrient discharges to surface water -Increasing demand -Salt water intrusion due to groundwater pumping -Realizing that potable water is not necessary for irrigation -County and city requirements to install reuse systems for irrigation	Public Access Areas and Landscape Irrigation (49%) Groundwater Recharge and indirect potable reuse (16%) Agricultural Irrigation (14%) Industrial (14%) Wetlands (7%) Toilet Flushing (< 1%) Fire Protection (< 1%) Other Uses (< 1 %)	-Seasonal fluctuations which create cyclic shortages and surpluses
Texas	160	-Lack of water supply -Drought -Cost of new water supplies	Cooling towers Golf course irrigation Manufacturing	Unknown

Notes:
1. Usages are based on data from years 1998-2004 depending the state. See Appendix B for more information.
2. Implementation issues include examples and are not considered an exhaustive list.

Reclaimed Water Use in Washington State

According to a Department of Ecology 2005 Study, by the end of 2004 seventeen facilities had been constructed or upgraded to operate under the state's reclaimed water standards (Ecology, 2005) . The drivers for these projects were:

- Elimination or decrease in wastewater discharges for environmental purposes (i.e. shellfish);
- Additional water supplies including drought resistant supplies;
- Growth;
- Having a nonpotable water supply for irrigation; and
- Construction of new wastewater facilities.

As water demands increase, reclaimed water may be evaluated as an option to decrease potable water usage since "development of new surface water and groundwater sources is becoming more lengthy, costly and uncertain, given the multiple demands being made on a finite resource. Stringent environmental, regulatory and legal requirements are involved in establishing water rights and developing new supply facilities. Moreover, Ecology requires that water suppliers demonstrate that water conservation efforts have been duly considered, developed, and implemented prior to the granting of additional water rights (King County, 1995)." Future reclaimed water projects may also be driven by local ordinances. For example, in the City of Yelm water reuse can be required for new construction.

One of the seventeen permitted facilities in Washington State is in Seattle. King County generates and uses reclaimed water at the West Point Treatment Plant. The plant has a capacity of 0.7 MGD of Class A reclaimed water. It produces 0.5 MGD of reclaimed water which is all used at the plant for irrigation, tank cleaning and other processes (Ecology, 2005).

POTENTIAL RECLAIMED WATER SOURCES FOR SEATTLE SERVICE AREA

Five potential reclaimed water sources have been identified. The first three sources were also identified in the 2003 Study.

- SPU sewer conveyance lines;
- King County Interceptors;
- King County Renton Effluent Transfer System (RETS) pipeline;
- Brightwater Reclaimed Water Backbone; and
- Reclaimed water at West Point Treatment Plant.

Figure 1 shows the location of each of these potential reclaimed water sources. A brief description of the sources is provided below.

SPU Conveyance Lines and King County Interceptors

SPU sewer conveyance lines and King County interceptors are sources of raw sewage which would require a higher level of treatment than the other identified sources. These sources are located throughout the SPU service areas and the volume of available sewage would depend on the project location.

King County RETS Pipeline

The King County RETS pipeline conveys secondary treated effluent from the Renton Wastewater Treatment Plant, through the Duwamish Corridor, to its outfall in the Puget Sound. Since the wastewater in the King County RETS pipeline has already received secondary treatment at the South Treatment Plant, less treatment would be required to bring the wastewater to reclaimed water quality standards. The RETS pipeline is 96-inches in diameter and carries an average of 115 million gallons per day. There are taps along the pipeline for future effluent withdrawal connections.

Brightwater Reclaimed Water Backbone

The Brightwater reclaimed water backbone will contain Class A reclaimed water which requires no additional treatment. The nearest location of the backbone to the City of Seattle will be in the City of Shoreline at approximately 195th Street and Ballinger Way. Pumps and an additional conveyance line will be required to convey the reclaimed water south to users within the City of Seattle limits.

West Point Treatment Plant

SPU and Metro King County co-funded a reclaimed water project to produce up to 700,000 gallons per day at the County's West Point Treatment Plant in Seattle. All water produced is used at the plant for tank cleaning, treatment processes such as foam control, and irrigation. SPU and King County are considering an expansion of this project.

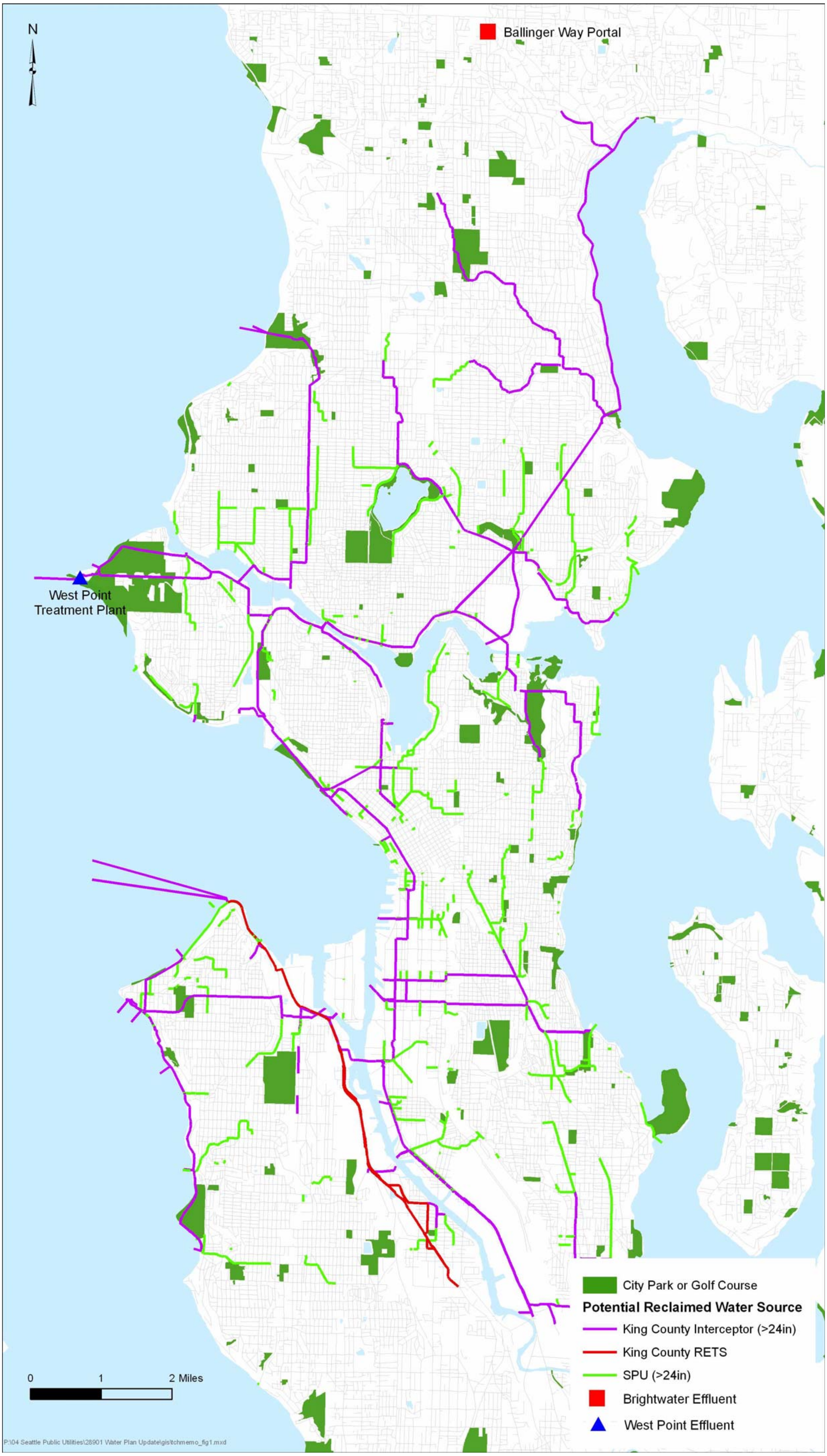


Figure 1. Potential Reclaimed Water Sources

IDENTIFICATION OF RECLAIMED WATER OPPORTUNITIES IN SEATTLE SERVICE AREA

In order to identify reclaimed water opportunities in the Seattle service area, potential reclaimed water users were first identified. Appendix C describes the process for identifying potential users of reclaimed water. Out of the list of potential users, five opportunities for generating reclaimed water and distributing it to potential users were selected for further evaluation. These opportunities are as follows:

1. Catholic Calvary Cemetery
2. Jackson Park Golf Course
3. Urban Commercial Core/Myrtle Edwards Park
4. West Seattle Golf Course Reclaimed Wastewater Facility “A”
5. West Seattle Golf Course Reclaimed Wastewater Facility “B”

The five opportunities were selected because of their proximity to a reclaimed water source, the size of their demand, and a preliminary assessment of cost feasibility from the 2003 Study. Figure 2 shows the location of each of these opportunities in Seattle.

Three of the five opportunities originated from the 2003 Study projects. These opportunities generally had the lowest unit costs for producing reclaimed water. The least expensive project from the 2003 Study, the Birmingham Steel and the West Seattle Golf Course alternative, was not selected for further evaluation because the current owners, Nucor Steel, are not in a financial position to consider retrofitting their facilities to add reclaimed water treatment. The next three projects, West Seattle Golf Course Reclaimed Wastewater Facilities “A” and “B”, and the Catholic Calvary Cemetery were carried forward. The next project that was considered is a project based on an expanded facility at the Myrtle Edwards Park. This facility is proposed to address the non-potable water needs of the projected residential and commercial development in the downtown/urban commercial core, as well as provide water for irrigation of the park. Finally, the Jackson Park Golf Course alternative was evaluated because it was identified by King County as a potential user of reclaimed water from the Brightwater reclaimed water backbone.

Some projects were not included in this evaluation because they were not considered “reclaimed water projects.” For example, the Green Lake Wading Pool project was left out of the evaluation because the project involves using on-site wading pool water as its source water, rather than wastewater from the sanitary sewer. Such projects which use on-site water as their source water are considered “re-use” projects and are evaluated in SPU’s water conservation planning program.

Brief descriptions of the reclaimed water projects are provided below. All components of the projects would need to meet the September 1997 Washington State Departments of Heath and Ecology Water Reclamation and Reuse Standards, and all updates and revisions. For the facilities described below, all would need to treat water to “Class A” standards, as defined in Chapter 90.46 in the Revised Code of Washington.

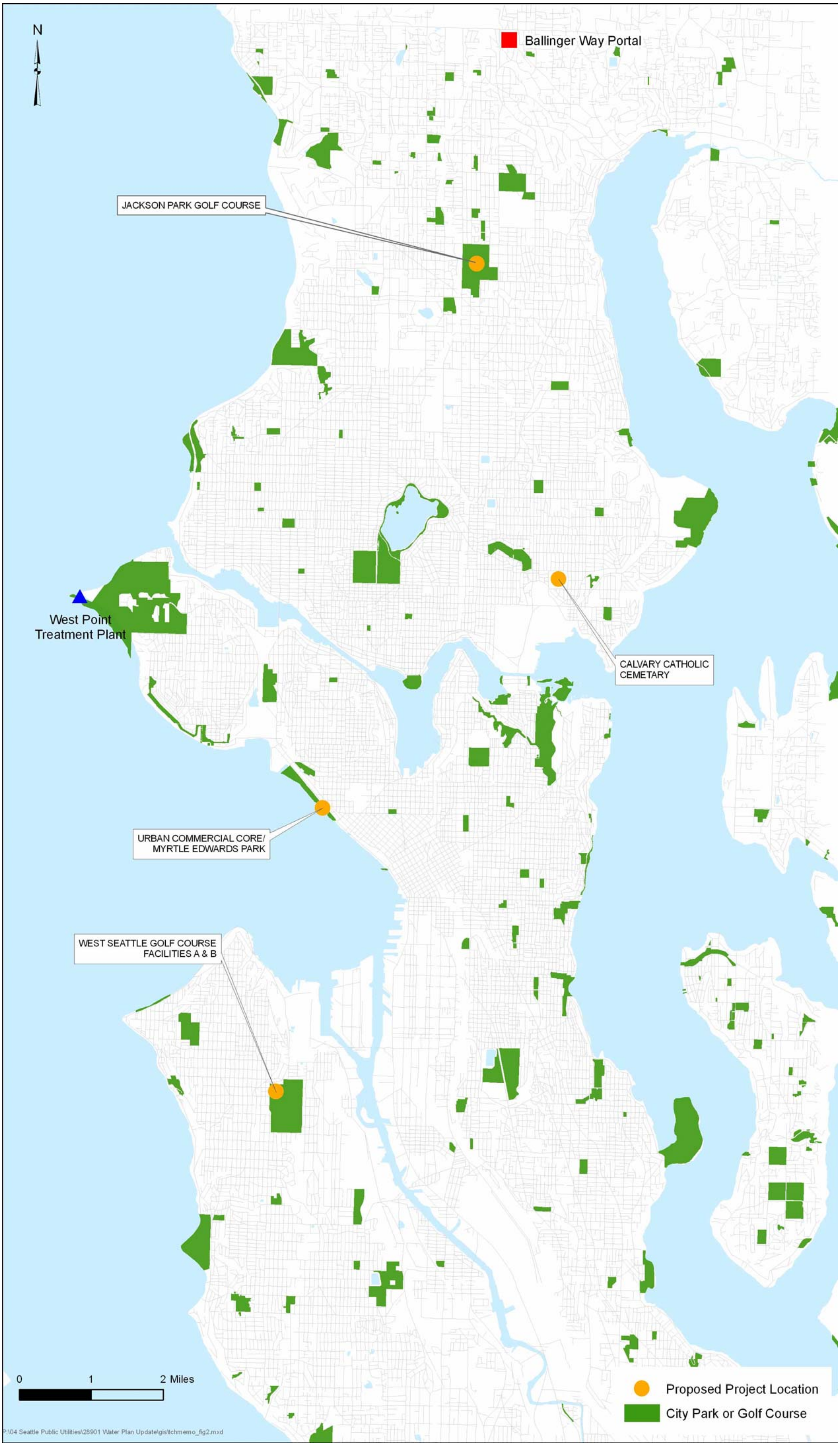


Figure 2. Reclaimed Water Opportunities in Seattle

Calvary Catholic Cemetery

This project was presented in the 2003 Study. As described in the Study, irrigation water for the cemetery would be replaced by reclaimed water treated by a MBR facility. This facility would draw raw sewage from a King County Interceptor adjacent to the cemetery. The facility would treat between 0.08 to 0.30 MGD and would meet all of the estimated irrigation demand of the cemetery. Since this facility is proposed for irrigation, it would run seasonally from June through October, which coincides with SPU peak water demands. In the 2003 Study, a location of the facility was not identified. The feasibility and cost estimate assumed a suitable site could be acquired. Refer the 2003 Study for additional information. For the evaluation of reclaimed water project opportunities for the 2007 Water System Plan update, the 2003 Study cost estimate, which was in 2002 dollars, was updated to 2005 dollars using the assumptions summarized on Appendix D - Table 1. Table 5 summarizes the costs associated with this reclaimed water alternative.

Jackson Park Golf Course

This project was proposed by King County in the *Reclaimed Water Backbone Project White Paper*, (King County DNR, March2006). Distribution facilities would need to be constructed, funded and maintained by SPU. A pump station will be located near the proposed Ballinger Way Portal where treated Brightwater effluent would be available. A distribution system would be constructed to convey the reclaimed water to the Jackson Park Golf Course. In the white paper, King County provided a demand estimate for the golf course, based on an assumed area of irrigation, a five month irrigation season, an agronomic application rate and an irrigation efficiency. This season was assumed to occur from June through October. SPU estimates the demand for golf courses, when accounting for the actual area irrigated and a turf application rate, is 33% of the King County demand. Actual use at Jackson Park is estimated because the golf course currently draws its irrigation water from Thornton Creek, and this is not metered.

Refer the Appendix E for project specific information on this reclaimed water alternative. Although costs for the pipeline from the Ballinger Way Portal to the golf course could potentially be shared between SPU and potential Shoreline reclaimed water users, it was conservatively assumed that SPU would pay for all the costs of a pipeline sized to handle only the golf course's water demands. Table 5 summarizes the costs associated with this reclaimed water alternative based on SPU's demand estimates. If King County's demand estimates are used instead of SPU's, the costs of the project double due to the increased size of the conveyance facilities. Application of reclaimed water on the Jackson Park Golf Course has a notable environmental concern, in that reclaimed water irrigation runoff could potentially flow into Thorton Creek, which is a salmon spawning creek. This could raise concerns regarding the impacts of endocrine disrupters on the salmon population.

Urban Commercial Core/Myrtle Edwards Park

A project for irrigating Myrtle Edwards Park was presented in the 2003 Study. The scope of this potential facility was expanded to include commercial and residential uses (primarily toilet flushing) in the downtown/urban commercial core area of Seattle, which is expected to experience significant development over the next 25 years.

Irrigation and toilet flushing water could be replaced by reclaimed water treated by a MBR facility located in Myrtle Edwards Park. This facility would draw raw sewage from a King County Interceptor adjacent to the park. The facility would treat between 0.58 to 0.61 MGD and would meet all of the estimated irrigation demand of Myrtle Edwards Park and the estimated toilet flushing water demands to accommodate growth projections outlined in the Comprehensive Plan (City of Seattle, 2005). The facility would operate year-round, and peak usage would occur during the summer months when Myrtle Edwards Park is irrigated.

Reclaimed water from the MBR facility would be distributed via reclaimed water pipelines to the users. Most users would require dual-piping inside their facility to distribute the reclaimed water inside their site. The project would consist of the following three components:

1. Reclaimed water facility (to treat wastewater and generate reclaimed water) at Myrtle Edwards Park
2. Reclaimed water distribution system piping on City roads (to distribute reclaimed water to the buildings or parks)
3. Internal dual-plumbing in buildings or parks

A cost estimate for this project was prepared and is provided in Appendix D - Table 1. The cost estimate does not include the costs of installing dual-plumbing inside buildings. It is assumed that this cost will be paid for by developers[6]. Table 5 summarizes the costs associated with this reclaimed water alternative. Appendix F provides more project specific information for the alternative.

West Seattle Golf Course Reclaimed Wastewater Facility "A"

This project was presented in the 2003 Study. As described in the Study, irrigation water for the West Seattle Golf Course would be replaced by reclaimed water treated by a membrane bioreactor facility (MBR). This facility would draw raw sewage from an SPU Wastewater Collection System adjacent to the golf course. The facility would treat 0.04 to 0.15 million gallons a day (MGD) to meet part of the estimated irrigation demand of the golf course, with the remaining demand supplied by the potable water system. Since this facility is proposed for irrigation, it would run seasonally from May through October, which coincides with SPU peak demands. Refer the 2003 Study for additional information. For the evaluation of reclaimed water project opportunities for the 2007 Water System Plan update, the 2003 Study cost estimate, which was in 2002 dollars, was updated to 2005 dollars using the assumptions summarized on Appendix D - Table 1. Table 5 summarizes the costs associated with this reclaimed water alternative. Application of reclaimed water on the West Seattle Golf Course has a notable environmental concern, in that reclaimed water irrigation runoff could potentially flow into Longfellow Creek, which is a salmon spawning creek. This could raise concerns regarding the impacts of endocrine disrupters on the salmon population.

West Seattle Golf Course Reclaimed Wastewater Facility "B"

This project was presented in the 2003 Study. As described in the Study, irrigation water would be replaced by reclaimed water treated by a MBR facility. This facility would draw raw sewage from a King County Interceptor adjacent to the golf course. The facility would treat between 0.04 to 0.40

[6] Currently, there are no incentives or regulatory requirements that would encourage developers to install dual-plumbing. If SPU chooses to pursue this opportunity, incentives or regulatory requirements for installing dual-plumbing in new developments should be considered (see Implementation Considerations).

MGD and would meet all of the estimated irrigation demand of the golf course. (This facility has a higher treatment capacity than Facility "A", which will only meet part of the irrigation demand.) Since this facility is proposed for irrigation, it would run seasonally from May through October, which coincides with SPU peak demands. Refer the 2003 Study for additional information. For the evaluation of reclaimed water project opportunities for the 2007 Water System Plan update, the 2003 Study cost estimate, which was in 2002 dollars, was updated to 2005 dollars using the assumptions summarized on Appendix D - Table 1. Table 5 summarizes the costs associated with this reclaimed water alternative. Similar to the West Seattle Golf Course Facility "A" alternative, this alternative would raise concerns regarding the potential impact of endocrine disrupters on the salmon population in Longfellow Creek.

All five projects were developed based on the current understanding of user demands. SPU is currently working will all the City's golf courses to evaluate efficiency improvements. Conservation efforts and improvements in efficiency could affect the golf course water needs and affect the project cost estimates.

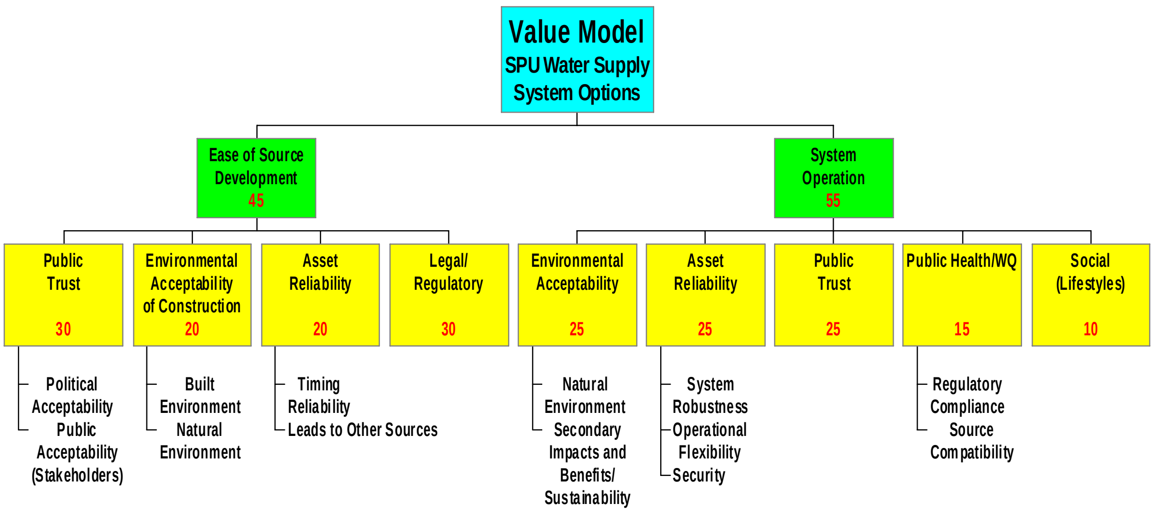
Table 5
Project Summary

Alternative	Average Annual Supply (MGD)	Average Daily Quantity (MGD)	Annual Treatment Volume (MG)	Pre-Construction[7] (includes Land Acquisition)		Design		Construction[8]		Annual Operations and Maintenance[9]	Levelized Cost ($/ccf)	Special Requirements
				Years	Costs	Years	Costs	Years	Costs			
1) Catholic Calvary Cemetery	0.04 June thru October	0.08-0.30	16	1.25	$656,000	1	$614,000	1.5	MBR $3,992,000 20-yr useful life Pumps $141,000 15-yr useful life Other $93,000 100-yr useful life Total: $4,226,000	$74,000/yr	$20.57	• Assumes MBR facility life of 20 years. • Assumes pumps will be replaced on the 15th year and MBR will be replaced on the 7th and 14th year.
2) Jackson Park Golf Course	0.1 June thru October	0.23	36	1	$585,000	1	$1,220,000	1.5	Pumps $322,000 15-yr useful life Other $6,861,000 100-yr useful life Total: $7,183,000	$182,000/yr	$12.63	• Assumes pumps will be replaced on the 15th year . • Assumes that King County will charge $1.35 per CCF for reclaimed water. (included in the Annual O&M costs)
3) Urban Commercial Core/Myrtle Edwards Park	0.4 Year-round, and seasonal	0.58-0.61	145	1.5	$1,004,000	1.5	$6,264,000	2	MBR $9,926,000 20-yr useful life Pumps $546,000 15-yr useful life Other $27,743,000 100-yr useful life Total: $38,215,000 Cost for dual plumbing in buildings not included	$175,000/yr	$13.66	• Assumes MBR facility life of 20 years. • Assumes distribution system life of 100 years. • Assumes pumps will be replaced on the 15th year and MBR will be replaced on the 7th and 14th year.
4) West Seattle Golf Course Reclaimed Wastewater Facility "A"	0.05 May thru October	0.04-0.15	20	1	$135,000	1	$435,000	1.5	MBR $2,772,000 20-year useful life Pumps $144,000 15-year useful life Other $74,000 50-yr useful life Total: $2,990,000	$70,000/yr	$11.55	• Assumes MBR facility life of 20 years. • Assumes pumps will be replaced on the 15th year and MBR will be replaced on the 7th and 14th year.
5) West Seattle Golf Course Reclaimed Wastewater Facility "B"	0.06 May thru October	0.04-0.40	23	1.25	$198,000	1	$794,000	1.5	MBR $5,057,000 20-year useful life Pumps $148,000 15-year useful life Other $259,000 50-yr useful life Total: $5,464,000	$107,000/yr	$17.56	• Assumes MBR facility life of 20 years. • Assumes pumps will be replaced on the 15th year and MBR will be replaced on the 7th and 14th year.

[7] Pre-Construction activities include environmental and engineering studies, water rights applications, permitting, land acquisition, and SEPA (EIS) compliance.
[8] Construction activities include construction, construction management, engineering support, environmental controls and mitigation work.
[9] Increased costs for treatment, transmission, and storage, as well as costs for maintaining/protecting new source facilities. Also includes annualized value of replacing key components during life of project.

EVALUATION OF RECLAIMED WATER OPPORTUNITIES IN SEATTLE SERVICE AREA

The five opportunities described in the previous section were evaluated in relation to the other supply alternatives available to SPU. This evaluation uses a methodology developed to analyze water supply alternatives as part of an update to SPUs water system plan[10]. It considers the unit cost of additional supply provided, as well a "value score" that captures the non-monetary benefits or impacts associated with each alternative. The value scores were determined using sixteen criteria related to social and environmental aspects of source development and system operation. The evaluation criteria are shown in the value model structure below. The numbers shown in red represent the relative weights applied to each of the criteria.



The projects were given performance scores ranging from a low of 1 (negative impacts) to a high of 5 (positive impacts) for each criterion. Appendix G provides the performance scores for each of the projects. A weighting scheme that expresses the relative importance of each criterion was applied to the performance scores to determine a single value score ranging from 0.0 (worse score) to 1.0 (best score) for each of the five projects.

Figure 3 shows the contribution from each criterion to the final score for the reclaimed water projects, along with SPU's other supply alternatives. The reclaimed water projects all have value scores in the middle of the scale, although Urban Commercial Core/Myrtle Edwards Park scored the lowest. Sensitivity analysis indicates that the relative scores and levels do not change significantly if the weights for any of the categories are varied.

[10] CH2M HILL. "SPU Water Supply Planning Model." April 2006.

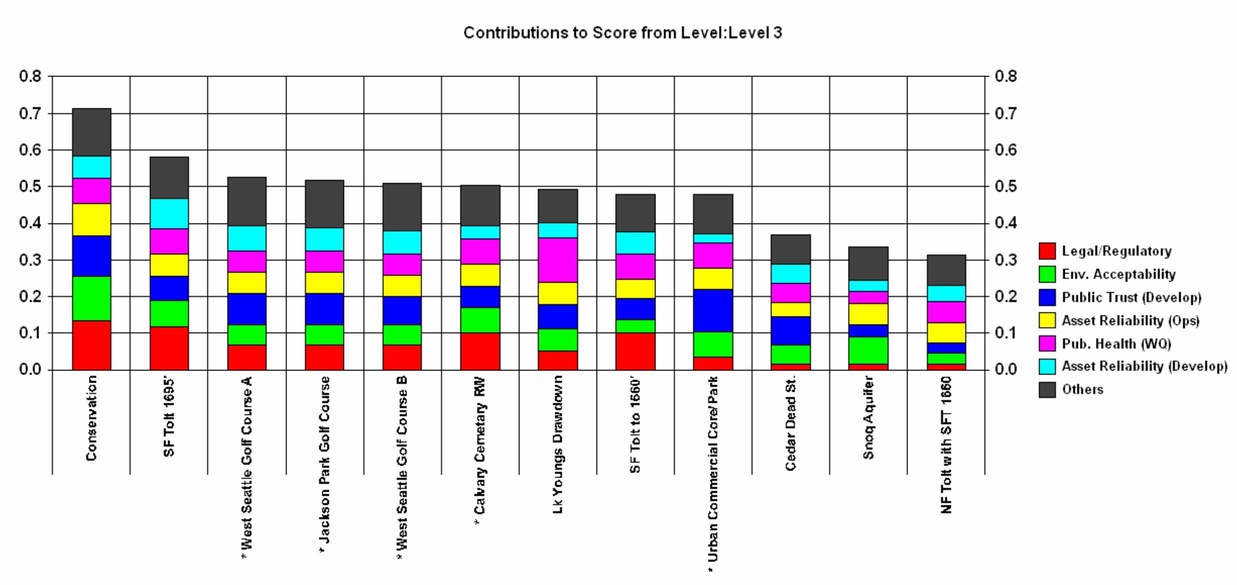
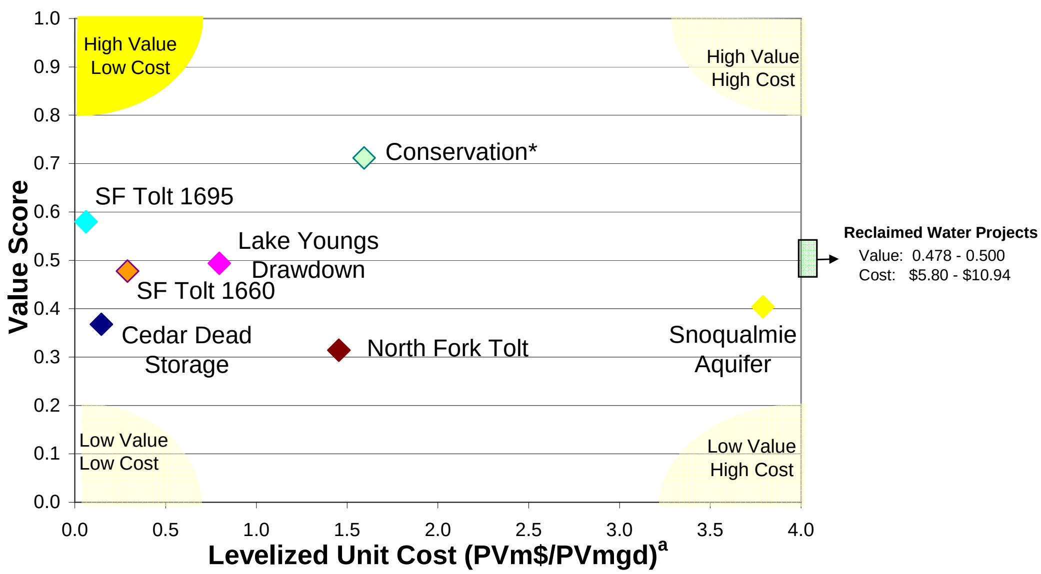


Figure 3 – Value Score Components

The value scores and levelized unit cost of the reclaimed water projects were compared against SPU's other drinking water supply alternatives, including conservation, as shown in Figure 4 and Appendix G. Preferred alternatives are in the high value, low cost quadrant (upper, left hand area) of the graphic. The reclaimed water projects all have levelized unit costs greater than the other alternatives analyzed. Conservation, South Fork Tolt Drawdown and Lake Youngs Drawdown have approximately the same value or higher, and at much lower costs, and would be preferred over any of the reclaimed water projects.



[a]Calculated assuming all sources online in 2050.
*4 mgd conservation program begins in 2045 and phases in over a 10-year period.

Figure 4 – Value Score vs. Levelized Unit Cost for Alternatives

Another important factor to point out when considering reclaimed water projects as viable supply alternatives is the quantity of water provided. The total amount of water provided by the four project locations is 0.6 MGD on an average annual basis. This is about 0.3% of SPU's current supply and significantly lower than the amount expected from other supply alternatives (Figure 5).

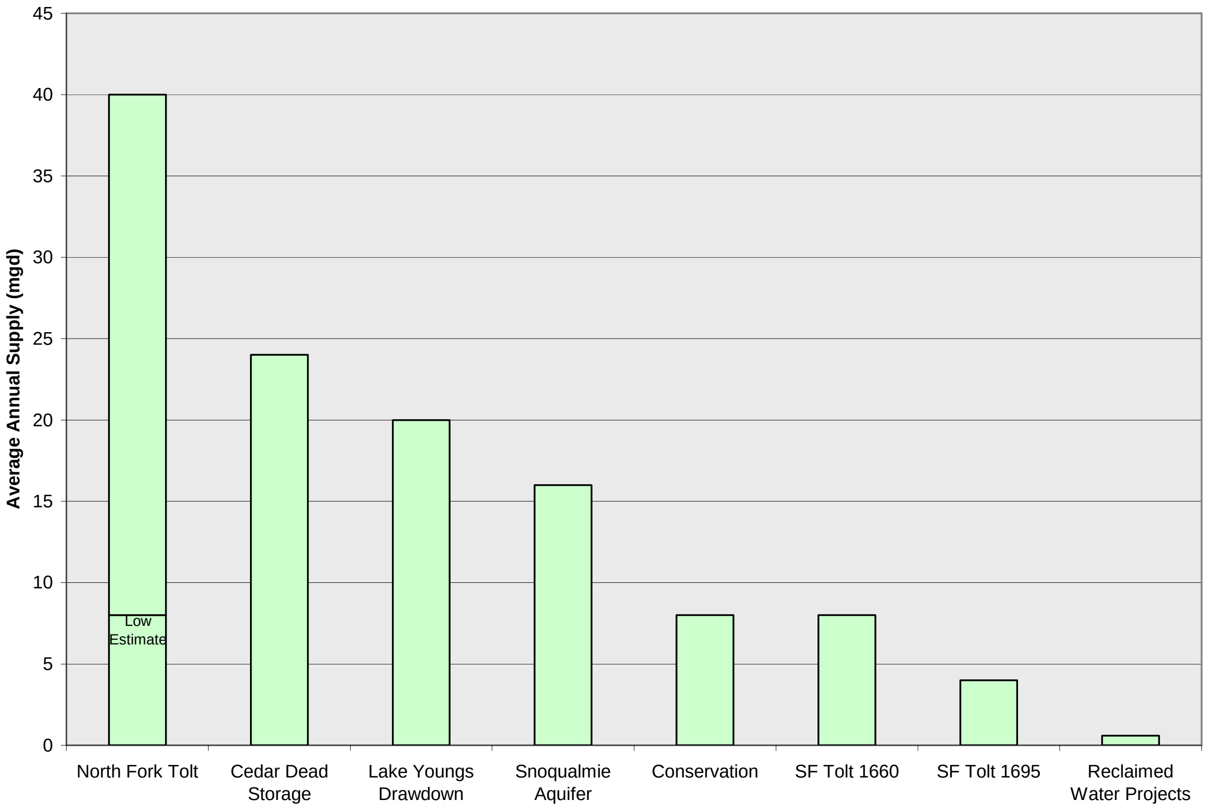


Figure 5 – Supply Provided by Alternatives

RECOMMENDED RECLAIMED WATER PROJECTS IN SEATTLE SERVICE AREA

Based on the evaluation described above, none of the reclaimed water alternatives discussed are currently considered as viable supply alternatives for SPU. This is due to the very high unit costs of these projects. Also, the small quantity of water would do little to offset future water demands in the SPU service area

The project costs for the Urban Commercial Core/Myrtle Edwards Park included an MBR facility as well as a lengthy distribution system throughout downtown Seattle. If the costs of the distribution system could be paid by others (e.g. developers[11]), then the cost of this alternative for SPU could drop significantly. Another opportunity for decreasing the costs of this alternative would be to install portions of the distribution system when other underground piping is being installed or

[11] Currently, there are no incentives or regulatory requirements that would encourage developers to install dual-plumbing and reclaimed water distribution piping. If SPU chooses to pursue this opportunity, incentives or regulatory requirements for installing dual-plumbing and distribution piping should be considered (see Implementation Considerations).

maintained. Similarly, the costs of the Jackson Park Golf Course alternative could be significantly reduced if the cost of the pipeline from the Ballinger Way Portal to the golf course could be shared with the potential users in the City of Shoreline. However, current efforts to improve irrigation efficiency would make this alternative less attractive.

IMPLEMENTATION CONSIDERATIONS

If SPU elected to implement any of these projects, there are a number of other issues that should be considered. These range from legislative issues to public concerns, coordination with other agencies such as King County, coordination with users, and the acquisition of land or easements to site the facilities. The following section briefly describes each of these implementation considerations.

Legislation

Water Reclamation and Reuse Standards and the City of Seattle Resolution should be considered and adhered to in the implementation of any of the reclaimed water opportunities.

Public concerns

As stated earlier, some projects in California were never implemented due to overwhelming public concerns. Projects would also need to take all the necessary precautions to ensure that the reclaimed water is used as intended.

Coordination with King County

Three of the projects propose using a King County Interceptor as the reclaimed water source. SPU would need to work with King County to determine if sewer scalping is possible. These projects would require coordination during the design phases to ensure the proposed facility is compatible with King County's distribution system operation and maintenance. A fourth project proposes using Brightwater effluent. SPU would need to work with King County to determine how the effluent would be extracted from the Ballinger Way Portal and what system limitations, if any, would exist. Ownership of the sewage effluent, the subsequent ownership of reclaimed water treatment and distribution facilities, the cost recovery of investments, and the avoidance of stranded SPU costs for existing service, will require close coordination between SPU and the County.

Coordination with users

All of the projects would require coordination with the end users. This coordination would need to occur during the facility siting and design to ensure the facility fits with their site uses and that the tie-into can be constructed. Also, for seasonal projects the facility operational schedule would need to be coordinated. The Urban Commercial Core/Myrtle Edwards project would require more coordination efforts, since there would be a larger number of end users. This project would require coordination with contractors installing internal dual plumbing and tapping into the reclaimed water distribution system. In addition, incentives or regulatory requirements infrastructure development and subsequent reclaimed water use would likely be needed to ensure usage.

Land acquisition

Some of the proposed projects are located on municipal golf courses (West Seattle Golf Course Reclaimed Wastewater Facilities "A" and "B") and Seattle parks (Myrtle Edwards Park). These projects would not require land acquisitions for the facility. Land would need to be acquired for the Jackson Park Golf Course pump station. A site for this facility has not been located. Easements may be necessary for the sewer scalping for the West Seattle Golf Course and the Urban Commercial Core/Myrtle Edwards projects. Easements may also need to be acquired for the Jackson Park Golf Course and Urban Commercial Core/Myrtle Edwards distribution systems. A site for the Catholic Calvary proposed facility has not been located. To implement this project a treatment site would need to be located and acquired. .

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APPENDICES

A – City of Seattle Resolution Number 30454
B – Reclaimed Water Use Nationally
C – Potential Reclaimed Water Users
D – Reclaimed Water Opportunities Cost Estimate
E – Urban Commercial Core/Myrtle Edwards project information
F – Jackson Park Golf Course project information
G – Reclaimed Water Projects Evaluation

APPENDIX A
City of Seattle
Resolution Number 30454

City of Seattle Legislative Information Service

Information updated as of April 18, 2002 11:04 AM

Resolution Number: h0h2**30454**

A RESOLUTION relating to the City of Seattle's interest in the beneficial reuse of wastewater and reclaimed rainwater; setting policies related to wastewater reuse and rainwater reclamation; and calling for the development of pilot projects and the full and careful study of the public health and environmental impacts of wastewater reuse and rainwater reclamation.
Date introduced/referred: Mar 25, 2002
Date adopted: Apr 15, 2002
Status: Adopted As Amended
Vote: 9-0

Committee: Water and Health
Sponsor: PAGELER
Index Terms: STATING-POLICY, WATER-SUPPLY, CONSERVATION
Text

Note to users: {- indicates start of text that has been amended out
-} indicates end of text that has been amended out
{+ indicates start of text that has been amended in
+} indicates end of text that has been amended in

A RESOLUTION relating to the City of Seattle's interest in the beneficial reuse of wastewater and reclaimed rainwater; setting policies related to wastewater reuse and rainwater reclamation; and calling for the development of pilot projects and the full and careful study of the public health and environmental impacts of wastewater reuse and rainwater reclamation.

WHEREAS, the City of Seattle has an interest in promoting the cost-effective conservation and efficient use of natural resources, including existing drinking water supplies and in developing cost-effective and environmentally responsible alternative sources of water supply; and

WHEREAS, the citizens of the City and the Puget Sound region desire the most secure and reliable water supply system possible; and

WHEREAS, the City and its partners in the Central Puget Sound Water Suppliers' Forum, have examined regional and long-term water supply issues, including wastewater reuse, in the course of developing a Regional Water Supply Outlook; and

WHEREAS, the State of Washington, through the enactment of RCW 90.46 has encouraged the development of wastewater reclamation for a variety of beneficial uses by providing for the funding of demonstration projects through the Department of Ecology; and

WHEREAS, the use of either reclaimed wastewater or rainwater as a substitute for potable water in some industrial, sanitation and irrigation applications could increase regional water supply system reliability while helping to preserve and protect our high-quality drinking water supplies; and

WHEREAS, in many areas of the City, rainwater runoff from roofs and other impervious surfaces is discharged directly into the sewer system; and

WHEREAS, the capture of rainwater from roofs and other impervious surfaces may also provide a supply of water for uses such as landscape irrigation and toilet flushing in place of drinking water, thereby decreasing the demand on the City's existing drinking water supplies; and

WHEREAS, the use of collected rainwater for landscape irrigation during the late spring and early summer months when lawn and garden water demand increases could help the City and the region meet water conservation goals by lowering demand on existing drinking water supplies; NOW, THEREFORE,

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF SEATTLE, THE MAYOR CONCURRING, THAT:

Section A. City of Seattle Water Reuse and Reclamation Policies

1) The City, through its Comprehensive Plan, sustainable building program and its commitment to Leadership in Energy and Environmental Design (LEED) standards, encourages the efficient use of all resources.

2) The City is committed to wastewater reuse and rainwater reclamation where they can serve as cost-effective and environmentally beneficial sources of water for industrial processes, sanitation and irrigation and thereby increase the security and reliability of the City's and the region's drinking water supplies.

3) In analyzing the cost-effectiveness of potential water reuse and/or reclamation projects, Seattle Public Utilities (SPU) shall use the methodology now in place for assessing the cost-effectiveness of water conservation projects within the City of Seattle under the Saving Water Partnership (also known as the 1% per year conservation program), and shall pursue only projects or programs that compete favorably by that standard.

(a) In considering the cost-effectiveness of a water reuse or reclamation project, the cost of the project shall be the full cost of producing and delivering the appropriate class of reclaimed water, including capital investments and operational costs.

(b) If reused water is to be purchased from an external supplier, the price paid shall be negotiated but the determination of the cost-effectiveness of the project shall be made based on the full cost of the reclaimed water as outlined in 3(a).

(c) Any water reuse or reclamation projects shall be designed and timed in such a manner as to avoid creating significant stranded water supply costs that would be borne by the remaining water ratepayers.

(d) This policy shall not apply to demonstration projects developed in 2003-2004 for the joint purposes of: i) educating the public about water reuse and reclamation and ii) developing and testing new technologies.

4) In developing wastewater reuse projects and programs, SPU (and other City agencies when involved) shall consult with the Washington State departments of Health and Ecology and U.S. Environmental Protection Agency (EPA) and other appropriate agencies, recognizing that regulations regarding reused or reclaimed waste water and rainwater are still being developed and at this time may be unclear or ambiguous in their application.

5) SPU shall monitor closely scientific and regulatory developments (including but not limited to the U.S. EPA's most current revision of reused water quality standards) regarding the risks associated with heavy metals, chemicals, residual pharmaceuticals and endocrine disruptors (separately and in combination) that may be present even in highly processed wastewater, and shall avoid actions that may result in the release of these residual substances into freshwater streams and lakes where they may be harmful to aquatic life, or where they would pose any risks to human health. Until there is more scientific certainty about treatment effectiveness or soil adsorption of such residual compounds, SPU shall take the following steps before developing projects that result in the use of reclaimed wastewater for irrigating parks or golf courses through which salmon-bearing streams flow:

(a) Identify the source of reclaimed water to be used for the project;

(b) Identify the treatment technology to be used, treatment capabilities and current applications of that technology;

(c) Measure the levels of both regulated and unregulated contaminants in the reclaimed water after treatment; and

(d) Identify and evaluate the manner in which the reclaimed water will be applied for the irrigation project in question and develop a monitoring program to demonstrate and ensure the safety of these practices.

(e) Submit the proposed irrigation project to a peer review panel composed of water quality experts from the USGS Toxic Substances Hydrology Program, the Washington State Department of Health and either the US Environmental Protection Agency or the Washington State Department of Ecology for an independent evaluation and a recommendation on whether to proceed with the proposed irrigation project.

6) Any demonstration or pilot projects and any other projects that may follow shall be developed in accordance with all applicable federal, state and local laws and regulations. Any reuse or reclamation project that is proposed to take place within five years from the effective date of this resolution shall be submitted to the City Council for review and approval.

Section B. Water Reuse and Reclamation Work Program

1) Survey of Water Reuse and/or Reclamation Opportunities

The City, through SPU, shall undertake and complete by the end of 2002 a survey of near-term water reuse/reclamation opportunities within the City of Seattle, including projects that can be developed by SPU alone or by SPU in partnership with other government agencies, King County Department of Natural Resources (DNR) or with private businesses, either as co-funders or as customers.

The survey of reuse/reclamation opportunities shall include projects involving highly treated wastewater and rainwater capture, shall analyze the drinking water conservation potential for each project and the costs and benefits of each (including quantifiable environmental benefits and benefits to other systems such as drainage), and shall rank them according to the greatest benefit per dollar.

2) Demonstration Project(s)

SPU, working in collaboration with other government agencies and private businesses where practical, shall, by the end of 2002, identify demonstration projects, at least one involving wastewater reuse and at least one involving rainwater reclamation, which will allow the City to test methodologies for and educate the public about water reuse and reclamation. The pilot projects to be selected will come from among the projects identified in Attachment A. SPU shall present to the City Council a proposed funding plan or plans for the pilot projects identified, that includes a proposed cost allocation for each project on a case-by-case basis.

3) Proposed Code Revisions to Encourage Reuse and Reclamation

Insofar as the City supports the development and application of cost effective and environmentally beneficial wastewater reuse and rainwater collection programs and technologies and the removal of barriers to such development, SPU shall recommend to the City Council proposed changes to the City's land use and building codes that may be desirable in order to encourage the promotion of these programs and technologies.

Adopted by the City Council the _____ day of _______________, 2002, and signed by me in open session in authentication of its adoption this _____ day of _______________, 2002.

____

President _____________of the City Council

THE MAYOR CONCURRING:

____

Mayor

Filed by me this _____ day of _______________, 2002.

____

City Clerk

Attachment A: Pilot Projects to be considered for Development and Implementation
30454_v8.doc
March 25, 2002
(Version 9)
ta
Attachment A

Pilot Projects to be considered for development and implementation

Wastewater reuse opportunities

South Seattle Community College (SSCC) - Installation of an on-site membrane bioreactor treatment plant which would collect and convert raw sewage into class "A" water to serve irrigation needs of SSCC gardens.

South Transfer Station - Installation of a tertiary treatment facility, most likely a sand filter, which would divert treated wastewater effluent from the Renton Treatment Plant effluent transmission line to the site for various uses. The facility would provide class "A" water for use at the transfer station, water that trucks would use to flush SPU sewer lines in the southern portion of Seattle, and possibly nearby bus washing needs for an adjacent and privately owned bus barn.

Rainwater reclamation opportunities

Sand Point Building #30 - Rooftop rainfall collection system. Water will be stored and conveyed to gardens/ballfields for summer irrigation. Sandpoint Building #30 will be re-roofed late Summer 2002 and the gardens adjacent to the building will be planted in Summer 2002.

Residential Rainfall Harvesting - A residential rainfall-harvesting example will be examined. A "pilot" program of installing 6-10 residential rainfall harvesting systems for monitoring may likely be recommended.

/~public/clrkhome.htm/~public/clrkhome.htm/~public/resn1.htm/~public/resn1.htm

APPENDIX B
RECLAIMED WATER USE NATIONALLY

According to the WateReuse Association, 90 percent of reuse in the United States takes place in Arizona, California, Florida and Texas. Many other states, however, recognize the need to consider reclaimed water as a water source (AWWA, 2004). A number of factors drive this need:

- Arid climates and lack of water resources;
- Drought;
- Water conservation as a regulatory requirement;
- Population growth and increasing demand;
- More stringent wastewater treatment requirements (i.e. for the protection of aquatic species);
- Technological advancements leading to reduced costs of reclaimed water; and
- Having a dependable nonpotable water source at a predictable cost.

Some of the obstacles that have been encountered when trying to implement reclaimed water projects are:

- Economic infeasibility;
- End user concerns with on-site conversion costs;
- Perception of potential health risks; and
- Gaining public acceptance.

There are other obstacles that projects have had to overcome. In some instances, dual piping for domestic use has been difficult to implement due to concerns about cross connections. Also, avoiding the creation of mosquito breeding grounds needs to be addressed when designing reclaimed water infiltration ponds.

Allowable uses of reclaimed water are based on the quality of the effluent. Each state's standards determine the effluent quality requirements.

Arizona

Reclaimed water is used for the irrigation of golf courses, landscapes, crops, parks, and siviculture, as well as wetlands enhancement. In addition, Arizona Department of Water Resources has a program to encourage water conservation through aquifer storage and recharge (ASR). Projects can receive Long Term Storage Credits for water used to recharge aquifers. These credits can be used after at least a year of storage, when the owner needs water. Due to the lack of water supplies and the increases in demand, reclaimed water will continued to be used as a water source in Arizona (AWWA, 2004).

California

According to a 2002 study conducted by the State Water Resources Control Board (SWRCB), California is currently recycling approximately 500,000 acre-feet of water annually. Table 1 and Figure 1 show the types of uses within the state. The long term goal of the 2002 California Recycled Water Task Force is to triple the amount of reuse by 2020 (AWWA, 2004).

Table 1
2002 Volume of Reclaimed Water Use in California

Types of Water Reuse	Volume (acre-feet/year)
Agricultural irrigation	240,951
Landscape and irrigation	111,100
Industrial Use	27,857
Ground water recharge	49,033
Seawater Barrier	25,651
Recreational Impoundment	33,103
Wildlife habitat or misc.	20,200
Geysers/Energy Production	2,198
Other or mixed type	15,369
Total	**525,462**

Source: Office of Water Recycling, California State Water Resources Control Board

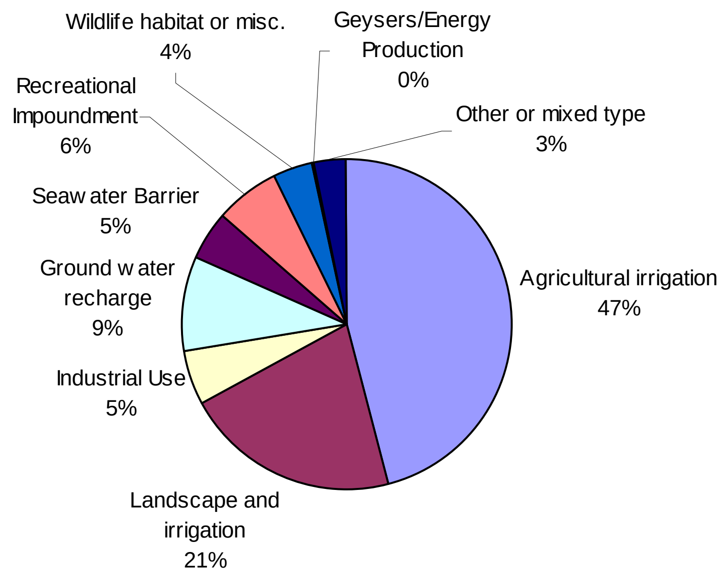


Figure 1
2002 Reclaimed Water Usage in California

Some projects in the state have been difficult to implement. For example, in 1999 the City of San Diego stopped plans for an indirect potable use of reclaimed water, due to questions about public safety and concerns that water would only be supplied to low income neighborhoods (Lee, 2005). Similarly, in 2002 the Dublin San Ramon Service District decided to use reclaimed water for landscape irrigation, instead of an ASR project in potable water groundwater basin. In other parts of the state, these projects have been easier to implement. For example, Orange County Water District is currently constructing an ASR project where reclaimed water will be injected in potable water groundwater basin (Lee, 2005). San Diego, which imports up to ninety percent of its drinking water, is still hoping to gain public acceptance for this type of project,

Florida

Water reuse systems have been developing in Florida for the last 20 years. Initially, reclaimed water was given away. Now there are hundreds of reuse projects (Table 2 and Table 3) and many of the communities that have developed systems are selling the water for as much as 80 percent of the cost of potable water.

Table 2
Summary of Florida Treatment/Reuse Facilities

Water Management District	No. of Treatment Facilities	No. of Reuse Systems	No. of Residences Irrigated	No. of Golf Courses Irrigated	No. of Parks Irrigated	No. of Schools Irrigated
Northwest Florida	53	52	821	22	4	1
South Florida	112	110	66,569	153	79	26
St. Johns River	143	135	43,260	118	148	72
Suwannee River	22	22	0	2	0	0

Table 2
Summary of Florida Treatment/Reuse Facilities

Water Management District	No. of Treatment Facilities	No. of Reuse Systems	No. of Residences Irrigated	No. of Golf Courses Irrigated	No. of Parks Irrigated	No. of Schools Irrigated
Southwest Florida	138	121	64,612	148	277	126
2004 Totals	**468**	**440**	**175,262**	**443**	**508**	**225**
2003 Totals	469	436	154,234	427	486	213
% Change	-0.21	+0.92	+13.6	+3.7	+4.5	+5.6

SOURCE: Florida Department of Environmental Protection, 2004 Reuse Inventory

Table 3
Summary of Florida Water Reuse Activities

Water Reuse Type	Number of Systems (1)	Reuse Capacity (MGD)	Reuse Flow (MGD)	Percent of Total
Public Access Areas and Landscape Irrigation				
Golf Course Irrigation	186	255.06	112.63	
Residential Irrigation	99	233.41	132.64	
Other Public Access Areas	101	135.67	63.85	
Subtotal	386	624.14	309.12	49
Agricultural Irrigation				
Edible Crops	19	46.87	14.71	
Other Crops	108	145.65	72.77	
Subtotal	127	192.52	87.48	14
Ground Water Recharge & Indirect Potable Reuse				
Rapid Infiltration Basins	171	159.65	85.45	
Absorption Fields	16	8.58	3.75	
Injection	1	10.00	8.61	
Subtotal	188	178.24	97.81	16
Industrial				
At Treatment Plant	94	117.70	56.11	
At Other Facilities	22	56.10	34.93	
Subtotal	116	173.80	91.04	14
Toilet Flushing	5	0.32	0.18	< 1
Fire Protection	1	0.10	0.10	< 1
Wetlands	16	92.13	40.38	7
Other Uses	9	11.82	4.07	< 1
Totals	**440**	**1,273.07**	**630.18**	

SOURCE: Florida Department of Environmental Protection, 2004 Reuse Inventory

Many communities have "public access" reuse systems that deliver direct nonpotable water to residential homes for irrigation. Many counties and cities require new developments to install reuse systems for irrigation. Treatment plants are required to provide Class 1 reliability, filtration and high level disinfection to provide high quality effluent for reclaimed water.

The key drivers to reuse in Florida have been:

- Discontinuing the practice of discharging effluent (and nutrients) to surface water;
- Increasing demand brought on by growth and compounded by salt water intrusion resulting from heavy groundwater pumping in coastal areas; and
- Realizing that potable water is not necessary for irrigation.

Since many of the projects are for irrigation, one of the challenges has been how to address the seasonal fluctuations which create cyclic shortages and surpluses. Sometimes these surpluses require a wet season discharge permit.

Texas

Based on a 1998 Water Use Survey conducted by Texas Water Development Board, one hundred ninety utilities reported municipal reuse totaling approximately 160 MGD (Texas Water Development Board, 2001). Golf course irrigation, manufacturing and cooling towers were the primary uses. Most of the reuse is occurring in the western half of the state, which receives significantly less rain than the eastern half. Data on reuse in the industrial sector was provided by 81 corporations/industries. These indicate reuse of 32 MGD, which likely underestimates the actual reuse since not all industries using reclaimed water responded. The major industrial reuse is in power plants, refineries, food processors, and chemical manufacturing operations. In addition, there are also over 600 no-discharge permits in Texas. These prevent an operation (most often agricultural and livestock) from discharging wastewater from its site. Texas water supplies are becoming increasingly scarce and more expensive. The state water plans calls for using current sources of water instead of developing new sources (AWWA, 2004).

Hawaii

According to the State of Hawaii Water Reuse Project Directory from November 2004, there are 68 reuse projects with a capacity of approximately 20 MGD (Table 4). These projects include irrigation of golf courses, agriculture and landscapes (parks, libraries, highways and schools) and dust control and other construction activities.

Table 4
Summary of Hawaii Reuse Projects

Types of Water Reuse	Number of Projects	Volume (MGD)
Agricultural irrigation	8	4.50
Landscape and irrigation	46	13.43
Industrial Use	6	1.60
Toilet Flushing	1	0.00
Other or mixed type	7	0.62
Total	68	20.14

SOURCE: State of Hawaii Water Reuse Project Directory, November 2004

Washington

According to a Washington State Department of Ecology (Ecology) 2005 Study, by the end of 2004 seventeen facilities had been constructed or upgraded to operate under the state's reclaimed water standards (Ecology, 2005) . The drivers for these projects were:
- Elimination or decrease in wastewater discharges for environmental purposes (i.e. shellfish);

- Additional water supplies including drought resistant supplies;
- Growth;
- Having a nonpotable water supply for irrigation; and
- Construction of new wastewater facilities.

As water demands increase, reclaimed water may be evaluated as an option to decrease potable water usage since "development of new surface water and groundwater sources is becoming more lengthy, costly and uncertain, given the multiple demands being made on a finite resource. Stringent environmental, regulatory and legal requirements are involve in establishing water rights and developing new supply facilities. Moreover, Ecology requires that water suppliers demonstrate that water conservation efforts have been duly considered, developed, and implemented prior to the granting of additional water rights (King County, 1995)." Future reclaimed water projects may also be driven by local ordinances. For example, in the City of Yelm water reuse can be required for new construction.

APPENDIX C
POTENTIAL RECLAIMED WATER USERS

In order to identify reclaimed water opportunities in the Seattle service area, potential reclaimed water users were first identified. The process for identifying potential reclaimed water users was as follows:

1. Identify major water users (see Table C-1) in the City of Seattle, based on 2004 records and obtain usage data including billed water consumption and billed sewer flow.
2. Estimate annual nonpotable water demand by subtracting sewer flow from water consumption. This number was used as an estimate of potential reclaimed water use. Actual reclaimed water use would depend on the type of water consumption at each site (i.e. irrigation, process water, etc.).

The potential reclaimed water users are mapped on Figure C-1, based on the parcel identification number (PIN). Users without PIN numbers are not shown. Users are mapped according to the nonpotable water demand estimate. For users with no billed sewer consumption the demand was not estimated. These are mapped in the demand "Unknown" category. Any demand that was estimated to be less than 500 ccf (100 cubic feet) per year was also included in the demand "Unknown" category, assuming that the water and sewer consumption were too close to include in the nonpotable demand categories.

In addition to the major water users, the projects identified in the 2003 Wastewater Reclamation and Rainwater Harvesting Study are also shown on Figure C-1. They are mapped according to the demand estimates in the 2003 Study (Table C-2).

Table C-1.
Major Seattle Water Users

Customer Name
ALEXANDRIA REAL ESTATE
AMERICAN PRESIDENT LINES
AMGEN INC
ARCTIC ICE CREAM
ASH GROVE CEMENT
BALLINGER COMMONS APTS
BENTALL CITY CENTRE LLC
BOEING COMMERCIAL AIRPLANE GROUP
BPB GYPSUM INC
BROADVIEW DEV ASSOC II
CAROLINE KLINE
CHILDRENS HOSPITAL
EDGEWATER INN
EDWARD J DEBARTOLO CORP
ELLIOTT BAY MARINA INC
EOP-COLUMBIA CENTER LLC
EQUITY OFFICE
FAIRMONT OLYMPIC HOTEL
FRED HUTCHINSON CANCER RESEARCH CENTER
GROUP HEALTH COOPERATIVE
HARBOR PROPERTIES INC
HARBORVIEW MEDICAL CENTER
HINES INTEREST LIMITED PARTNERSHIP
HORIZON HOUSE INC
HOSPITAL CENT SERV
IMMUNEX CORP
KING COUNTY DEPT METRO SVCS
KING COUNTY FACILITIES MANAGEMENT
KING COUNTY HOUSING AUTHORITY
L C FOSS SUNSET HOME INC
LAFARGE CORPORATION
LAKE WASHINGTON APTS LTD
METROPOLITAN TOWER
NORTHWEST HOSPITAL
NUCOR STEEL SEATTLE INC
OCEAN BEAUTY SEAFOODS INC
PARK-REGENCY WASH INC
PEPSI BOTTLING GROUP

Table C-1.
Major Seattle Water Users

Customer Name
PGC INTERBAY LLC
PIKE PLACE MARKET
PINE STREET DEVELOPMENT LLC
PORT OF SEATTLE
PROVIDENCE - MT ST VINCENT
PROVIDENCE HOSPITAL
PYRAMID BREWERIES INC
R C HEDREEN LLC
RADFORD COURT PROPERTIES
SAINT GOBAIN CONTAINERS
SEAFREEZE LTD PARTNERSHIP
SEATTLE CROWNE PLAZA
SEATTLE HOUSING AUTHORITY
SEATTLE MARINERS
SEATTLE MUNICIPAL TOWER
SEATTLE PARKS DEPARTMENT
SEATTLE SHERATON HOTEL
SEATTLE STEAM COMPANY
SHOREWOOD APTS
STEVEDORING SERVICE OF AMERICA
STOUFFER MADISON HOTEL
SUNSET VIEW APTS
SWEDISH MEDICAL CENTER
THE HIGHLANDS INC
THE WESTIN HOTEL SEATTLE
TODD SHIPYARDS
U VILLAGE LTD PARTNERSHIP
UNION SQUARE LIMITED PARNERSHIP
UNIVERSITY OF WASHINGTON
V A MEDICAL CENTER (04)
VINTAGE PARK APTS
VIRGINIA MASON MEDICAL CENTER
W SEATTLE
WASH ATHLETIC CLUB
WASH STATE TRADE & CONVENTION CENTER
WESTFARM FOODS
WESTLAKE CENTER ASSN
WOODLAND PARK ZOOLOGICAL SOCIETY

Table C-2.
2003 Study Demand Estimates for
Potential Reclaimed Water Project

Customer Name	Nonpotable Demand Estimate, ccf
NUCOR STEEL	106,311
MYRTLE EDWARDS PARK	2,304
ARBORETUM	9,366
MUNICIPAL GOLF OF SEATTLE - WEST SEATTLE	31,048
SOUTH SEATTLE COMMUNITY COLLEGE	1,996
CALVARY CATHOLIC	20,812
SOUTH TRANSFER STATION	3480
GREEN LAKE	n/a

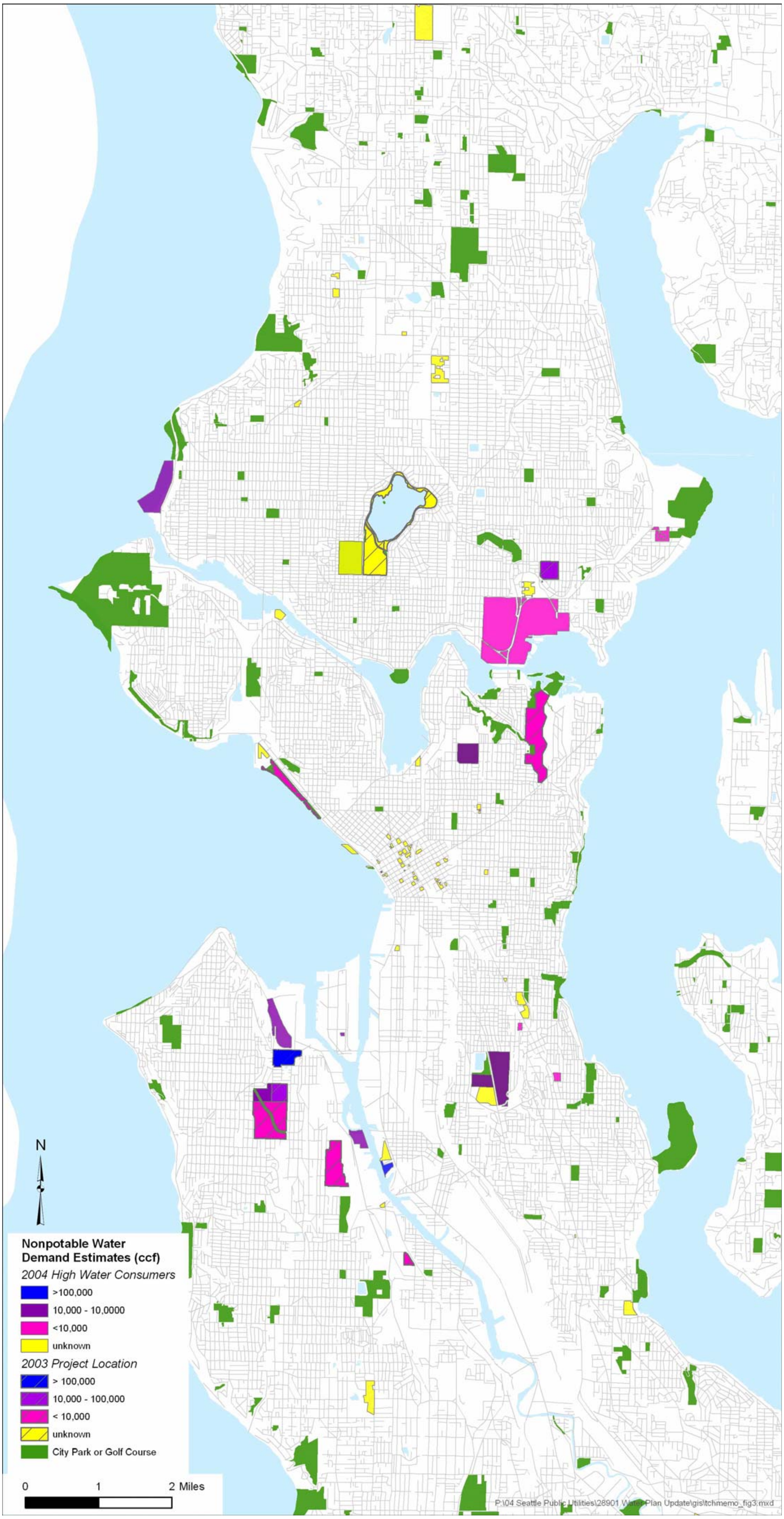


Figure C-1. Potential Reclaimed Water Users

APPENDIX D
Reclaimed Water Opportunities
Cost Estimate

Table 1
Reclaimed Water Oppurtunities
Cost Estimate

		2002			2005					
		West Seattle Golf Course Reclaimed Wastewater Facility A	West Seattle Golf Course Reclaimed Wastewater Facility B	Calvary Catholic Cemetery	West Seattle Golf Course Reclaimed Wastewater Facility A	West Seattle Golf Course Reclaimed Wastewater Facility B	Calvary Catholic Cemetery	Urban Commercial Core/Myrtle Edwards Park	Jackson Park Golf Course - KC Demand Estimate	Jackson Park Golf Course - SPU Demand Estimate
	Treatment Capacity (MGD)	*0.04-0.15*	*0.04-0.4*	*0.08-0.3*	*0.04-0.15*	*0.04-0.4*	*0.08-0.3*	*0.58-0.61*	*0.70*	*0.23*
	Treatment Volume (CCF)	*26,571*	*31,043*	*20,807*	*26,571*	*31,043*	*20,807*	*193,396*	*144,000*	*47,520*
	Percent of Construction Cost									
Pre-Construction										
Easement/Property Acquisition		$50,000	$50,000	$500,000	$57,600	$57,600	$547,300	$23,900	$400,000	$400,000
Planning/Permitting/SEPA	2%	$45,827	$83,732	$64,751	$51,106	$93,379	$72,211	$178,982	$6,468	$5,502
Administration/Project Management	1%	$22,913	$41,866	$32,376	$25,553	$46,690	$36,106	$89,491	$3,234	$2,751
Distribution System Planning	3%	$0	$0	$0	$0	$0	$0	$711,338	$367,575	$175,911
subtotal		*$119,000*	*$176,000*	*$598,000*	*$135,000*	*$198,000*	*$656,000*	*$1,004,000*	*$778,000*	*$585,000*
Design										
Design Services	15%	$343,699	$627,994	$485,634	$383,297	$700,346	$541,585	$1,342,364	$48,513	$41,261
Administration/Project Management	2%	$45,827	$83,732	$64,751	$51,106	$93,379	$72,211	$178,982	$6,468	$5,502
Distribution System Design	20%	$0	$0	$0	$0	$0	$0	$4,742,250	$2,450,500	$1,172,739
subtotal		*$390,000*	*$712,000*	*$551,000*	*$435,000*	*$794,000*	*$614,000*	*$6,264,000*	*$2,506,000*	*$1,220,000*
Construction										
MBR Facilty:										
Construction		$1,634,176	$2,981,120	$2,353,344	$1,822,452	$3,324,580	$2,624,477	$6,525,340	$0	$0
Construction Contingency	30%	$490,253	$894,336	$706,003	$546,736	$997,374	$787,343	$1,957,602	$0	$0
Construction Management	15%	$318,664	$581,318	$458,902	$355,378	$648,293	$511,773	$1,272,441	$0	$0
Administration/Project Management	2%	$42,489	$77,509	$61,187	$47,384	$86,439	$68,236	$169,659	$0	$0
subtotal		*$2,486,000*	*$4,535,000*	*$3,580,000*	*$2,772,000*	*$5,057,000*	*$3,992,000*	*$9,926,000*	*$0*	*$0*
Pumps										
Construction		$84,864	$87,040	$82,688	$94,641	$97,068	$92,215	$358,579	$248,784	$211,597
Construction Contingency	30%	$25,459	$26,112	$24,806	$28,392	$29,120	$27,664	$107,574	$74,635	$63,479
Construction Management	15%	$16,548	$16,973	$16,124	$18,455	$18,928	$17,982	$69,923	$48,513	$41,261
Administration/Project Management	2%	$2,206	$2,263	$2,150	$2,461	$2,524	$2,398	$9,323	$6,468	$5,502
subtotal		*$130,000*	*$133,000*	*$126,000*	*$144,000*	*$148,000*	*$141,000*	*$546,000*	*$379,000*	*$322,000*
Other										
Construction		$43,520	$152,320	$54,400	$48,534	$169,869	$60,668	$15,807,500	$9,425,000	$4,510,536
Construction Contingency[(4)]	30%	$13,056	$45,696	$16,320	$14,560	$50,961	$18,200	$7,903,750	$2,827,500	$1,353,161
Construction Management	15%	$8,486	$29,702	$10,608	$9,464	$33,124	$11,830	$3,556,688	$1,837,875	$879,554
Administration/Project Management	2%	$1,132	$3,960	$1,414	$1,262	$4,417	$1,577	$474,225	$245,050	$117,274
subtotal		*$67,000*	*$232,000*	*$83,000*	*$74,000*	*$259,000*	*$93,000*	*$27,743,000*	*$14,336,000*	*$6,861,000*
construction subtotal		*$2,683,000*	*$4,900,000*	*$3,789,000*	*$2,990,000*	*$5,464,000*	*$4,226,000*	*$38,215,000*	*$14,715,000*	*$7,183,000*

Notes:
(1) 2002 Costs from 2003 Study were modified to reflect a higher construction contingency.
(2) 2002 Construction costs updated to 2005 dollars with Engineering Record (ENR) construction cost ratio.
(3) 2002 Easement/Property Acquisition costs updated to 2005 dollars based on assumed King County Assessor Commercial Appraisal Reports
(4) 50% contingency used for the Urban Commercial Core/Myrtle Edwards Park due to the added uncertainity of installing a distribution system downtown.
MBR = Membrane Bioreactor
MGD = million gallons per day
CCF = 100 cubic feet

ENR Construction Costs

	Seattle	20 Cities
2002 ENR, 12 month ave	7,560	6,538
2005 ENR, Nov	8,431	7,630
Conversion	1.12	1.17

APPENDIX E
Jackson Park Golf Course
Proposed Project Demand and Cost Estimates

Contractor markups are allocated to the individual line items with the exception of Contingency and are based on conventionally accepted values, adjusted for project-area economic factors. The markups used are:

Item	Rate, percent
Prime contractor	
Labor (Employer Payroll Burden)	18
Materials and Process Equipment	15
Equipment (Construction related)	15
Subcontractor	5
Sales Tax (State & Local for Materials, Process Equipment & Construction equipment rentals, etc.)	8.8
Builder's Risk, Liability, and Vehicle Insurance	2.85
Material Shipping & Handling	2
Subcontractor Markups:	Same as Prime
Escalation to midpoint of construction:	3
Building Permits	1.5
Performance Bond	1
Payment Bond	1

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Grand Total
1101 - 18" PIPELINE ALTERNATE											
01 - GENERAL REQUIREMENTS											
01050 - Contractors Operations											
0050	Field personnel, superintendent	13.00	week	2,292.30	29,800						29,800
01160 - Office											
0040	Office, storage boxes, 28' x 10', rent per month	3.00	each			304.09	912				912
01170 - Field office expense											
0050	Field subcontract, utility underground locating service	0.50	week					772			772
0060	Field office expense, small tool allowance	3.00	each							11,482	11,482
01200 - General equipment rental											
0300	Rent toilet portable chemical	3.00	mo					257			257
0403	Rent truck pickup 3/4 ton 2 wheel drive, superintendent	3.00	mo					4,117			4,117
01240 - As-Built Drawings											
0010	As-built drawings,punch list, permits	1.00	lsum							8,748	8,748
01250 - Surveying											
0020	Surveying, crew for building layout, 3 person crew	1.00	day	1,306.61	1,307						1,307
	GENERAL REQUIREMENTS Total				*31,107*		*912*	*5,146*		*20,230*	*57,394*
02 - SITE CONSTRUCTION											
02160 - Rubbish handling											
9999	Dump Charge, typical urban city, fees only, bldg constr mat'ls	12.15	ton							439	439
02330 - Backfill, structural											
0080	Backfill, structural, 300 H.P., 300' haul, common earth	9.44	cuyd	0.45	4				12		17
02340 - Bedding											
0010	Bedding, crushed stone 3/4" to 1/2"	3.10	cuyd	7.65	24	28.02	87		6		117
02360 - Compaction											
0030	Compaction, vibratory plate, 8" lifts, Bedding	2.67	cuyd	1.79	5				1		6
0040	Compaction, vibratory plate, 8" lifts, Backfill	8.50	cuyd	1.66	14				4		18
0130	Compaction, walk behind, vibrating plate, 8" lifts, Subgrade	2.67	cuyd	2.56	7				2		9
02420 - Excavating, structural											
0030	Excavating, structural, mach excav, com earth, hyd backhoe, 1 CY bkt	15.61	cuyd	7.99	125				121		245
0030	Edge Excavating, structural, mach excav, com earth, hyd backhoe, 1 CY bkt	3.56	cuyd	7.99	28				28		56
02430 - Fill											
0080	Granular fill	2.67	cuyd	12.74	34	11.33	30		36		100

SPU RECLAIMED WATER SYSTEM, 18 INCH PIPELINE

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Grand Total
02460 - Hauling											
0020	Hauling, LCY, no loading, 12 c.y dump truck, 10 MI RT, 0.60 lds/hr	12.15	cuyd	5.01	61				125		186
0900	Loading Trucks, F.E. Loader, 3 C.Y.	12.15	cuyd	0.63	8				16		24
	SITE CONSTRUCTION Total				*309*		*117*		*352*	*439*	*1,217*
03 - CONCRETE											
03090 - Forms place, slab grade											
0030	Forms in place, SOG, edge forms, over 12", wood	72.00	sfca	4.59	331	3.48	250				581
03130 - Reinforcing in place											
0070	Reinforcing in place, A615 Gr 60, slab on grade, #3 to #7	0.36	ton	802.28	289	2,162.40	778				1,066
0070	Reinforcing in place, A615 Gr 60, slab on grade, #3 to #7	0.03	ton	802.28	22	2,162.40	60				82
0070	Reinforcing in place, A615 Gr 60, slab on grade, #3 to #7	0.10	ton	802.28	82	2,162.40	221				303
03150 - Concrete, ready mix											
0030	Concrete, ready mix, regular weight, 4000 psi	8.89	cuyd			162.18	1,442				1,442
0030	Concrete, ready mix, regular weight, 4000 psi	0.40	cuyd			162.18	64				64
03170 - Placing concrete											
0120	Placing conc, incl vib, slab on grade, slab over 6" thick, pumped	8.89	cuyd	16.25	144				54		198
0120	Placing conc, incl vib, slab on grade, slab over 6" thick, pumped	0.40	cuyd	16.25	6				2		9
03180 - Finishing floors											
0030	Finishing floors, monolithic, screed, float & broom finish	152.00	sqft	0.68	103						103
	CONCRETE Total				*978*		*2,815*		*56*		*3,849*
11 - EQUIPMENT											
11090 - Pumps, general utility											
0240	Pump, cntfgl, horiz mtd, end suct,vert splt,sgl stg,1050GPM,40HP	4.00	each	1,567.93	6,272	6,410.84	25,643				31,915
	EQUIPMENT Total				*6,272*		*25,643*				*31,915*
13 - SPECIAL CONSTRUCTION											
13100 - Pre-engnrd Metal Buildngs											
0010	Pre-engd.bldg.,rgd.clr.span fr.,26 ga.rfg. & sdg.12'x12'w.	144.00	sqft					18,936			18,936
	SPECIAL CONSTRUCTION Total							*18,936*			*18,936*
15 - MECHANICAL											
15010 - Misc. Mechanical											
0530	Misc. Mechanical, allowance	1.00	each	5,094.00	5,094	6,757.50	6,758		1,332		13,183
15255 - Valves, iron body											

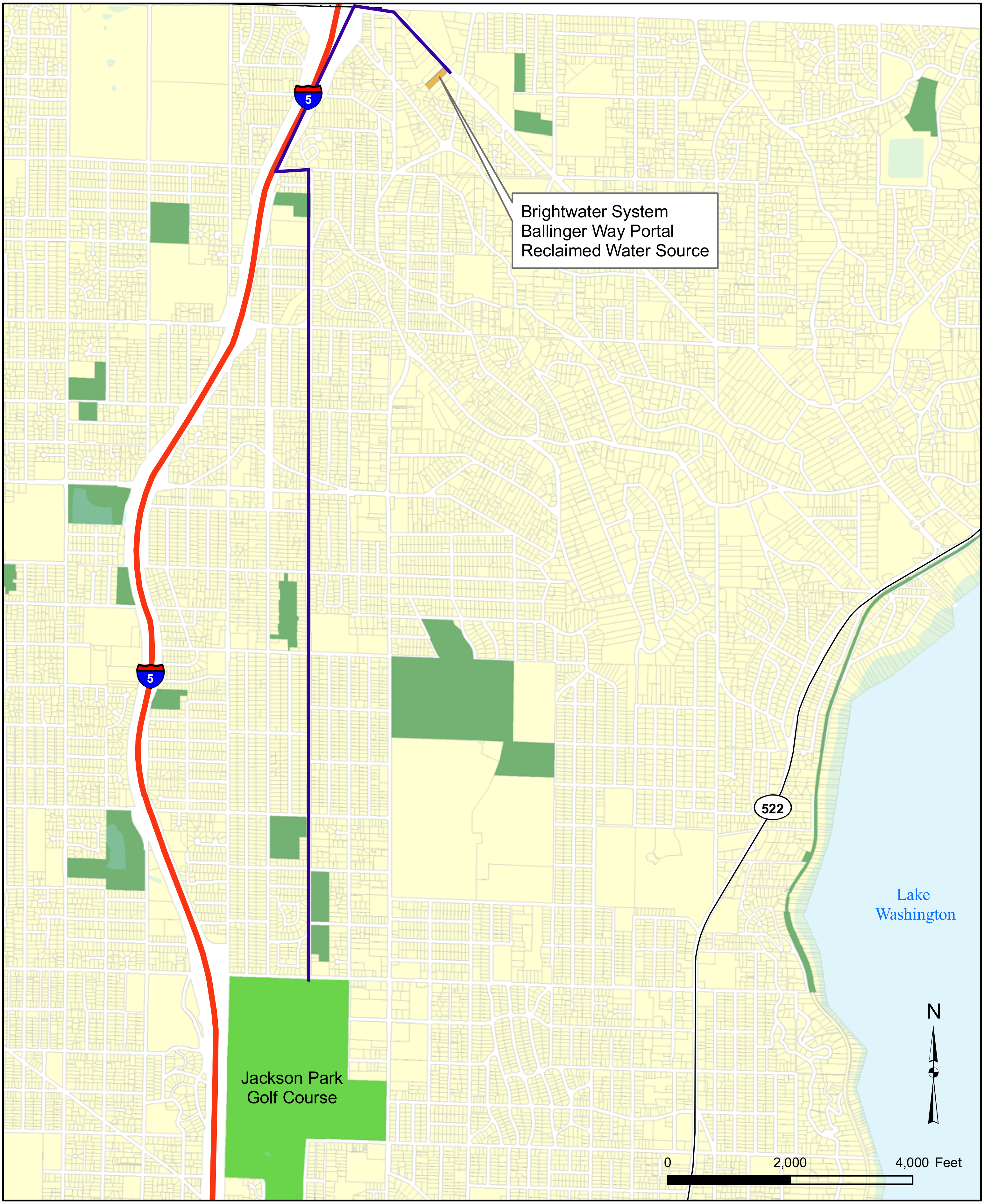
Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Grand Total
0150	Valves, iron body, butterfly, lug type, 200 PSI, gear operated, 6"	6.00	each	313.59	1,882	406.86	2,441				4,323
15265 - Multipurpose valves											
0170	Valve, pressure relief, 8"	1.00	each	555.31	555	2,578.66	2,579				3,134
15300 - Automatic air vent											
0080	Auto air vent, CI body, sst internals, float type, 2" NP inl, 250psi	2.00	each	78.39	157	1,117.42	2,235				2,392
15515 - Misc HVAC											
0010	HVAC heating, cooling allowance	144.00	sqft					2,058			2,058
	MECHANICAL Total				*7,688*		*14,012*	*2,058*	*1,332*		*25,090*
16 - ELECTRICAL											
16195 - Electrical & Instrument											
0101	Electrical and Instrumentation, allowance	1.00	lsum					57,175			57,175
16225 - Vrbl frqn drv/ frqn drivs											
1180	Variable frequency drives custom-engineered, 460 V, 40 HP motor size	4.00	each	2,096.56	8,386	11,205.52	44,822				53,208
	ELECTRICAL Total				*8,386*		*44,822*	*57,175*			*110,383*
	1101 - 18" PIPELINE ALTERNATE Total				*54,739*		*88,322*	*83,315*	*1,739*	*20,668*	*248,784*

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Grand Total
1102 - 10" PIPELINE ALTERNATE											
01 - GENERAL REQUIREMENTS											
01050 - Contractors Operations											
0050	Field personnel, superintendent	13.00	week	2,292.30	29,800						29,800
01160 - Office											
0040	Office, storage boxes, 28' x 10', rent per month	3.00	each			304.09	912				912
01170 - Field office expense											
0050	Field subcontract, utility underground locating service	0.50	week					772			772
0060	Field office expense, small tool allowance	3.00	each							11,482	11,482
01200 - General equipment rental											
0300	Rent toilet portable chemical	3.00	mo					257			257
0403	Rent truck pickup 3/4 ton 2 wheel drive, superintendent	3.00	mo					4,117			4,117
01240 - As-Built Drawings											
0010	As-built drawings,punch list, permits	1.00	lsum							8,748	8,748
01250 - Surveying											
0020	Surveying, crew for building layout, 3 person crew	1.00	day	1,306.61	1,307						1,307
	GENERAL REQUIREMENTS Total				*31,107*		*912*	*5,146*		*20,230*	*57,394*
02 - SITE CONSTRUCTION											
02160 - Rubbish handling											
9999	Dump Charge, typical urban city, fees only, bldg constr mat'ls	8.84	ton							319	319
02330 - Backfill, structural											
0080	Backfill, structural, 300 H.P., 300' haul, common earth	8.27	cuyd	0.45	4				11		14
02340 - Bedding											
0010	Bedding, crushed stone 3/4" to 1/2"	2.15	cuyd	7.65	16	28.02	60		4		81
02360 - Compaction											
0030	Compaction, vibratory plate, 8" lifts, Bedding	1.85	cuyd	1.79	3				1		4
0040	Compaction, vibratory plate, 8" lifts, Backfill	7.45	cuyd	1.66	12				4		16
0130	Compaction, walk behind, vibrating plate, 8" lifts, Subgrade	1.85	cuyd	2.56	5				1		6
02420 - Excavating, structural											
0030	Excavating, structural, mach excav, com earth, hyd backhoe, 1 CY bkt	12.38	cuyd	7.99	99				96		195
0030	Edge Excavating, structural, mach excav, com earth, hyd backhoe, 1 CY bkt	2.96	cuyd	7.99	24				23		47
02430 - Fill											
0080	Granular fill	1.85	cuyd	12.73	24	11.33	21		25		69

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Grand Total
02460 - Hauling											
0020	Hauling, LCY, no loading, 12 c.y dump truck, 10 MI RT, 0.60 lds/hr	8.84	cuyd	5.01	44				91		135
0900	Loading Trucks, F.E. Loader, 3 C.Y.	8.84	cuyd	0.63	6				12		17
	SITE CONSTRUCTION Total				*237*		*81*		*268*	*319*	*905*
03 - CONCRETE											
03090 - Forms place, slab grade											
0030	Forms in place, SOG, edge forms, over 12", wood	60.00	sfca	4.59	276	3.48	209				484
03130 - Reinforcing in place											
0070	Reinforcing in place, A615 Gr 60, slab on grade, #3 to #7	0.25	ton	802.28	203	2,162.40	548				752
0070	Reinforcing in place, A615 Gr 60, slab on grade, #3 to #7	0.02	ton	802.28	18	2,162.40	50				68
0070	Reinforcing in place, A615 Gr 60, slab on grade, #3 to #7	0.09	ton	802.28	68	2,162.40	184				253
03150 - Concrete, ready mix											
0030	Concrete, ready mix, regular weight, 4000 psi	6.67	cuyd			162.18	1,081				1,081
0030	Concrete, ready mix, regular weight, 4000 psi	0.33	cuyd			162.18	53				53
03170 - Placing concrete											
0120	Placing conc, incl vib, slab on grade, slab over 6" thick, pumped	6.67	cuyd	16.25	108				40		149
0120	Placing conc, incl vib, slab on grade, slab over 6" thick, pumped	0.33	cuyd	16.25	5				2		7
03180 - Finishing floors											
0030	Finishing floors, monolithic, screed, float & broom finish	106.67	sqft	0.68	72						72
	CONCRETE Total				*752*		*2,126*		*42*		*2,920*
11 - EQUIPMENT											
11090 - Pumps, general utility											
0220	Pump, cntfgl, horiz mtd, end suct,vert splt,sgl stg,500GPM,25HP	3.00	each	1,088.84	3,267	4,441.03	13,323				16,590
	EQUIPMENT Total				*3,267*		*13,323*				*16,590*
13 - SPECIAL CONSTRUCTION											
13100 - Pre-engnrd Metal Buildngs											
0020	Pre-engd.bldg.,rgd.clr.span fr.,26 ga.rfg. & sdg.10'x10'w.	100.00	sqft					13,150			13,150
	SPECIAL CONSTRUCTION Total							*13,150*			*13,150*
15 - MECHANICAL											
15010 - Misc. Mechanical											
0530	Misc. Mechanical, allowance	1.00	each	3,820.50	3,821	5,406.00	5,406		1,332		10,558
15255 - Valves, iron body											

Item	Item Description	Quantity	Unit	Labor $/Unit	Labor Amount	Materials $/Unit	Material Amount	Subs Amount	Equip Amount	Other Amount	Grand Total
0160	Valves, iron body, butterfly, lug type, 200 PSI, gear operated, 8"	8.00	each	382.18	3,057	2,713.33	21,707				24,764
15265 - Multipurpose valves											
0170	Valve, pressure relief, 8"	1.00	each	555.31	555	2,578.66	2,579				3,134
15300 - Automatic air vent											
0080	Auto air vent, CI body, sst internals, float type, 2" NP inl, 250psi	2.00	each	78.39	157	1,117.42	2,235				2,392
15515 - Misc HVAC											
0010	HVAC heating, cooling allowance	100.00	sqft					1,429			1,429
	MECHANICAL Total				*7,590*		*31,926*	*1,429*	*1,332*		*42,277*
16 - ELECTRICAL											
16195 - Electrical & Instrument											
0101	Electrical and Instrumentation, allowance	1.00	lsum					45,740			45,740
16225 - Vrbl frqn drv/ frqn drivs											
1160	Variable frequency drives custom-engineered, 460 V, 25 HP motor size	3.00	each	2,096.56	6,290	8,777.07	26,331				32,621
	ELECTRICAL Total				*6,290*		*26,331*	*45,740*			*78,361*
	1102 - 10" PIPELINE ALTERNATE Total				*49,242*		*74,700*	*65,465*	*1,641*	*20,549*	*211,597*

Jackson Park Golf Course Alternative
Force Main Location Used for Cost Estimate



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APPENDIX F
Urban Commercial Core/Myrtle Edwards
Proposed Project Demand and Cost Estimates

SPU 2007 Water Plan Update
Reclaimed Water Opportunities
Jackson Park Golf Course

DEMAND ESTIMATE

Entity	*Estimated MGD*			*Estimated CFS*			*Estimated GPM*		
	5 Mo Season	*Peak Day*	*Peak Hour*	*5 Mo Season*	*Peak Day*	*Peak Hour*	*5 Mo Season*	*Peak Day*	*Peak Hour*
King County	0.70	1.08	3.25	1.1	1.7	5.0	489	753	2,259
SPU	0.23	0.36	1.07	0.4	0.6	1.7	161	248	745

Month	*Days in month*	***King County*** ADD (MGD)	Monthly Demand (MG)	Monthly Demand (CCF)	***SPU*** ADD (MGD)	Monthly Demand (MG)	Monthly Demand (CCF)
June	30	0.704	21.12	28,235	0.232	6.97	9,318
July	31	0.704	21.82	29,176	0.232	7.20	9,628
August	31	0.704	21.82	29,176	0.232	7.20	9,628
September	30	0.704	21.12	28,235	0.232	6.97	9,318
October	31	0.704	21.82	29,176	0.232	7.20	9,628
Total	*153*	*3.5*	*108*	*144,000*	*1.2*	*36*	*47,520*

MGD = million gallons per day
CFS = cubic feet per second
gallons per minut
MG = million gallons
CCF = 100 cubic feet

gal per cf
7.48

SPU demand adjustment
0.33

DEMAND ESTIMATE

Toilet Flush Flows

Age	*Type*	*Volume per Use (gallons)*
New	1.6 gal/flush	1.6

Source: Seattle Home Water Conservation Study, December 2000

Urinal Flush Flows

Age	*Type*	*Volume per Use (gallons)*
New	1.0 gal/flush	1

Source: Washington State 1993 Plumbing Code

Daily Toilet Usage

	Mean (uses/day)
Residential (1)	5.46
Commercial - women (2)	2.14
Commercial - men (2)	0.71

Sources: (1) Seattle Home Water Conservation Study, December 2000
(2) Vickers, Amy. Handbook of Water Use and Conservation, 2001
Notes: Commercial usage for women based on 3 uses/day during a 5 day work week
Commercial usage for men based on 1 use/day during a 5 day work week

Daily Urinal Usage

	Mean (uses/day)
Residential	NA
Commercial	1.43

Source: Vickers, Amy. Handbook of Water Use and Conservation, 2001
Note: Commercial usage based on 2 uses/day during a 5 day work week

Residential Toilet Flushing *(gal/day/person)*	8.74
Commercial Toilet/Urinal Flushing *(gal/day/person)*	3.00

Assumptions

	Fraction of Workforce	*Commercial Use (gal/day)*
Women	0.5	3.4
Men	0.5	2.6

Potential Reclaimed Water Daily Usage

	Residential			Commercial		*Total*
	Households Growth Target	*Population Growth Target*	*Toilet Flushing (gal/day)*	*Jobs Growth Target*	*Toilet Flushing (gal/day)*	*Use (gal/day)*
Denny Triangle	3,000	6,150	53,726	9,515	28,545	82,271
Belltown	4,700	9,635	84,171	4,000	12,000	96,171
South Lake Union	8,000	16,400	143,270	16,000	48,000	191,270
Uptown Queen Anne	1,000	2,050	17,909	1,150	3,450	21,359
Total (MGD)			**0.30**		**0.09**	**0.39**

Notes: Growth Targets are for the year 2024 and are from the City of Seattle Comprehensive Plan, 2005
Population Growth Target estimated as 2.05 People/Households * Household Growth Target
Average Household size is for the year 2020 and is from the City of Seattle Comprehensive Plan, 2005

Other Potential Uses

	Use
Irrigation of Myrtle Edwards Park	1.7 MGY (from May to November)

MONTHLY DEMAND ESTIMATE

Average Daily Demand (gal/day)

	Residential	*Commerical*	*Myrtle Edwards* [(1)]	*Total*	*Total (MGD)*
Jan	299,077	91,995	0	391,072	0.39
Feb	299,077	91,995	0	391,072	0.39
March	299,077	91,995	0	391,072	0.39
April	299,077	91,995	0	391,072	0.39
May	299,077	91,995	1,954	393,026	0.39
June	299,077	91,995	3,416	394,488	0.39
July	299,077	91,995	6,660	397,732	0.40
August	299,077	91,995	12,402	403,474	0.40
September	299,077	91,995	12,716	403,788	0.40
October	299,077	91,995	12,185	403,257	0.40
November	299,077	91,995	7,006	398,078	0.40
December	299,077	91,995	0	391,072	0.39
				Min	0.39
				Max	0.40

(1) Source: SPU Wastewater Reclamation and Rainwater Harvesting Study, 2003

Maximum Daily Demand (gal/day)

	Residential	*Commerical*	*Myrtle Edwards*	*Total*	*Total (MGD)*
Peak Factor	1.5	1.5	1.5		
Jan	448,615	137,993	0	586,608	0.59
Feb	448,615	137,993	0	586,608	0.59
March	448,615	137,993	0	586,608	0.59
April	448,615	137,993	0	586,608	0.59
May	448,615	137,993	2,932	589,540	0.59
June	448,615	137,993	5,124	591,732	0.59
July	448,615	137,993	9,989	596,597	0.60
August	448,615	137,993	18,603	605,211	0.61
September	448,615	137,993	19,074	605,682	0.61
October	448,615	137,993	18,278	604,886	0.60
November	448,615	137,993	10,509	597,117	0.60
December	448,615	137,993	0	586,608	0.59
				Min	0.59
				Max	0.61

Notes:
2003 Study assumed Monthly Irrigation PDD = 1.5 x ADD
Water System Design Manual PDD = (1.5 to 3.0)ADD

Peak Hourly Demand (gpm)

	Residential	*Commerical*	*Myrtle Edwards*	*Total (gpm)*
Peak Factor	1.7	1.7	1.7	
Jan	353	109	0	462
Feb	353	109	0	462
March	353	109	0	462
April	353	109	0	462
May	353	109	2	464
June	353	109	4	466
July	353	109	8	470
August	353	109	15	476
September	353	109	15	477
October	353	109	14	476
November	353	109	8	470
December	353	109	0	462
			Min	462
			Max	477

Water System Design Manual states PHD should be calculated as per equation 5-3. This calculation, however, is not appropriate for this analysis.

The generalized equation for PHD determinations is:

PHD = (MDD/1440)[(C)(N) + F] + 18 (equation 5-3)

Where:
PHD = Peak Hourly Demand, (gallons per minute, gpm)
C = Coefficient Associated with Ranges of ERUs
N = Number of Service Connections, ERUs
F = Factor Associated with Ranges of ERUs
MDD = Maximum Day Demand, (gpd/ERU)

SYSTEM SIZING BASIS

Component	*Sizing Basis*	*min*	*max*	*units*	*notes*
MBR	MDD	0.59	0.61	MGD	Design Life = 50 years
Storage Tank	OS+SB+ES+DS	928,796	958,996	gal	
Booster Pumps to end user	PHD	462	477	gpm	
Distribution Piping	PHD at 30 psi	12		inches	
Transmission Piping	PHD at 30 psi	6		inches	

Operational Storage, OS	Continuous Pumping: 0	0	0	gal	Volume to supply demands while MBR is off. Assume MBR is operating 24-hour/day, 365 days/year
Standby Storage, SB	2*ADD @ 20 psi	782,144	807,576	gal	Sizing for a single source
Equalizing Storage, ES	25% MDD	146,652	151,420	gal	Water System Design Manual: On-Call Demand: (PHD-Qs)*(150 min) @ 30 psi Continuous Pumping: Prepare Mass Analysis
Dead Storage, DS		0	0	gal	If volume booster is not capable of pumping at design flow rate.

Other Sizing Criteria
The entire system must meet MDD.
A pressure of 30 psi must be maintained in the distribution system when ES is depleted.
The maximum system pressure is 100 psi.

Notes
ADD = Average Day Demand
MDD = Maximum Day Demand
PHD = Peak Hourly Demand

Urban Village Element Appendix

Urban Village Appendix A

Growth Targets for Urban Centers, Center Villages, Manufacturing/ Industrial Centers, Hub Urban Villages, & Residential Urban Villages

Center or Village	Land Area in Acres	Households (HH)				Employment (Jobs)			
		Existing (2004)	Existing Density (HH/ Acre)	Growth Target (HH Growth)	2024 Density (Est.)	Existing (2002)	Existing Density (Jobs/ Acre)	Growth Target (Job Growth)	2024 Density (Est.)
Urban Centers & Center Villages									
Downtown Urban Center Total	**952**	**15,700**	**16**	**10,000**	**28**	**156,960**	**165**	**29,015**	**195**
Belltown	220	8,640	39	4,700	63	19,760	90	4,000	108
Chinatown/ International District	171	1,910	11	1,000	18	5,080	30	2,000	41
Commercial Core	276	3,070	11	300	13	103,790	376	10,000	412
Denny Triangle	143	1,290	9	3,000	30	18,020	126	9,515	189
Pioneer Square[1]	142	790	6	1,000	13	10,310	73	3,500	97
First Hill/Capitol Hill Center Total	**916**	**22,520**	**25**	**3,500**	**30**	**37,940**	**41**	**4,600**	**47**
12th Ave.	160	1,450	9	700	14	4,040	25	700	30
Capitol Hill	397	12,250	31	1,000	35	7,300	18	900	21
First Hill	228	6,020	26	1,200	33	22,020	97	2,000	105
Pike/Pine	131	2,800	21	600	27	4,580	35	1,000	43
Northgate Urban Center Total	**411**	**3,490**	**8**	**2,500**	**15**	**11,030**	**27**	**4,220**	**38**
South Lake Union Urban Center Total	**340**	**1,210**	**4**	**8,000**	**33**	**19,690**	**58**	**16,000**	**135**
University Community Urban Center Total[2]	**758**	**6,850**	**9**	**2,450**	**11**	**32,360**	**43**	**6,140**	**53**
Ravenna	123	1,400	11	450	14	1,960	16	500	21
University District Northwest	287	5,230	18	2,000	23	6,170	21	2,640	37
Uptown Queen Anne Urban Center Total	**297**	**4,580**	**15**	**1,000**	**20**	**15,570**	**52**	**1,150**	**56**

average household size in 2020 = 2.05 people

SPU WATER SYSTEM UPDATE

FACILITY LOCATED WITHIN MYRTLE EDWARDS PARK

prelinimary cost estimate

Prepared By Brown and Caldwell, December 7, 2005

Except for facility entrances, all facilities are assumed to be constructed below grade to midigate impact on park and associated views. Facilities to be earth covered and planted. Where screening is required, brick and precast concrete is assumed for cost estimate. Facility shall be provided with odor control by means of a biofilter and sound proofing of structures and buildings is to be provided

				Material		Labor				Equipment			
Item	**Description**	**Quantity**	**Unit**	**Unit cost**	**Amount**	**Labor Hr.**	**Total Hr.**	**Rate**	**Amount**	**Unit Cost**	**Amount**	**Total**	
INFLUENT PUMP STATION													
Division 2, Civil Site													
1	Sheeting/Shoring	1,800	SF	$14.00	$25,200	0	0	$55	$0	$0.00	$0	$25,200	
	Dewatering Allowance	1	LS	$0.00	$0	0	0	$55	$0	$10,000.00	$10,000	$10,000	
	Excavation	250	CY	$0.00	$0	0	0	$45	$0	$3.50	$875	$875	
	Material Disposal	250	CY	$0.00	$0	0	0	$45	$0	$20.00	$5,000	$5,000	
	Import Backfill	170	CY	$25.00	$4,250	0.16	27.2	$45	$1,224	$5.00	$850	$6,324	
2	110-Inch Precast Wet Well(18' Depth)	1	EA	$13,000.00	$13,000	0	0	$48	$0	$800.00	$800	$13,800	
3	12" Base Rock	8	CY	$25.00	$200	0.1	0.8	$48	$38	$2.50	$20	$258	
4	Pipe Excavation	900	CY	$0.00	$0	0	0	$45	$0	$3.00	$2,700	$2,700	
	Bedding	200	CY	$25.00	$5,000	0.1	20	$45	$900	$2.50	$500	$6,400	
	Import Backfill	350	CY	$20.00	$7,000	0.16	56	$45	$2,520	$5.00	$1,750	$11,270	
	Native Backfill	350	CY	$0.00	$0	0.16	56	$45	$2,520	$5.00	$1,750	$4,270	
	Surplus Disposal	550	CY	$0.00	$0	0	0	$45	$0	$25.00	$13,750	$13,750	
	Surface Restoration	666	SY	$10.00	$6,660	0	0	$45	$0	$0.00	$0	$6,660	
	Trench Safety Allowance	600	LF	$0.00	$0	0	0	$45	$0	$2.50	$1,500	$1,500	
	Trench Dewatering Allowance	1	LS	$0.00	$0	0	0	$45	$0	$5,000.00	$5,000	$5,000	
4	Not Used	1	EA	$0.00	$0	0	0	$45	$0	$0.00	$0	$0	
Subtotal Division 2, Civil					**$61,310**		**160**		**$7,202**		**$44,495**	**$113,007**	**$113,007**
Division 3, Concrete													
1	14' X 2' Base Slab	12	CY	$400.00	$4,800	0	0	$48	$0	$0.00	$0	$4,800	
2	Construct Top Slab Wet Well	8	CY	$1,100.00	$8,800	0	0	$45	$0	$5.00	$40	$8,840	
3	Cast in Place Utility Vault	1	EA	$0.00	$0	0	0	$45	$0	$5.00	$5	$5	
	Bottom Slab On Grade	3	CY	$400.00	$1,200	0	0	$45	$0	$5.00	$15	$1,215	
	Perimeter Walls	4	CY	$1,000.00	$4,000	0	0	$45	$0	$5.00	$20	$4,020	
	Top Slab Of Vault	1	CY	$1,100.00	$1,100	0	0	$45	$0	$5.00	$5	$1,105	
4	Wet Well Interior Grout Allowance	1	LS	$1,000.00	$1,000	0	0	$45	$0	$0.00	$0	$1,000	
5	Misc Allowance	1	EA	$500.00	$500	12	12	$45	$540	$250.00	$250	$1,290	
Subtotal Division 3, Concrete					**$21,400**		**12**		**$540**		**$335**	**$22,275**	**$22,275**
Division 5, Metals													
1	Allowance for Metals & Hatches	1	LS	$5,000.00	$5,000	24	24	$56	$1,344	$150.00	$150	$6,494	
Subtotal Division 5, Metals					**$5,000**		**24**		**$1,344**		**$150**	**$6,494**	**$6,494**

Division 11, Equipment

1	7.5 HP Submersible Pumps/Control PNL	2	EA	$10,000.00	$20,000	32	64	$56	$3,584	$50.00	$100	$23,684	
2	Not Used	1	EA	$0.00	$0	0	0	$56	$0	$0.00	$0	$0	
Subtotal Division 11, Equipment					**$20,000**		**64**		**$3,584**		**$100**	**$23,684**	**$23,684**

Division 15, Mechanical

1	18-Inch DIP Incoming Raw Sewage	500	LF	$50.00	$25,000	0.58	290	$56	$16,240	$8.00	$4,000	$45,240	
	18-Inch Fitting Allowance	5	EA	$1,000.00	$5,000	5.8	29	$56	$1,624	$75.00	$375	$6,999	
	18-Inch Valve Allowance	1	EA	$3,750.00	$3,750	0	15	$56	$840	$0.00	$0	$4,590	
2	6-Inch Pump Discharge to Vault	34	LF	$26.00	$884	0.571	19.414	$56	$1,087	$0.00	$0	$1,971	
	6-Inch Fittings	4	EA	$60.00	$240	1	4	$56	$224	$0.00	$0	$464	
	6-Inch Check Valves	2	EA	$600.00	$1,200	8	16	$56	$896	$0.00	$0	$2,096	
	6-Inch Plug Valves	2	EA	$650.00	$1,300	8	16	$56	$896	$0.00	$0	$2,196	
	6-Inch Flanges	10	EA	$78.00	$780	1.043	10.43	$56	$584	$0.00	$0	$1,364	
	6-Inch bolt and Gasket Sets	10	EA	$14.00	$140	0	0	$56	$0	$0.00	$0	$140	
3	8-Inch Discharge @ Vault	8	LF	$40.00	$320	0.65	5.2	$56	$291	$0.00	$0	$611	
	8-Inch Y	2	EA	$120.00	$240	1.143	2.286	$56	$128	$0.00	$0	$368	
4	1-Inch Relief Pipe	10	LF	$2.50	$25	0.151	1.51	$56	$85	$0.00	$0	$110	
	1-Inch Fittings	5	EA	$12.50	$63	0.615	3.075	$56	$172	$0.00	$0	$235	
	1-Inch Air Relief Valve	1	EA	$300.00	$300	0.5	0.5	$56	$28	$0.00	$0	$328	
	1-Inch Drain Pipe	10	LF	$2.50	$25	0.151	1.51	$56	$85	$0.00	$0	$110	
	1-Inch Plug Valves	2	EA	$80.00	$160	0.571	1.142	$56	$64	$0.00	$0	$224	
5	Vault Drain & Pipe Allowance	1	EA	$750.00	$750	12	12	$56	$672	$0.00	$0	$1,422	
6	8-Inch Discharge to Grinder (DIP)	100	LF	$20.00	$2,000	0.3	30	$56	$1,680	$4.00	$400	$4,080	
	8-Inch Fittings	5	EA	$285.00	$1,425	4.501	22.505	$56	$1,260	$0.00	$0	$2,685	
	8-Inch Isolation Valve	1	EA	$1,175.00	$1,175	9.6	9.6	$56	$538	$0.00	$0	$1,713	
	8-Inch Flanges	3	EA	$88.00	$264	1.412	4.236	$56	$237	$0.00	$0	$501	
	8-Inch Bolt and Gasket Sets	3	EA	$15.00	$45	0	0	$56	$0	$0.00	$0	$45	
7	Not Used	1	EA	$0.00	$0	0	0	$56	$0	$0.00	$0	$0	
Subtotal Division 15, Mechanical					**$45,086**		**493.408**		**$27,631**		**$4,775**	**$77,491**	**$77,491**

Division 16/17 Electrical/Instrumentation

1	Percent for Electrical	15.00%								$129,944.35	$19,492	$19,492	
Subtotal Division 16/17 Electrical/Instrumentation											**$19,492**	**$19,492**	**$19,492**

Base Cost of Influent Pump Station				**$262,443**
	Contractor Indirects	5.00%		$13,122
Subtotal				**$275,566**
	Contractor Overhead & Profit	15.00%		$41,335
Subtotal				**$316,900**
	Bonds	1.00%		$3,169
	Permits	1.00%		$3,169
	Insurance	2.00%		$6,338
Subtotal				**$329,576**
	Design Contingency	0.00%	**See Note 1**	$0
Subtotal				**$329,576**
	Wash State Sales Tax	8.80%		$29,003
Estimated Opinion of Construction Cost				**$358,579**

				Material		Labor				Equipment			
Item	Description	Quantity	Unit	Unit cost	Amount	Labor Hr.	Total Hr.	Rate	Amount	Unit Cost	Amount	Total	
	WASTEWATER DISCHARGE PUMP STATION												
	Division 2, Civil Site												
1	Sheeting/Shoring	1,200	SF	$14.00	$16,800	0	0	$55	$0	$0.00	$0	$16,800	
	Dewatering Allowance	1	LS	$0.00	$0	0	0	$55	$0	$5,000.00	$5,000	$5,000	
	Excavation	190	CY	$0.00	$0	0	0	$45	$0	$3.50	$665	$665	
	Material Disposal	190	CY	$0.00	$0	0	0	$45	$0	$20.00	$3,800	$3,800	
	Import Backfill	140	CY	$25.00	$3,500	0.16	22.4	$45	$1,008	$5.00	$700	$5,208	
2	96-Inch Precast Wet Well(12' Depth)	1	EA	$6,300.00	$6,300	0	0	$48	$0	$600.00	$600	$6,900	
3	12" Base Rock	8	CY	$25.00	$200	0.1	0.8	$48	$38	$2.50	$20	$258	
4	Pipe Excavation	700	CY	$0.00	$0	0	0	$45	$0	$3.00	$2,100	$2,100	
	Bedding	100	CY	$25.00	$2,500	0.1	10	$45	$450	$2.50	$250	$3,200	
	Import Backfill	300	CY	$20.00	$6,000	0.16	48	$45	$2,160	$5.00	$1,500	$9,660	
	Native Backfill	300	CY	$0.00	$0	0.16	48	$45	$2,160	$5.00	$1,500	$3,660	
	Surplus Disposal	400	CY	$0.00	$0	0	0	$45	$0	$25.00	$10,000	$10,000	
	Surface Restoration	666	SY	$10.00	$6,660	0	0	$45	$0	$0.00	$0	$6,660	
	Trench Safety Allowance	600	LF	$0.00	$0	0	0	$45	$0	$2.50	$1,500	$1,500	
	Trench Dewatering Allowance	1	LS	$0.00	$0	0	0	$45	$0	$5,000.00	$5,000	$5,000	
4	Not Used	1	EA	$0.00	$0	0	0	$45	$0	$0.00	$0	$0	
Subtotal Division 2, Civil					**$41,960**		**129.2**		**$5,816**		**$32,635**	**$80,411**	**$80,411**
	Division 3, Concrete												
1	14' X 2' Base Slab	10	CY	$400.00	$4,000	0	0	$48	$0	$0.00	$0	$4,000	
2	Construct Top Slab Wet Well	6.5	CY	$1,100.00	$7,150	0	0	$45	$0	$5.00	$33	$7,183	
3	Cast in Place Utility Vault	1	EA	$0.00	$0	0	0	$45	$0	$5.00	$5	$5	
	Bottom Slab On Grade	3	CY	$400.00	$1,200	0	0	$45	$0	$5.00	$15	$1,215	
	Perimeter Walls	4	CY	$1,000.00	$4,000	0	0	$45	$0	$5.00	$20	$4,020	
	Top Slab Of Vault	1	CY	$1,100.00	$1,100	0	0	$45	$0	$5.00	$5	$1,105	
4	Wet Well Interior Grout Allowance	1	LS	$750.00	$750	0	0	$45	$0	$0.00	$0	$750	
5	Misc Allowance	1	EA	$500.00	$500	12	12	$45	$540	$250.00	$250	$1,290	
Subtotal Division 3, Concrete					**$18,700**		**12**		**$540**		**$328**	**$19,568**	**$19,568**
	Division 5, Metals												
1	Allowance for Metals & Hatches	1	LS	$5,000.00	$5,000	24	24	$56	$1,344	$150.00	$150	$6,494	
Subtotal Division 5, Metals					**$5,000**		**24**		**$1,344**		**$150**	**$6,494**	**$6,494**
	Division 11, Equipment												
1	5 HP Submersible Pumps/Control PNL	2	EA	$5,500.00	$11,000	24	48	$56	$2,688	$50.00	$100	$13,788	
2	Not Used	1	EA	$0.00	$0	0	0	$56	$0	$0.00	$0	$0	
Subtotal Division 11, Equipment					**$11,000**		**48**		**$2,688**		**$100**	**$13,788**	**$13,788**

Division 15, Mechanical

1	4-Inch DIP Discharge to Sewer	500	LF	$13.00	$6,500	0.2	100	$56	$5,600	$2.50	$1,250	$13,350	
	4-Inch Fitting Allowance	5	EA	$130.00	$650	2	10	$56	$560	$0.00	$0	$1,210	
	4-Inch Valve Allowance	1	EA	$335.00	$335	5.333	5.333	$56	$299	$0.00	$0	$634	
2	4-Inch Pump Discharge to Vault	34	LF	$26.00	$884	0.571	19.414	$56	$1,087	$0.00	$0	$1,971	
	4-Inch Fittings	4	EA	$130.00	$520	2	8	$56	$448	$0.00	$0	$968	
	4-Inch Y	2	EA	$153.00	$306	3	6	$56	$336	$0.00	$0	$642	
	4-Inch Check Valves	2	EA	$320.00	$640	5.3	10.6	$56	$594	$0.00	$0	$1,234	
	4-Inch Plug Valves	2	EA	$335.00	$670	5.333	10.666	$56	$597	$0.00	$0	$1,267	
	4-Inch Flanges	10	EA	$61.00	$610	0.696	6.96	$56	$390	$0.00	$0	$1,000	
	4-Inch bolt and Gasket Sets	10	EA	$9.00	$90	0	0	$56	$0	$0.00	$0	$90	
4	1-Inch Relief Pipe	10	LF	$2.50	$25	0.151	1.51	$56	$85	$0.00	$0	$110	
	1-Inch Fittings	5	EA	$12.50	$63	0.615	3.075	$56	$172	$0.00	$0	$235	
	1-Inch Air Relief Valve	1	EA	$300.00	$300	0.5	0.5	$56	$28	$0.00	$0	$328	
	1-Inch Drain Pipe	10	LF	$2.50	$25	0.151	1.51	$56	$85	$0.00	$0	$110	
	1-Inch Plug Valves	2	EA	$80.00	$160	0.571	1.142	$56	$64	$0.00	$0	$224	
5	Vault Drain & Pipe Allowance	1	EA	$750.00	$750	12	12	$56	$672	$0.00	$0	$1,422	
6	4-Inch Influent Pipe (DIP)	100	LF	$13.00	$1,300	0.2	20	$56	$1,120	$2.50	$250	$2,670	
	4-Inch Fittings	5	EA	$130.00	$650	2	10	$56	$560	$0.00	$0	$1,210	
	4-Inch Isolation Valve	1	EA	$335.00	$335	5.333	5.333	$56	$299	$0.00	$0	$634	
	4-Inch Flanges	3	EA	$61.00	$183	0.696	2.088	$56	$117	$0.00	$0	$300	
	4-Inch Bolt and Gasket Sets	3	EA	$9.00	$27	0	0	$56	$0	$0.00	$0	$27	
7	Not Used	1	EA	$0.00	$0	0	0	$56	$0	$0.00	$0	$0	
Subtotal	**Division 15, Mechanical**				**$15,023**		**234.131**		**$13,111**		**$1,500**	**$29,634**	**$29,634**

Division 16/17 Electrical/Instrumentation

1	Percent for Electrical	15.00%								$69,483.34	$10,423	$10,423	
Subtotal	**Division 16/17 Electrical/Instrumentation**										**$10,423**	**$10,423**	**$10,423**

Base Cost of Wastewater Pump Station				**$160,317**
	Contractor Indirects	5.00%		$8,016
Subtotal				**$168,333**
	Contractor Overhead & Profit	15.00%		$25,250
Subtotal				**$193,583**
	Bonds	1.00%		$1,936
	Permits	1.00%		$1,936
	Insurance	2.00%		$3,872
Subtotal				**$201,326**
	Design Contingency	0.00%	**See Note 1**	$0
Subtotal				**$201,326**
	Wash State Sales Tax	8.80%		$17,717
Estimated Opinion of Construction Cost				**$219,043**

				Material		Labor				Equipment			
Item	Description	Quantity	Unit	Unit cost	Amount	Labor Hr.	Total Hr.	Rate	Amount	Unit Cost	Amount	Total	
	WATER TREATMENT FACILITY												
	Division 2, Civil Site												
1	Sheeting/Shoring	8,300	SF	$14.00	$116,200	0	0	$55	$0	$0.00	$0	$116,200	
	Dewatering Allowance	1	LS	$0.00	$0	0	0	$55	$0	$15,000.00	$15,000	$15,000	
	Excavation	4,100	CY	$0.00	$0	0	0	$45	$0	$3.50	$14,350	$14,350	
	Material Disposal	4,100	CY	$0.00	$0	0	0	$45	$0	$20.00	$82,000	$82,000	
	Import Backfill	1,200	CY	$25.00	$30,000	0.16	192	$45	$8,640	$5.00	$6,000	$44,640	
2	6" Base Rock	70	CY	$25.00	$1,750	0.1	7	$48	$336	$2.50	$175	$2,261	
3	Not Used	1	EA	$0.00	$0	0	0	$45	$0	$0.00	$0	$0	
Subtotal Division 2, Civil					**$147,950**		**199**		**$8,976**		**$117,525**	**$274,451**	**$274,451**
	Division 3, Concrete												
1	2' Base Slab	270	CY	$400.00	$108,000	0	0	$48	$0	$0.00	$0	$108,000	
2	Perimeter Walls of Gallery	260	CY	$1,000.00	$260,000	0	0	$48	$0	$5.00	$1,300	$261,300	
3	Perimeter Walls of Tanks	62	CY	$1,000.00	$62,000	0	0	$48	$0	$5.00	$310	$62,310	
4	Not Used	1	EA	$0.00	$0	0	0	$48	$0	$5.00	$5	$5	
5	Interior Walls of Tanks	18	CY	$400.00	$7,200	0	0	$48	$0	$5.00	$90	$7,290	
6	Second Floor (MCC) floor Slab	14	CY	$1,100.00	$15,400	0	0	$48	$0	$5.00	$70	$15,470	
7	Ground Floor Slab	45	CY	$1,100.00	$49,500	0	0	$48	$0	$5.00	$225	$49,725	
8	Stairs	10	CY	$900.00	$9,000	0	0	$48	$0	$5.00	$50	$9,050	
	Landings	10	CY	$1,100.00	$11,000	0	0	$48	$0	$5.00	$50	$11,050	
9	Tank Cover	30	CY	$1,100.00	$33,000	0	0	$48	$0	$5.00	$150	$33,150	
10	MCC Room CMU Wall	200	SF	$12.00	$2,400	0	0	$48	$0	$0.00	$0	$2,400	
	Bond Beams	100	LF	$5.00	$500	0	0	$48	$0	$0.00	$0	$500	
	Steel Reinforcement Allowance	1	LS	$750.00	$750	0	0	$48	$0	$0.00	$0	$750	
11	Misc Allowance	1	EA	$5,000.00	$5,000	0	0	$45	$0	$0.00	$0	$5,000	
12	Crane Use	360	DAY	$0.00	$0	0	0	$45	$0	$200.00	$72,000	$72,000	
Subtotal Division 3, Concrete					**$563,750**		**0**		**$0**		**$74,250**	**$638,000**	**$638,000**
	Division 5, Metals												
1	Mezzanine Steel Frame	1	LS	$20,000.00	$20,000	0	0	$48	$0	$0.00	$0	$20,000	
	Grating	400	SF	$19.35	$7,740	0.032	12.8	$48	$614	$0.10	$40	$8,394	
	Steel Stair Risers @ Mezzanine	18	EA	$218.00	$3,924	1.067	19.206	$48	$922	$2.75	$50	$4,895	
2	Steel Stair Riser from MCC Room	18	EA	$218.00	$3,924	1.067	19.206	$48	$922	$2.75	$50	$4,895	
3	Not Used	1	EA	$0.00	$0	0	0	$48	$0	$0.00	$0	$0	
4	Roof Hatches	5	EA	$4,500.00	$22,500	8	40	$48	$1,920	$0.00	$0	$24,420	
5	Hand Rail	310	LF	$31.00	$9,610	0.234	72.54	$48	$3,482	$0.60	$186	$13,278	
6	Stair Well Railing to Basement	70	LF	$14.00	$980	0.15	10.5	$48	$504	$0.10	$7	$1,491	
7	Misc. Metals Allowance	1	LS	$10,000.00	$10,000	80	80	$48	$3,840	$0.00	$0	$13,840	
8	Not Used	1	EA	$0.00	$0	0	0	$48	$0	$0.00	$0	$0	
Subtotal Division 5				**$0.00**	**$78,678**	**0**	**254.252**	**$48**	**$12,204**	**$0.00**	**$332**	**$91,214**	**$91,214**

Division 6, Woods and Plastic

1	Frame and FRP Grate Or MBR Walks	320	SF	$20.00	$6,400	0.1	32	$48	$1,536	$0.00	$0	$7,936	
2	Trim/Woods Allowance	1	LS	$2,500.00	$2,500	0	0	$48	$0	$0.00	$0	$2,500	
3	Not Used	1	EA	$0.00	$0	0	0	$48	$0	$0.00	$0	$0	
Subtotal Division 5					**$8,900**		**32**	**$48**	**$1,536**		**$0**	**$10,436**	**$10,436**

Division 7, Thermal and Moisture Protection

1	Roof Membrane	2,800	SF	$0.00	$0	0	0	$48	$0	$0.00	$0	$0	
	Topping	26	CY	$375.00	$9,750	0	0	$48	$0	$0.00	$0	$9,750	
2	Misc Allowance	1	LS	$4,000.00	$4,000	40	40	$48	$1,920	$0.00	$0	$5,920	
3	not Used	1	EA	$0.00	$0	0	0	$48	$0	$0.00	$0	$0	
Subtotal Division 7, Thermal/Moisture					**$13,750**		**40**		**$1,920.00**		**$0**	**$15,670**	**$15,670**

Division 8, Doors and Windows

1	Double Man Doors	5	EA	$450.00	$2,250	8	40	$48	$1,920	$0.00	$0	$4,170	
2	Single Man Doors	2	EA	$800.00	$1,600	16	32	$48	$1,536	$0.00	$0	$3,136	
3	misc. Hardware Allowance	1	LS	$3,500.00	$3,500	0	0	$48	$0	$0.00	$0	$3,500	
4	Not Used	1	EA	$0.00	$0	0	0	$48	$0	$0.00	$0	$0	
Subtotal Division 8, Doors & Windows					$7,350		**72**		**$3,456.00**		**$0**	**$10,806**	**$10,806**

Division 9, Coating Systems

1	Equipment Paint Allowance	1	LS	$20,000.00	$20,000	0	0	$48	$0	$0.00	$0	$20,000	
	Pipe Painting Allowance	1	LS	$8,000.00	$8,000	0	0	$48	$0	$0.00	$0	$8,000	
2	Building Paint Allowance	1	LS	$20,000.00	$20,000	0	0	$48	$0	$0.00	$0	$20,000	
3	Not used	1	EA	$0.00	$0	0	0	$48	$0	$0.00	$0	$0	
Subtotal Division 9, Coating Systems					**$48,000**		**0**		**$0**		**$0**	**$48,000**	**$48,000**

Division 10, Specialties

1	Sign Allowance	1	LS	$1,500.00	$1,500	8	8	$48	$384	$0.00	$0	$1,884	
2	Fire Extinguisher Allowance	1	LS	$500.00	$500	4	4	$48	$192	$0.00	$0	$692	
3	Architectural Louver Allowance	1	LS	$10,000.00	$10,000	0	0	$48	$0	$0.00	$0	$10,000	
4	Sound Proofing	1	LS	$30,000.00	$30,000	0	0	$48	$0	$0.00	$0	$30,000	
Subtotal Division 10, Specialties					**$42,000**		**12**		**$576**		**$0**	**$42,576**	**$42,576**

Division 11, Equipment

1	MBR Equipment Package	1	LS	$850,000.00	$850,000	2500	2500	$56	$140,000	$600.00	$600	$990,600	
2	Sump Pump Package	1	LS	$6,000.00	$6,000	40	40	$56	$2,240	$0.00	$0	$8,240	
3	HVAC Equipment Allowance	1	LS	$40,000.00	$40,000	40	40	$56	$2,240	$200.00	$200	$42,440	
4	Supply/Exhaust Fan Allowance	1	LS	$3,000.00	$3,000	0	0	$56	$0	$0.00	$0	$3,000	
5	Bridge Crane	1	LS	$30,000.00	$30,000	60	60	$56	$3,360	$250.00	$250	$33,610	
6	UV Disinfection	1	EA	$86,000.00	$86,000	0	0	$56	$0	$0.00	$0	$86,000	
Subtotal Equipment					**$1,015,000**		**2640**		**$147,840**		**$1,050**	**$1,163,890**	**$1,163,890**

Division 15, Mechanical

1	Misc. Process Piping Allowance	1	EA	$5,000.00	$5,000	100	100	$56	$5,600	$0.00	$0	$10,600	
2	Potable Water Piping Allowance	1	EA	$3,000.00	$3,000	40	40	$56	$2,240	$0.00	$0	$5,240	
3	Reclaimed Water Pipe Allowance	1	EA	$3,000.00	$3,000	40	40	$56	$2,240	$0.00	$0	$5,240	
4	Air Piping Allowance	1	EA	$3,000.00	$3,000	32	32	$56	$1,792	$0.00	$0	$4,792	
5	Wastewater Pipe Allowance	1	LS	$20,000.00	$20,000	180	180	$56	$10,080	$0.00	$0	$30,080	
5	Drain Piping Allowance	1	EA	$3,000.00	$3,000	80	80	$56	$4,480	$0.00	$0	$7,480	
6	Emergency Eye Wash/Shower	2	EA	$1,600.00	$3,200	8	16	$56	$896	$0.00	$0	$4,096	
7	Permeate Pipe Allowance	1	LS	$10,000.00	$10,000	80	80	$56	$4,480	$0.00	$0	$14,480	
8	Agitation Air Pipe Allowance	1	LS	$7,500.00	$7,500	60	60	$56	$3,360	$0.00	$0	$10,860	
9	Backpulse Pipe Allowance	1	LS	$10,000.00	$10,000	80	80	$56	$4,480	$0.00	$0	$14,480	
10	WAS Pipe Allowance	1	LS	$12,000.00	$12,000	72	72	$56	$4,032	$0.00	$0	$16,032	
11	RAS Pipe Allowance	1	LS	$4,000.00	$4,000	40	40	$56	$2,240	$0.00	$0	$6,240	
12	FA Pipe Allowance	1	LS	$15,000.00	$15,000	90	90	$56	$5,040	$0.00	$0	$20,040	
13	Pipe Support Allowance	1	LS	$10,000.00	$10,000	80	80	$56	$4,480	$0.00	$0	$14,480	
14	Not Used	1	EA	$0.00	$0	0	0	$56	$0	$0.00	$0	$0	
Subtotal Division 15, Mechanical					**$108,700**		**990**		**$55,440**		**$0**	**$164,140**	**$164,140**

Division 16/17, Electrical/Instrumentation

1	Electrical	15.00%	EA	$0.00	$0	0	0	$52	$0	$1,328,030.00	$199,205	$199,205	
2	PLC/Program/Controls	1	EA	$0.00	$0	0	0	$52	$0	$150,000.00	$150,000	$150,000	
3	Not Used	1	EA	$0.00	$0	0	0	$52	$0	$0.00	$0	$0	
Subtotal Division 16/17, Electrical/Instrumentation											**$349,205**	**$349,205**	**$349,205**

Base Cost of Water Treatment Facility			**$2,808,388**
Contractor Indirects	5.00%		$140,419
Subtotal			**$2,948,807**
Contractor Overhead & Profit	15.00%		$442,321
Subtotal			**$3,391,128**
Bonds	1.00%		$33,911
Permits	1.00%		$33,911
Insurance	2.00%		$67,823
Subtotal			**$3,526,773**
Design Contingency	0.00%	**See Note 1**	$0
Subtotal			**$3,526,773**
Wash State Sales Tax	8.80%		$310,356
Estimated Opinion of Construction Cost			**$3,837,129**

				Material		Labor				Equipment			
Item	Description	Quantity	Unit	Unit cost	Amount	Labor Hr.	Total Hr.	Rate	Amount	Unit Cost	Amount	Total	
	1,000,000 TREATED WATER STORAGE	**80' x 100' x 17' WATER DEPTH WITH 2' FREEBOARD**											
	Division 2, Civil Site												
1	Sheeting/Shoring	11,000	SF	$14.00	$154,000	0	0	$55	$0	$0.00	$0	$154,000	
	Dewatering Allowance	1	LS	$0.00	$0	0	0	$55	$0	$15,000.00	$15,000	$15,000	
	Excavation	8,400	CY	$0.00	$0	0	0	$45	$0	$3.50	$29,400	$29,400	
	Material Disposal	8,000	CY	$0.00	$0	0	0	$45	$0	$20.00	$160,000	$160,000	
	Import Backfill	1,000	CY	$25.00	$25,000	0.16	160	$45	$7,200	$5.00	$5,000	$37,200	
4	Pipe Excavation	700	CY	$0.00	$0	0	0	$45	$0	$3.00	$2,100	$2,100	
	Bedding	100	CY	$25.00	$2,500	0.1	10	$45	$450	$2.50	$250	$3,200	
	Import Backfill	300	CY	$20.00	$6,000	0.16	48	$45	$2,160	$5.00	$1,500	$9,660	
	Native Backfill	300	CY	$0.00	$0	0.16	48	$45	$2,160	$5.00	$1,500	$3,660	
	Surplus Disposal	400	CY	$0.00	$0	0	0	$45	$0	$25.00	$10,000	$10,000	
5	Native Embankment over Structure	400	CY	$0.00	$0	0	0	$45	$0	$6.00	$2,400	$2,400	
6	Green Roof Cover	1,100	SY	$5.00	$5,500	0	0	$45	$0	$0.00	$0	$5,500	
7	Not Used	1	EA	$0.00	$0	0	0	$45	$0	$0.00	$0	$0	
Subtotal	**Division 2, Civil**				**$193,000**		**266**		**$11,970**		**$227,150**	**$432,120**	**$432,120**
	Division 3, Concrete												
1	Bottom Slab On Grade (24")	770	CY	$400.00	$308,000	0	0	$48	$0	$0.00	$0	$308,000	
2	Perimeter Walls (15")	345	CY	$1,000.00	$345,000	0	0	$45	$0	$5.00	$1,725	$346,725	
3	Interior Weir Wall (10")	44	CY	$1,000.00	$44,000	0	0	$45	$0	$5.00	$220	$44,220	
4	Top Slab (15")	333	CY	$1,100.00	$366,300	0	0	$45	$0	$5.00	$1,665	$367,965	
5	Not Used	1	EA	$0.00	$0	0	0	$45	$0	$0.00	$0	$0	
Subtotal	**Division 3, Concrete**				**$1,063,300**		**0**		**$0**		**$3,610**	**$1,066,910**	**$1,066,910**
	Division 5, Metals												
1	Allowance for Hatches	4	EA	$3,500.00	$14,000	8	32	$48	$1,536	$0.00	$0	$15,536	
2	Allowance for Misc Metals	1	LS	$3,000.00	$3,000	40	40	$48	$1,920	$500.00	$500	$5,420	
Subtotal	**Division 5, Metals**				**$17,000**		**72**		**$3,456**		**$500**	**$20,956**	**$20,956**
	Division 11, Equipment												
1	7.5 HP Submersible Pumps/Control PNL	2	EA	$12,000.00	$24,000	32	64	$56	$3,584	$100.00	$200	$27,784	
	VFD	2	EA	$9,000.00	$18,000	24	48	$52	$2,496	$100.00	$200	$20,696	
2	2 HP Process Water Pumps	2	EA	$2,500.00	$5,000	12	24	$56	$1,344	$90.00	$180	$6,524	
	Control Panel	1	EA	$2,000.00	$2,000	8	8	$52	$416	$0.00	$0	$2,416	
3	Sampler Unit	1	EA	$6,000.00	$6,000	8	8	$56	$448	$0.00	$0	$6,448	
4	12-Inch Inlet Gate	1	EA	$5,000.00	$5,000	32	32	$56	$1,792	$150.00	$150	$6,942	
5	Backup Generator	1	EA	$40,000.00	$40,000	8	8	$56	$448	$0.00	$0	$40,448	
Subtotal	**Division 11, Equipment**				**$100,000**		**192**		**$10,528**		**$730**	**$111,258**	**$111,258**

Division 15, Mechanical

1	**6-Inch to Sprinkler System**	100	LF	$26.00	$2,600	0.571	57.1	$56	$3,198	$0.00	$0	$5,798	
	6-Inch Fittings	2	EA	$60.00	$120	1	2	$56	$112	$0.00	$0	$232	
	6-Inch Butterfly Valve	1	EA	$300.00	$300	4.8	4.8	$56	$269	$0.00	$0	$569	
	6-Inch Flanges	2	EA	$78.00	$156	1.043	2.086	$56	$117	$0.00	$0	$273	
2	**6-Inch Pump Discharge to Vault**	34	LF	$26.00	$884	0.571	19.414	$56	$1,087	$0.00	$0	$1,971	
	6-Inch Fittings	6	EA	$60.00	$360	1	6	$56	$336	$0.00	$0	$696	
	6-Inch Check Valves	2	EA	$600.00	$1,200	8	16	$56	$896	$0.00	$0	$2,096	
	6-Inch Butterfly Valves	2	EA	$300.00	$600	4.8	9.6	$56	$538	$0.00	$0	$1,138	
	6-Inch Flanges	10	EA	$78.00	$780	1.043	10.43	$56	$584	$0.00	$0	$1,364	
	6-Inch bolt and Gasket Sets	10	EA	$14.00	$140	0	0	$56	$0	$0.00	$0	$140	
3	1-Inch pressure/Air Relief Pipe	10	LF	$2.50	$25	0.151	1.51	$56	$85	$0.00	$0	$110	
	1-Inch Fittings	5	EA	$12.50	$63	0.615	3.075	$56	$172	$0.00	$0	$235	
	1-Inch Air Relief Valve	1	EA	$300.00	$300	0.5	0.5	$56	$28	$0.00	$0	$328	
	1-Inch Drain Pipe	10	LF	$2.50	$25	0.151	1.51	$56	$85	$0.00	$0	$110	
	1-Inch Plug Valves	2	EA	$80.00	$160	0.571	1.142	$56	$64	$0.00	$0	$224	
4	Vault Drain & Pipe Allowance	1	EA	$750.00	$750	12	12	$56	$672	$0.00	$0	$1,422	
5	**3-Inch Process Water Discharge**	200	LF	$7.00	$1,400	0.32	64	$56	$3,584	$4.00	$800	$5,784	
	3-Inch Fittings	5	EA	$25.00	$125	0.727	3.635	$56	$204	$0.00	$0	$329	
	3-Inch Butterfly Valve	2	EA	$125.00	$250	2	4	$56	$224	$0.00	$0	$474	
	3-Inch Check Valves	2	EA	$205.00	$410	3.556	7.112	$56	$398	$0.00	$0	$808	
	3-Inch Flanges	9	EA	$46.00	$414	0.516	4.644	$56	$260	$0.00	$0	$674	
	3-Inch Bolt and Gasket Sets	9	EA	$5.00	$45	0	0	$56	$0	$0.00	$0	$45	
7	Not Used	1	EA	$0.00	$0	0	0	$56	$0	$0.00	$0	$0	
Subtotal	**Division 15, Mechanical**				**$11,107**		**230.558**		**$12,911**		**$800**	**$24,818**	**$24,818**

Division 16/17 Electrical/Instrumentation

1	Percent for Electrical	20.00%								$136,075.75	$27,215	$27,215	
Subtotal	**Division 16/17 Electrical/Instrumentation**										**$27,215**	**$27,215**	**$27,215**

Base Cost of Treated Water Storage				**$1,683,277**
	Contractor Indirects	5.00%		$84,164
Subtotal				**$1,767,441**
	Contractor Overhead & Profit	15.00%		$265,116
Subtotal				**$2,032,557**
	Bonds	1.00%		$20,326
	Permits	1.00%		$20,326
	Insurance	2.00%		$40,651
Subtotal				**$2,113,859**
	Design Contingency	0.00%	**See Note 1**	$0
Subtotal				**$2,113,859**
	Wash State Sales Tax	8.80%		$186,020
Estimated Opinion of Construction Cost				**$2,299,879**

Item	Description	Quantity	Unit	Material Unit cost	Material Amount	Labor Hr.	Total Hr.	Rate	Labor Amount	Equipment Unit Cost	Equipment Amount	Total	
Biofilter 20' X 40'													
Division 2, Civil													
1	Excavation	170	CY	$0.00	$0	0	0	$45	$0	$2.50	$425	$425	
2	Surplus Disposal	170	CY	$0.00	$0	0	0	$45	$0	$25.00	$4,250	$4,250	
3	Liner	164	SY	$10.00	$1,640	0.1	16.4	$50	$820	$0.00	$0	$2,460	
4	Pea Gravel	74	CY	$25.00	$1,850	0.2	14.8	$45	$666	$5.00	$370	$2,886	
5	36" of Media	90	CY	$32.00	$2,880	0.18	16.2	$56	$907	$1.00	$90	$3,877	
6	6-Inch of lBark Material	20	CY	$28.00	$560	0.16	3.2	$45	$144	$0.00	$0	$704	
7	Not Used	1	EA	$0.00	$0	0	0	$45	$0	$0.00	$0	$0	
Subtotal Division 2, Civil					**$6,930**		**50.6**		**$2,537**		**$5,135**	**$14,602**	**$14,602**
Division 3, Concrete													
1	Concrete Blower Pad	1	EA	$1,000.00	$1,000	0	0	$48	$0	$0.00	$0	$1,000	
2	Drainage Sump	1	LS	$2,500.00	$2,500	16	16	$45	$720	$100.00	$100	$3,320	
Subtotal Division 3, Concrete					**$3,500**		**16**		**$720**		**$100**	**$4,320**	**$4,320**
Division 11, Mechanical													
1	Blower Unit	1	EA	$25,000.00	$25,000	24	24	$56	$1,344	$100.00	$100	$26,444	
2	Mister Unit	1	EA	$10,000.00	$10,000	24	24	$56	$1,344	$50.00	$50	$11,394	
3	Sound Proof Enclosure	1	EA	$5,000.00	$5,000	32	32	$56	$1,792	$0.00	$0	$6,792	
Subtotal Division 11, Mechanical					**$40,000**		**80**		**$4,480**		**$150**	**$44,630**	**$44,630**
Division 15, Mechanical													
	FA Pipe Within Biofilter	1	EA	$0.00	$0	0	0	$56	$0	$0.00	$0	$0	
1	20-Inch HDPE FA Pipe	48	LF	$45.00	$2,160	0	0	$56	$0	$0.00	$0	$2,160	
	20-Inch Fittings	3	EA	$1,475.00	$4,425	0	0	$56	$0	$0.00	$0	$4,425	
	Welding Labor Per Joint	5	EA	$0.00	$0	1.73	8.65	$56	$484	$0.00	$0	$484	
2	10-Inch HDPE FA Pipe	300	LF	$20.00	$6,000	0	0	$56	$0	$0.00	$0	$6,000	
	10-Inch Fittings	4	EA	$430.00	$1,720	0	0	$56	$0	$0.00	$0	$1,720	
	Welding Labor Per Joint	48	EA	$0.00	$0	1	48	$56	$2,688	$0.00	$0	$2,688	
3	Welder Rental	4	DAY	$0.00	$0	0	0	$56	$0	$480.00	$1,920	$1,920	
4	Irrigation Piping Within top 6" Allowance	1	LS	$6,000.00	$6,000	0	0	$56	$0	$0.00	$0	$6,000	
5	20-Inch Buried HDPE to Biofilter	150	LF	$0.00	$0	0	0	$56	$0	$0.00	$0	$0	
6	Connection @ Blower Allowance	2	EA	$250.00	$500	2	4	$56	$224	$0.00	$0	$724	
7	20-Inch Butterfly Valves	2	EA	$1,850.00	$3,700	24	48	$56	$2,688	$0.00	$0	$6,388	
	20-Inch Flanges	4	EA	$1,250.00	$5,000	1.73	6.92	$56	$388	$0.00	$0	$5,388	
6	6-Inch HDPE Drain Pipe	160	LF	$100.00	$16,000	0	0	$56	$0	$0.00	$0	$16,000	
	Welding Labor Per Joint	6	EA	$0.00	$0	0.635	3.81	$56	$213	$0.00	$0	$213	
7	Misc. Allowance	1	LS	$1,000.00	$1,000	40	40	$56	$2,240	$0.00	$0	$3,240	
Subtotal Division 15, Mechanical					**$46,505**		**159.38**		**$8,925**		**$1,920**	**$57,350**	**$57,350**

Division 16, Electrical

1	Electrical Allowance	1	LS	$0.00	$0	0	0	$52	$0	$3,000.00	$3,000	$3,000	
Subtotal Electrical					**$0**		**0**		**$0**		**$3,000**	**$3,000**	**$3,000**
Base Cost of Biofilter													**$123,902**
	Contractor Indirects	5.00%											$6,195
Subtotal													**$130,098**
	Contractor Overhead & Profit	15.00%											$19,515
Subtotal													**$149,612**
	Bonds	1.00%											$1,496
	Permits	1.00%											$1,496
	Insurance	2.00%											$2,992
Subtotal													**$155,597**
	Design Contingency	0.00%		**See Note 1**									$0
Subtotal													**$155,597**
	Wash State Sales Tax	8.80%											$13,693
Estimated Opinion of Construction Cost													**$169,289**

Estimated Construction Cost of Facility **$6,883,919**

Note 1: Design contingency accounted for elsewhere
Note 2: Does not include distribution piping

2003 Date: ______ Subject: ______ Name: ______ Page: 1/2

JANUARY

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

FEBRUARY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

MARCH

S	M	T	W	T	F	S
						1
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

APRIL

S	M	T	W	T	F	S
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6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

MAY

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

JUNE

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

JULY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

AUGUST

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

SEPTEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

OCTOBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

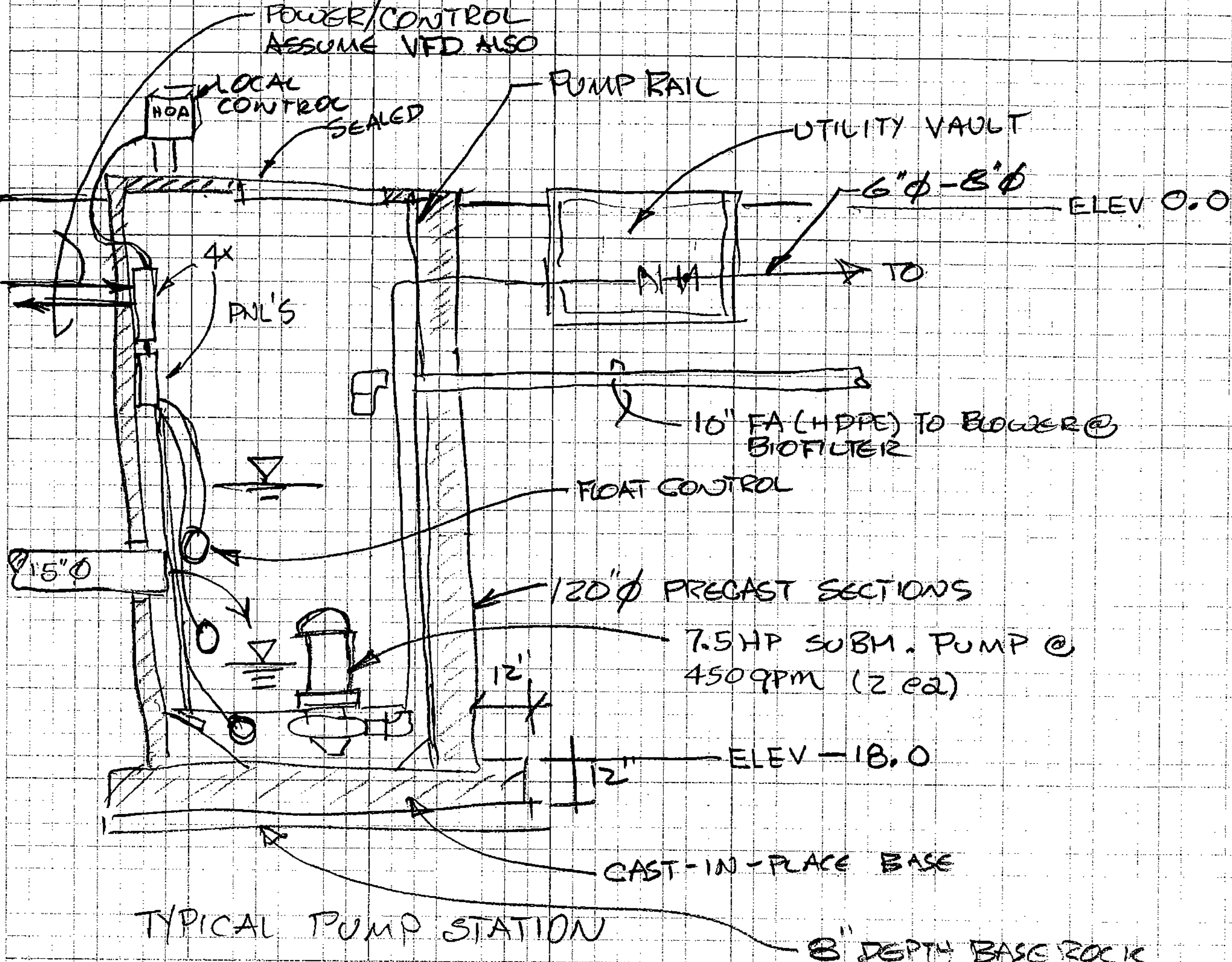
NOVEMBER

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

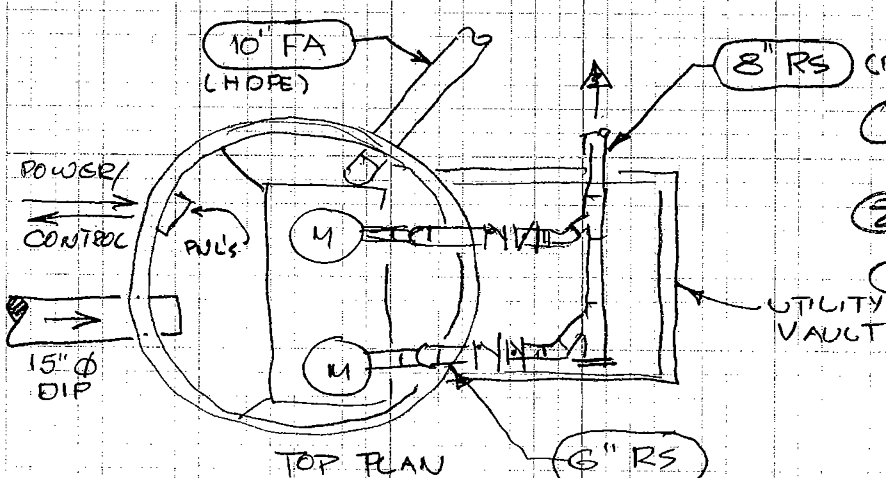
DECEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

PROVIDE FOR TWO PUMP STATIONS



TYPICAL PUMP STATION

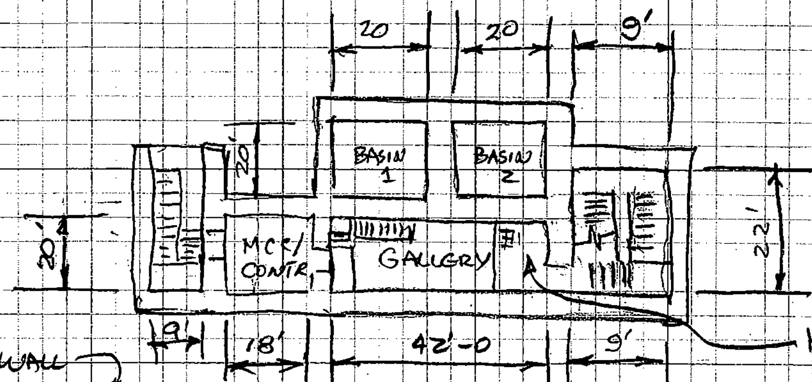


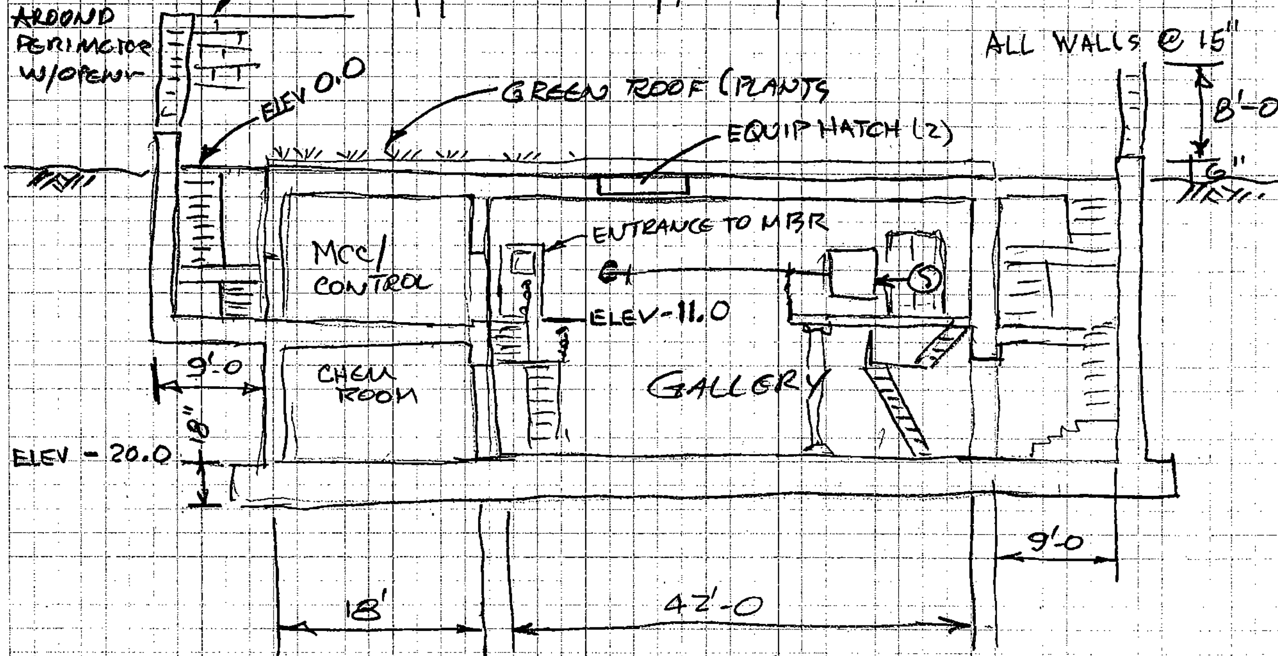
TOP PLAN

CONDITIONS

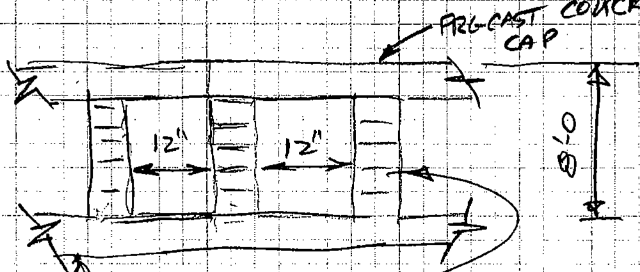
1. ASSUME WATER CONDITION – IE DEWATER
2. SHEET & SHORE
3. ALL IMPORT BACKFILL

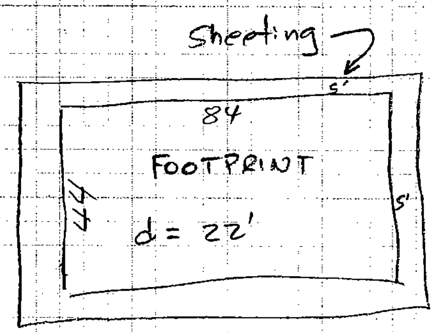
MYRTLE EDWARDS PARK LOCATION
TYPICAL PUMP STATION
SPU WATER SYSTEM PLAN UPDATE





SECTION VIEW





CALLOW TO SEE THROUGH TO WATER (SOUND)

BULDING OR PERIMETER CURB AROUND OUTSIDE

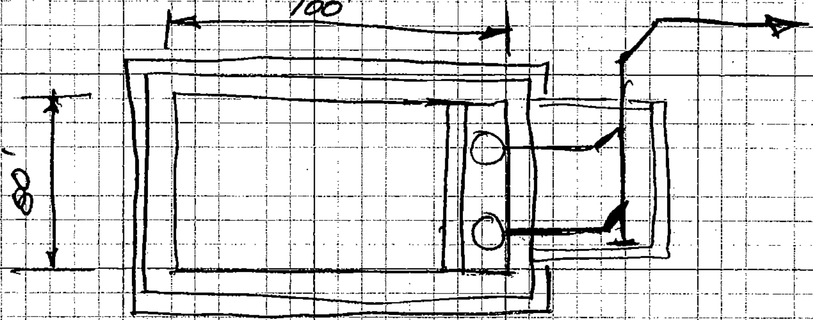
PROVIDE 8'0 HIGH METAL GATES TO STAIRWELLS

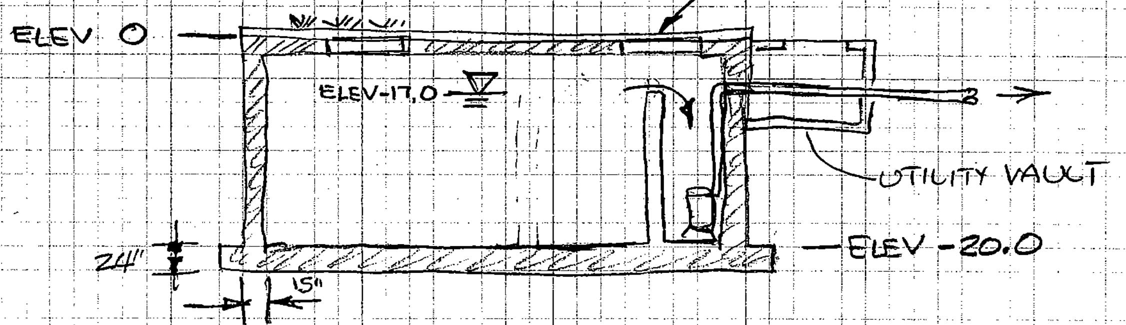
1824
~~15 PS~~

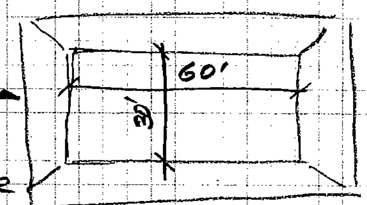
MYRTLE EDWARDS PARK LOCATION

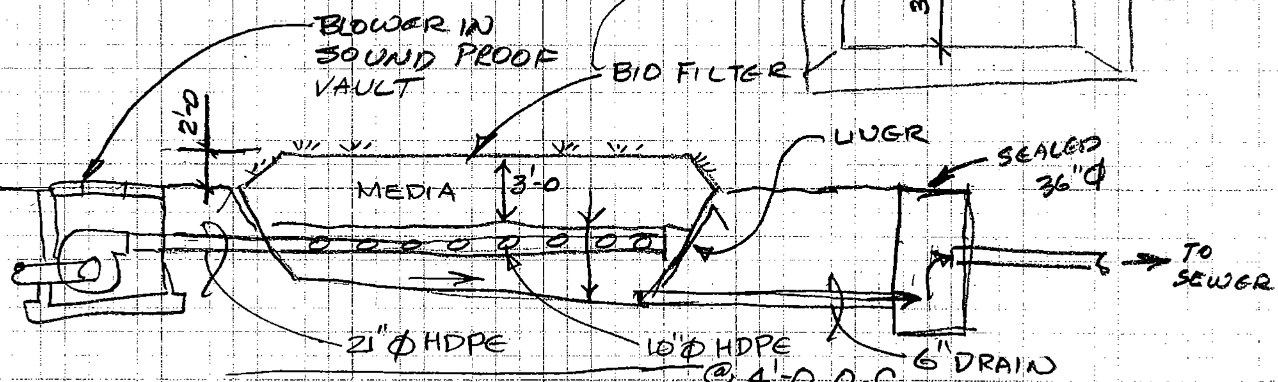
SPU WATER SYSTEM PLAN UPDATE — TREATMENT FACILITY

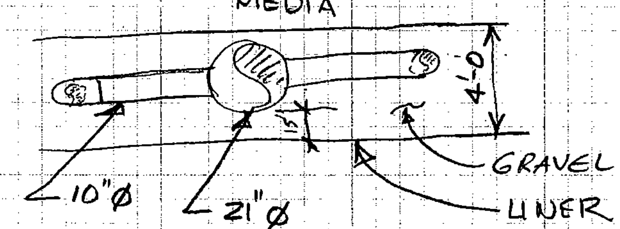
1.0 Million Capacity Below Ground (134,000 CF)







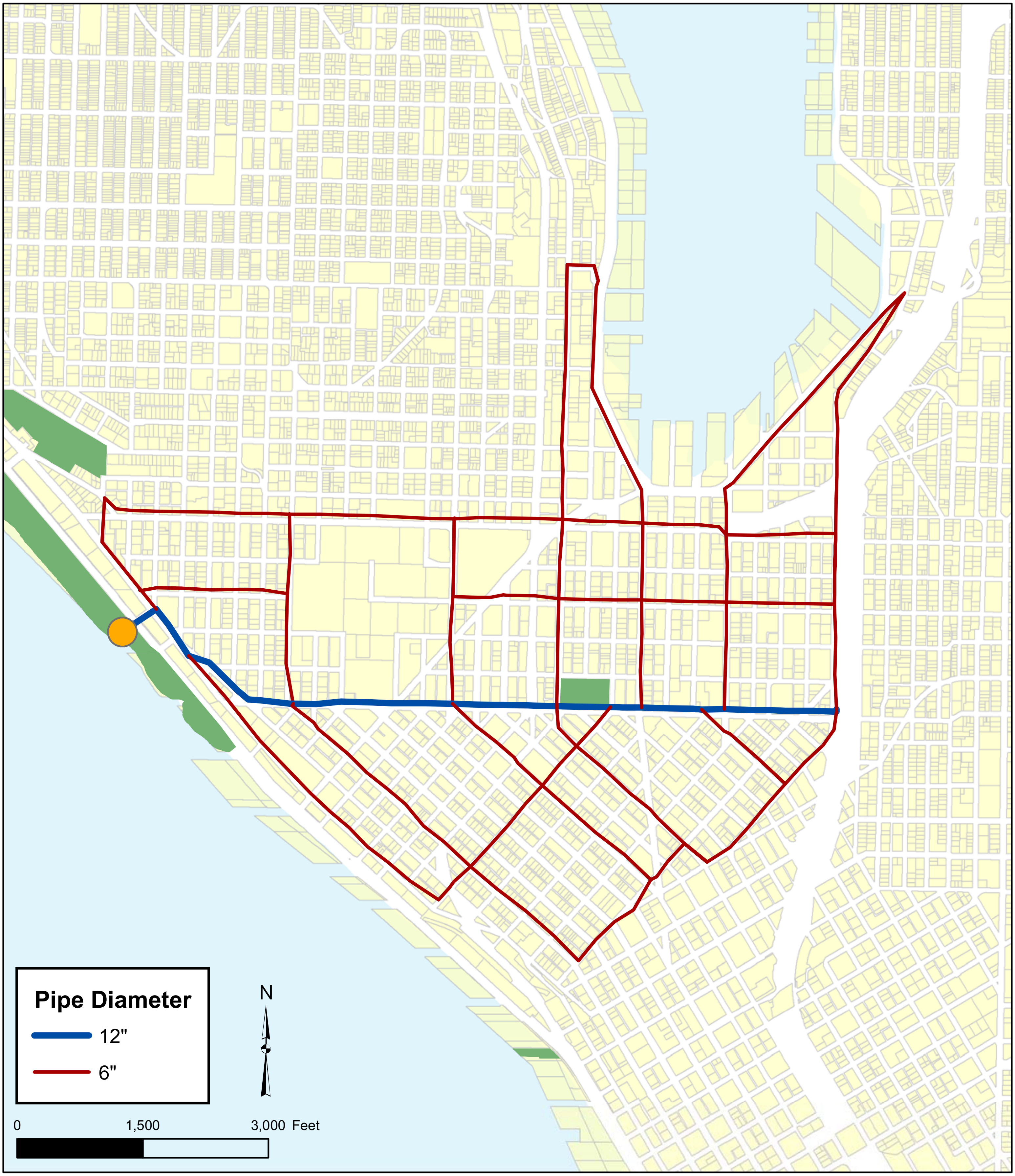




BELOW GROUND STORAGE TANK

IN MYRTLE EDWARDS PARK

Urban Commercial Core/Myrtle Edwards Park Alternative Distribution System Used for Cost Estimate



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APPENDIX G
Reclaimed Water Projects Evaluation

Performance Scales for Value Hierarchy

Results from January 26, 2006, Workshop with Joan Kersnar an

			Performance Scales (1-5 for Each Value)					Initial Scoring					Comments				
			5	4	3	2	1	Calvary Catholic Reclaimed Water	Jackson Park Golf Course Reclaimed Water	Urban Commericial Core/Myrtle Edwards Park	West Seattle Golf Course Reclaimed Water Facility "A"	West Seattle Golf Course Reclaimed Water Facility "B"	Calvary Catholic Reclaimed Water	Jackson Park Golf Course Reclaimed Water	Urban Commericial Core/Myrtle Edwards Park	West Seattle Golf Course Reclaimed Water Facility "A"	West Seattle Golf Course Reclaimed Water Facility "B"
	Attribute	**Attribute Description**	**Enhanced/ Advantaged**	**Improvement some of the time, in some cases**	**No change from existing conditions or offsetting impacts**	**Some negative impacts in some cases that may be fairly easy to resolve**	**Severe negative impact or some impact in many cases that are difficult to resolve**						- 0.08-0.3 MGD treament facility for irrigating the cemetery - approximately 20,807 ccf treated annually - facility source is King County Interceptor	- X MGD treament facility for irrigating the golf course - approximately 47,520 ccf treated annually - facility source is Ballinger Portal (Brightwater effluent)	- 0.58-0.61 MGD treament facility for irrigating the park and residential/ commercial toilet flushing - approximately 193,396 ccf treated annually - facility source is King County Interceptor	- 0.04-0.15 MGD treament facility for irrigating the golf course - approximately 26,571 ccf treated annually - facility source is SPU wastewater collection system	- 0.04-0.4 MGD treament facility for irrigating the golf course - approximately 31,043 ccf treated annually - facility source is King County Interceptor
A.	**Ease of Source Development**																
1	**Public Trust**	Related to how it meets or counters public expectations															
	Political Acceptability	Related to political pressure or reaction of electeds and media exposure	Accolades and desire to emulate from other municipalities. Exuberant political support.	Positive news coverage and strong support by elected officials in retail and wholesale service areas.	No news coverage, media call but no follow up story. Little involvement or reaction by electeds.	Mixed support from City Council. Negative news story expected, at least one somewhat influential person would negatively react	Active opposition from City Council, high possibility of intervention from external sources, state or federal legislation, daily local negative news stories could be generated, possible negative national news coverage	3	3	4.5	4	3.5	Not a visible project, and the City does not own the Cemetary.	Because of on-going costs to King County for reclaimed water supply (Brightwater). Project will require considerable coordination with King County and City of Shoreline.	Council would likely support this environmental initiative; however, there could be some issues raised over costs.	No involvement of King County. City Council more likely to support a 100% City effort.	Will be a good news story, but will require management of the risks of pharmaceuticals and PCPs. There are treatment options (i.e. RO) to remove pharmaceuticals and PCPs
	Public Acceptability (Stakeholders)	Related to customer or stakeholder reactions to the option	Customers and stakeholders gleefully support and encourage action.	Customers and stakeholders support action.	Customers and stakeholders show little interest	Public opinion survey might show a negative rating, a fair number of calls or letters expected, would take a short time to mitigate problem	Customers and specific stakeholders vocal and actively oppose utility action	2.5	4	4.5	3	3	Some of the current family members of buried ones at the Cemetary would have concerns re: respecting the deceased.	There would be some supporters because of environmental supporters of Brightwater. However, there would also be opponents because of costs.	Would likely be supported as a cutting-edge, show-cased use of reclaimed water by developers. Only disadvantage would be grumbling about costs.	Some supporters and some negative response expected.	Some supporters and some negative response expected.
2	**Environmental Acceptability of Construction**	Related to potential for temporary harm to life forms as a result of changes made to the environment during construction.															
	Built Environment	Impacts to people and existing infrastructure such as water outages, traffic, noise, odor, air quality	Substantial improvement	Moderate improvements	Negligible or no impacts	Moderate impacts	Deterioration, substantially worse and can't be mitigated	2.5	2.5	1.5	2.5	2.5	There would be construction impacts. However, facility size is small and therefore impacts are considered small.	There would be construction impacts. However, facility size is small and therefore impacts are considered small.	There would be increased street disruptions in a dense urban area, especially if the construction of pipelines is not coordinated with other reasons for tearing up the streets.	There would be construction impacts. However, facility size is small and therefore impacts are considered small.	There would be construction impacts. However, facility size is small and therefore impacts are considered small.
	Natural Environment	Impacts to ecosystems (e.g., rivers)	Improvements to habitat or ecosystem function		No measurable harm to environment or contribution to pollution, release of non-harmful substances or release, but within legal limits, clean up achieved easily	Small area of ecosystems disturbed, but function not significantly impaired, release of substances contained or impacts confined	Major ecosystem destruction, erosion or sedimentation, releases of substances in toxic quantities	3	3	3	3	3	Any impacts can be mitigated.	Any impacts can be mitigated.	Any impacts can be mitigated.	Any impacts can be mitigated.	Any impacts can be mitigated.

SPU Water Supply Value Model

Performance Scales for Value Hierarchy

Results from January 26, 2006, Workshop with Joan Kersnar an

			Performance Scales (1-5 for Each Value)					Initial Scoring					Comments				
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	Attribute	**Attribute Description**	**Enhanced/ Advantaged**	**Improvement some of the time, in some cases**	**No change from existing conditions or offsetting impacts**	**Some negative impacts in some cases that may be fairly easy to resolve**	**Severe negative impact or some impact in many cases that are difficult to resolve**						- 0.08-0.3 MGD treament facility for irrigating the cemetery - approximately 20,807 ccf treated annually - facility source is King County Interceptor	- X MGD treament facility for irrigating the golf course - approximately 47,520 ccf treated annually - facility source is Ballinger Portal (Brightwater effluent)	- 0.58-0.61 MGD treament facility for irrigating the park and residential/ commercial toilet flushing - approximately 193,396 ccf treated annually - facility source is King County Interceptor	- 0.04-0.15 MGD treament facility for irrigating the golf course - approximately 26,571 ccf treated annually - facility source is SPU wastewater collection system	- 0.04-0.4 MGD treament facility for irrigating the golf course - approximately 31,043 ccf treated annually - facility source is King County Interceptor
3	**Asset Reliability**	Related to reliability of the potential utility asset in its implementation															
	Timing Reliability	Intangible issues around starting and stopping a project, such as confusion, agency relations, momentum, etc.	Requires no additional resources or measures to stop & restart.	Could be easily stopped and started again.	Has ability to be stopped and started again, but it would be somewhat difficult		Cannot be stopped and started	2	4	1	4.5	4	Coordination with the cemetary would be an issue.	Starting and stopping the project will have some cost impacts. Coordination with King County will be necessary.	The timing of the project is critical, especially with other development plans and construction in the street. If the project is delayed, it could impact the viability of the overall project.	No coordination with King County necessary, b/c sewer line is SPU's.	Starting and stopping the project will have some cost impacts. Coordination with King County will be necessary.
	Leads to Other Sources	Opens up or closes opportunities for other sources for SPU.	Includes additional supply readily accessible with additional development.	Opens up opportunities for other source options.	Has no impact on the possibility of other sources		Closes off other source opportunities	3.5	3.5	4	3.5	3.5	Could lead to other opportunities with private entities.	Could potentially open up opportunity for other reclaimed water projects in the area.	New/Re-development opportunities in the downtown area could also use reclaimed water.	Could potentially open up opportunity for other reclaimed water projects in the area.	Could potentially open up opportunity for other reclaimed water projects in the area.
4	**Legal/Regulatory**	Related to legal or regulatory obstacles to developing a new source such as new legislation or variance required, lawsuits, condemnation	No legal or regulatory issues exist, or they have already been resolved		There are standard legal or regulatory matters to address that can be resolved in reasonable amount of time.	There are many minor legal or regulatory obstacles to overcome to implement the source option that may be difficult to overcome.	There are major legal or regulatory obstacles that will either be difficult to resolve or cannot be resolved.	4	3	2	3	3	The City of Seattle Resolution does not apply since the reclaimed water will not runoff into a salmon-bearing creek. Other regular permits and SEPA will still apply.	There are RW permit requirements, fulfilling requirements of the Pageler resolution, and SEPA.	The legal/regulatory issues would be greater because there are more dual-plumbing issues with developers and building owners.	There are RW permit requirements, fulfilling requirements of the Pageler resolution, and SEPA.	There are RW permit requirements, fulfilling requirements of the Pageler resolution, and SEPA.

Performance Scales for Value Hierarchy

Results from January 26, 2006, Workshop with Joan Kersnar an

	Attribute	Attribute Description	Performance Scales (1-5 for Each Value) 5	4	3	2	1	Initial Scoring: Calvary Catholic Reclaimed Water	Jackson Park Golf Course Reclaimed Water	Urban Commericial Core/Myrtle Edwards Park	West Seattle Golf Course Reclaimed Water Facility "A"	West Seattle Golf Course Reclaimed Water Facility "B"	Comments: Calvary Catholic Reclaimed Water	Jackson Park Golf Course Reclaimed Water	Urban Commericial Core/Myrtle Edwards Park	West Seattle Golf Course Reclaimed Water Facility "A"	West Seattle Golf Course Reclaimed Water Facility "B"
	Attribute	**Attribute Description**	**Enhanced/ Advantaged**	**Improvement some of the time, in some cases**	**No change from existing conditions or offsetting impacts**	**Some negative impacts in some cases that may be fairly easy to resolve**	**Severe negative impact or some impact in many cases that are difficult to resolve**						- 0.08-0.3 MGD treament facility for irrigating the cemetery - approximately 20,807 ccf treated annually - facility source is King County Interceptor	- X MGD treament facility for irrigating the golf course - approximately 47,520 ccf treated annually - facility source is Ballinger Portal (Brightwater effluent)	- 0.58-0.61 MGD treament facility for irrigating the park and residential/ commercial toilet flushing - approximately 193,396 ccf treated annually - facility source is King County Interceptor	- 0.04-0.15 MGD treament facility for irrigating the golf course - approximately 26,571 ccf treated annually - facility source is SPU wastewater collection system	- 0.04-0.4 MGD treament facility for irrigating the golf course - approximately 31,043 ccf treated annually - facility source is King County Interceptor
B. System Operation																	
1	**Environmental Acceptability**	Related to potential for permanent harm to life forms as a direct result of changes made to the environment from the existence and operation of the new source															
	Natural Environment	Related to impact on ecosystems (e.g., instream flows and wetlands)	Provides net improvement to ecosystems. Establishes a sustainable ecosystem.		Maintains existing ecosystems.		Has severe impact on ecosystems and cannot be mitigated.	3	2.5	3	2.5	2.5	No application on salmon-bearing stream.	Again, some potential impacts to Thornton Creek because of endocrine disrupters and PCPs.	No application on salmon-bearing stream.	The project could have impacts on salmon-bearing Longfellow Creek.	The project could have impacts on salmon-bearing Longfellow Creek.
	Secondary Impacts and Benefits/ Sustainability	Related to benefits or impacts other than drinking water such as power generation, energy savings, or recreation, which are not monetized.	Substantial secondary benefits.	Some secondary benefits.	No net secondary benefits or impacts.		Potential negative secondary impacts.	3	3	3	3	3	Small reduction in wastewater discharge to the Puget Sound and small increase in energy consumption. Both are minimal and therefore would be negligible.	Small reduction in wastewater discharge to the Puget Sound and small increase in energy consumption. Both are minimal and therefore would be negligible.	Small reduction in wastewater discharge to the Puget Sound and small increase in energy consumption. Both are minimal and therefore would be negligible.	Small reduction in wastewater discharge to the Puget Sound and small increase in energy consumption. Both are minimal and therefore would be negligible.	Small reduction in wastewater discharge to the Puget Sound and small increase in energy consumption. Both are minimal and therefore would be negligible.

SPU Water Supply Value Model

Performance Scales for Value Hierarchy

Results from January 26, 2006, Workshop with Joan Kersnar an

	Attribute	Attribute Description	Performance Scales (1-5 for Each Value) 5: Enhanced/ Advantaged	4: Improvement some of the time, in some cases	3: No change from existing conditions or offsetting impacts	2: Some negative impacts in some cases that may be fairly easy to resolve	1: Severe negative impact or some impact in many cases that are difficult to resolve	Initial Scoring: Calvary Catholic Reclaimed Water	Jackson Park Golf Course Reclaimed Water	Urban Commericial Core/Myrtle Edwards Park	West Seattle Golf Course Reclaimed Water Facility "A"	West Seattle Golf Course Reclaimed Water Facility "B"	Comments: Calvary Catholic Reclaimed Water	Jackson Park Golf Course Reclaimed Water	Urban Commericial Core/Myrtle Edwards Park	West Seattle Golf Course Reclaimed Water Facility "A"	West Seattle Golf Course Reclaimed Water Facility "B"
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2	**Asset Reliability**	Related to operational reliability of the source option															
	System Robustness	Related to confidence and predictability in system's ability to meet demand (drought, critical seasons, infrastructure)	Enhances ability of supply system to withstand different kinds of droughts, and is able to contribute to system during peak season. It can also provide continuous service during infrastructure outages or failures.	Can either enhance ability of supply system to withstand different kinds of droughts, or is able to contribute to system during critical seasons, or is able to provide continuous service during infrastructure outages or failures.	Does not add anything to ability of system to withstand different kinds of droughts, does not contribute to system during critical seasons, and does not provide continuous service during infrastructure outages or failures.		Detracts from ability of system to withstand different kinds of droughts, is not always available during critical seasons, and is more susceptible to outages or failures.	3	3	3	3	3	Benefit of increased reliable RW supply. However, the entire system's reliability is not increased substantially.	Benefit of increased reliable RW supply. However, the entire system's reliability is not increased substantially.	Benefit of increased reliable RW supply. However, the entire system's reliability is not increased substantially.	Benefit of increased reliable RW supply. However, the entire system's reliability is not increased substantially.	Benefit of increased reliable RW supply. However, the entire system's reliability is not increased substantially.
	Operational Ease and Flexibility	Relative ease of moving water around the system	Enhances operational flexibility		No impact on system operation	Creates additional work for system operation.	Reduces operational flexibility	2	2	1.75	2	2	Requires 0.5 FTE of City-paid employee to operate and maintain the MBR Tretament Plant.	Requires 0.5 FTE of City-paid employee to operate and maintain the MBR Tretament Plant.	Year-round 0.5 FTE and dual-plumbed building.	Requires 0.5 FTE of City-paid employee to operate and maintain the MBR Tretament Plant.	Requires 0.5 FTE of City-paid employee to operate and maintain the MBR Tretament Plant.
	Security	Related to physical security of supply system	Significant improvement in the security of the supply system		Has no effect on security of the system	May introduce a security risk to the system	Presents a significant security risk	3	3	3	3	3	No impact on system security.	No impact on system security.	No impact on system security.	No impact on system security.	No impact on system security.
3	**Public Trust**	Related to customer or stakeholder confidence in and opinions of the option as a result of curtailments or rate stability or general acceptability of source	Customers and stakeholders have high confidence and high opinions of system and SPU's ability to provide them with water		No change in confidence or opinions of system and SPUs ability to provide them with water		Customers and specific stakeholders have low confidence or poor opinions of system	3	4	3	4	4	Not very visible project.	Public would appreciate golf course during drought; there might be some confusion regarding why the golf course is green during the drought.	Most likely, support would be neutral. The water is not as visible (i.e. landscaping).	Public would appreciate golf course during drought; there might be some confusion regarding why the golf course is green during the drought.	Public would appreciate golf course during drought; there might be some confusion regarding why the golf course is green during the drought.

SPU Water Supply Value Model

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4	**Public Health (Water Quality)**	Related to temporary or permanent harm to humans from water supply															
	Meets Regulations	Inherent qualities of source in meeting current and near-future drinking water quality regulations to protect public health or secondary benefits	Provides clear public health protection benefits and/or significant secondary water quality benefits		Meets current and near-term future regulations		Compromises ability to meet current water quality standards and is at risk of not meeting anticipated future water quality regulations	3	2.5	3	2.5	2.5	No concerns re: future regs on endocrine disrupters.	Small possibility that restrictions on endocrine disrupters would drive treatment to RO, thereby increasing operations costs significantly.	No concerns re: future regs on endocrine disrupters.	Small possibility that restrictions on endocrine disrupters would drive treatment to RO, thereby increasing operations costs significantly.	Small possibility that restrictions on endocrine disrupters would drive treatment to RO, thereby increasing operations costs significantly.
	Source and Treatment Compatibility	Degree to which source and treatment process is consistent with SPU's other sources and policies	Improves water quality with the addition of new source and/or treatment capacity		Is compatible with existing sources	Requires minor additional treatment or changes in operation to allow for source compatibility	Is not compatible with existing sources so major changes to existing system or treatment processes would be necessary	3	3	3	3	3	No change to drinking water quality. RW is suitable for use as irrigation water.	No change to drinking water quality. RW is suitable for use as irrigation water.	No change to drinking water quality. RW is suitable for use as irrigation water.	No change to drinking water quality. RW is suitable for use as irrigation water.	No change to drinking water quality. RW is suitable for use as irrigation water.
5	**Social (Lifestyles)**	Related to impacts on how customers live, work, play, and relate to one another	Improves customer lifestyle		Has no change to customer lifestyles		Requires significant change to customer's lifestyles	3	3	3	3	3	No change to customer lifestyle.	Some benefit from green golf course during drought. Some additional training on purple pipe required for Golf Course staff. No drinking/swimming allowed in golf course ponds, etc.	No change to customer lifestyle.	Some benefit from green golf course during drought. Some additional training on purple pipe required for Golf Course staff. No drinking/swimming allowed in golf course ponds, etc.	Some benefit from green golf course during drought. Some additional training on purple pipe required for Golf Course staff. No drinking/swimming allowed in golf course ponds, etc.

Value Score and Cost Summary of Reclaimed Water Alternatives

Alternative	Value Score	PV Cost ($m)[a]	Levelized Unit Cost ($m/MGD)[b]
Catholic Calvary Cemetery	0.500	$1.1	$10.94
Jackson Park Golf Course	0.518	$1.5	$5.80
Urban Comerical Core/Myrtle Edwards Park	0.478	$6.2	$6.10
West Seattle Golf Course Facility A	0.525	$0.8	$6.32
West Seattle Golf Course Facility B	0.510	$1.4	$9.16

Notes:

[a]Present value of pre-construction, construction, and O&M costs for each alternative at a 3% discount rate assuming online date of 2050, and accounting for the remaining useful life of MBR, Pumps, and Other costs. Online date of 2050 was selected to be consistent with cost estimates prepared for other SPU water supply options in the Water System Plan.

[b]Levelized unit costs are calculated by dividing the present value (PV) of cost by the PV of annual yield (mgd) for each alternative at a 3% discount rate assuming online date of 2050.

Pre-Construction activities include environmental and engineering studies, water rights applications, permitting, land acquisition, and SEPA (EIS) compliance.

Construction activities include construction, construction management, engineering support, environmental controls and mitigation work.

Increased costs for treatment, transmission, and storage, as well as costs for maintaining/protecting new source facilities. Also includes annualized value of replacing key components during life of project.

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

I. WATER RESOURCES

APPENDIX F
GROUNDWATER ELEVATIONS AT SEATTLE WELL FIELDS

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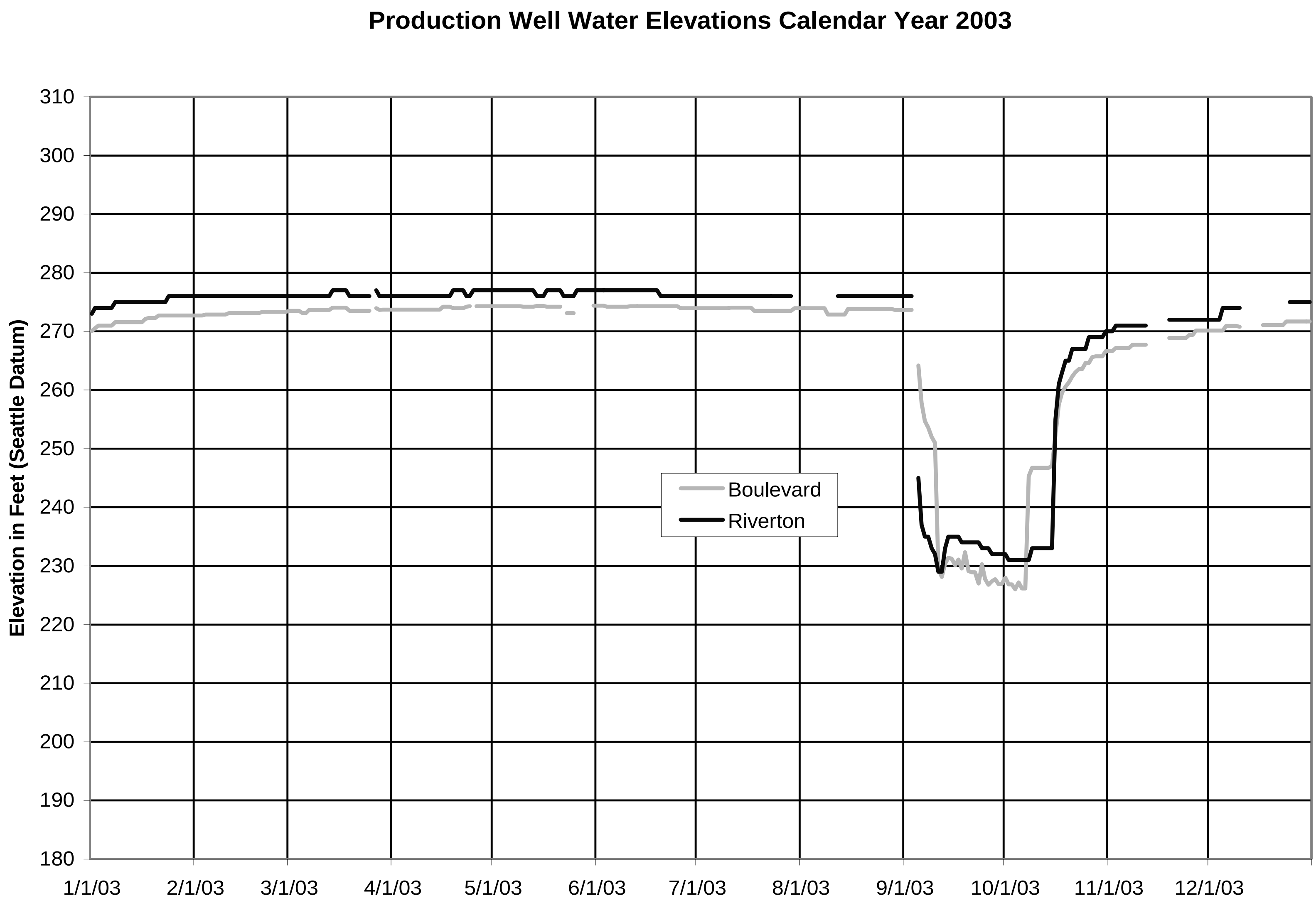
Groundwater Elevations at Seattle Well Fields
May 2006

SPU monitors groundwater levels in the vicinity of the Riverton and Boulevard Park Well Fields as part of its management of this source of supply. Underlying the area are three water-bearing, sand and gravel formations now known as the Shallow, Intermediate and Deep Aquifers. The aquifers are arranged in layers and separated by much less pervious, silt and clay layers which act as aquitards. At the land surface, over much of the Highline area, is a highly compacted layer composed of glacial till. SPU has three production wells tapped into the Intermediate Aquifer.

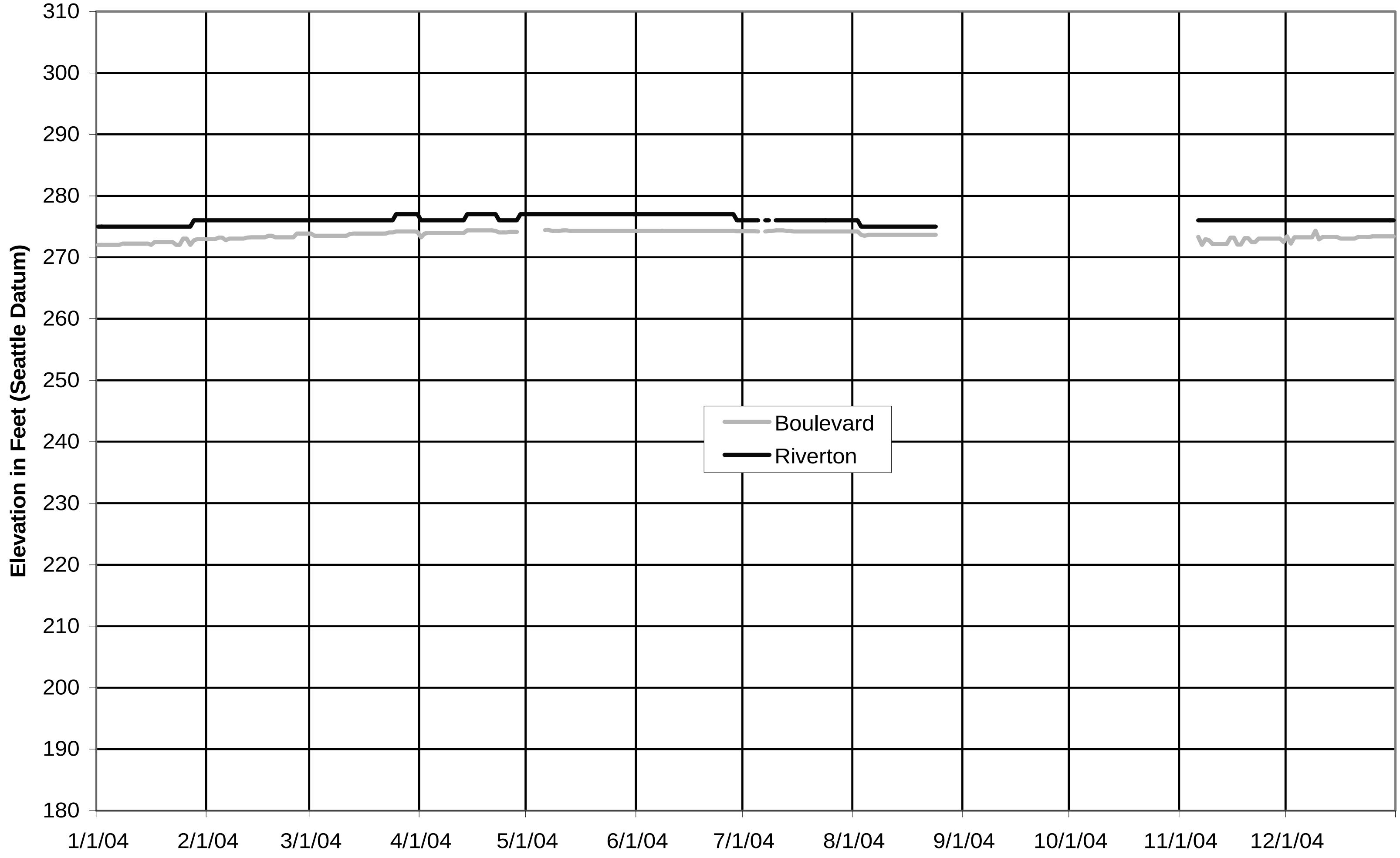
In addition to the production wells, SPU has a network of six monitoring wells in the Well Fields. Three of these wells can monitor water levels in the intermediate aquifer, two in the shallow aquifer, and one in the deep aquifer. Data loggers collected continuous elevation data from the monitoring wells from late 1991 through late 1999, primarily during and immediately after the ASR demonstration project. Routine collection of water level data from the observation wells was suspended in early 2000. In the absence of recharge operations, it was felt that levels recorded continuously in the three production wells by the SCADA system would adequately track trends in the intermediate aquifer. However, well field SCADA data prior to January 2003 was lost during the upgrade of the system in 2005. As a result, there is no elevation data available for 2000, 2001, or 2002, either from SCADA or the monitoring wells.

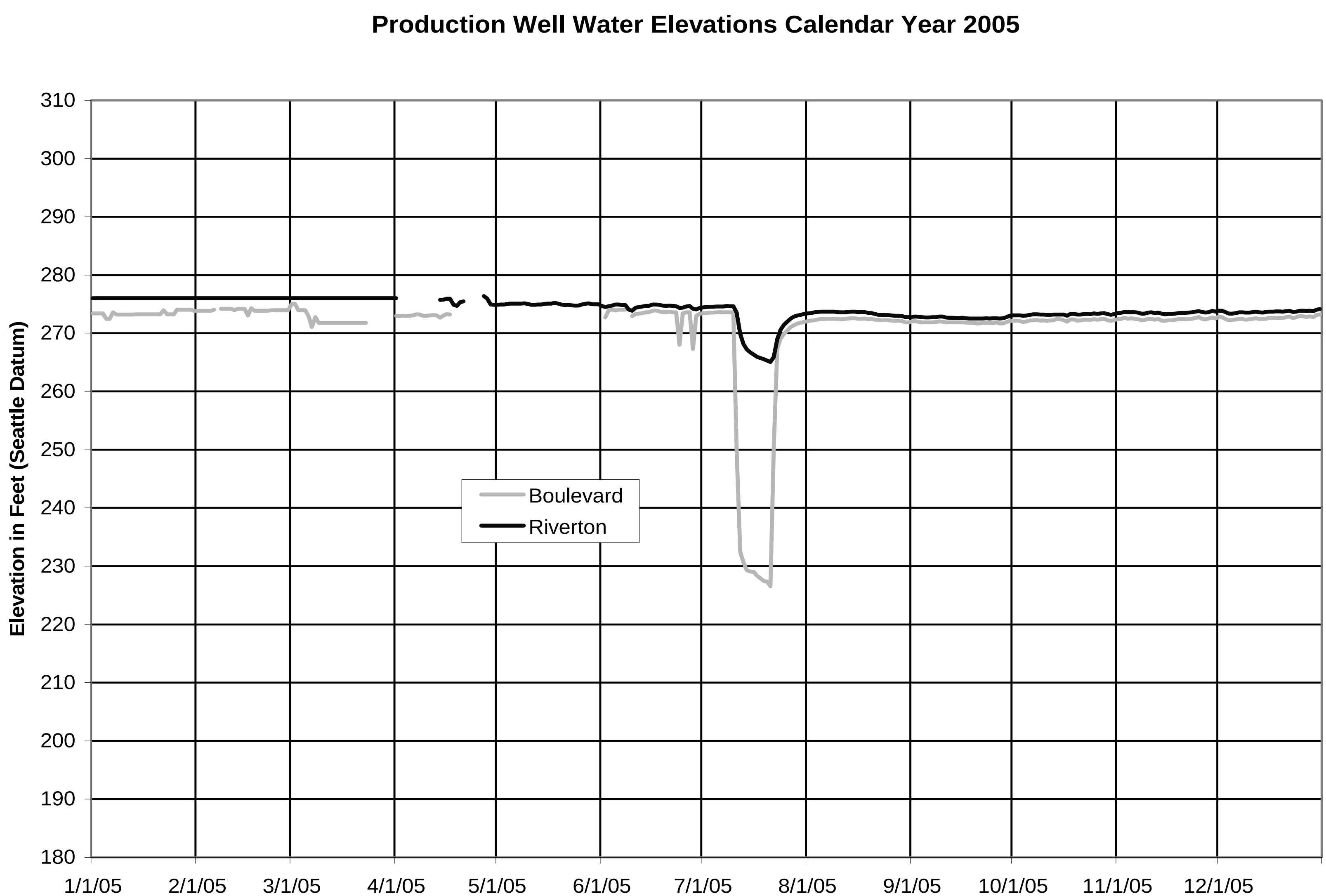
The attached graphs show the ground water elevations from the SCADA system at the Riverton and Boulevard Park Well Fields from January 2003 to May 2006. No long term trends appear in the data. Short term decline occurred in September and October 2003 when the wells were placed in service, but levels quickly recovered when pumping ceased. The short-term decline in July 2005 resulted from test pumping of Boulevard Park as part of well rehabilitation.

SPU will continue to monitor the elevations in the production wells for any trends, and will re-activate the monitoring well network if recharge operations are undertaken.


Production Well Water Elevations Calendar Year 2003
Elevation in Feet (Seattle Datum)
310
300
290
280
270
260
250
240
230
220
210
200
190
180
1/1/03
2/1/03
3/1/03
4/1/03
5/1/03
6/1/03
7/1/03
8/1/03
9/1/03
10/1/03
11/1/03
12/1/03
Boulevard
Riverton

Production Well Water Elevations Calendar Year 2004




Production Well Water Elevations Calendar Year 2005
Elevation in Feet (Seattle Datum)
310
300
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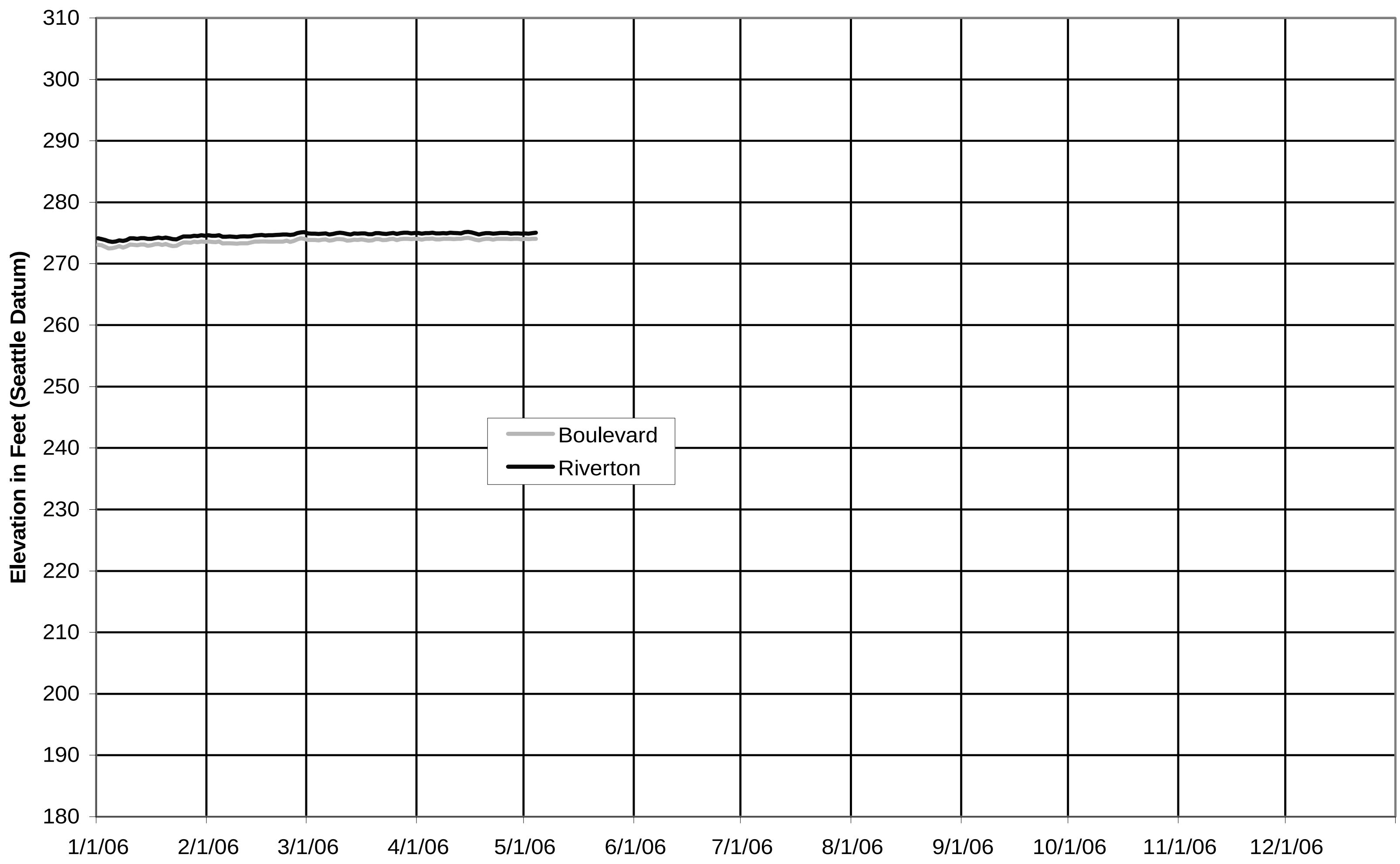
12/1/05
Boulevard
Riverton

Production Well Water Elevations Calendar Year 2006



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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

II. WATER QUALITY AND TREATMENT

APPENDIX A
TREATMENT ASSETS INVENTORY

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Cedar Treatment Facility Design Criteria

Landsburg Diversion Dam	
Chlorination	
System	Chorine Gas
Target Dosage	0.65 to 1.7 mg/L
Fluoridation	
System	Hydrofluosilicic Acid; Simple gravity feed
Target Dosage	1.15 mg/L
Lake Youngs	
Plant	
Type:	Raw Water Ozonation and Ultra Violet Disinfection
Capacity:	180 mgd
Intake and Raw Water Pump Station	
Pump type	Submersible
Number of units:	7
Size	2 @ 20 mgd, 5 @ 40 mgd
Ozone Generation	
Type:	LOX Feed
Number of units:	2
Design concentration of ozone	6 - 12 %
Capacity:	825 lbs/day @ 12 % each (nomimal)
	1250 lbs/day @ 6 % each (peak)
Applied ozone dose	0.3 - 0.6 mg/L (typical)
	0.8 mg/L (peak)
Ozone Contacting	
Type:	Fine bubble diffusion
Flow direction	Counter-current
Contactor type	Pipeline
Number of units:	Two parallel trains
Volume	0.61 MG
Contact time:	9.8 min @ peak capacity
Ultra Violet Disinfection	
Design basis	3-log Cryptosporidium
Method	Medium pressure
Dosage	40 mJ/sq cm
Contactor type	Closed vessel
Number	13 total, 12 @ 180 MGD
Capacity:	15 MGD each
Clearwell	
Type:	Pre-stressed Concrete
Number of units:	2
Total volume:	20 MG
Treatment Chemicals	
Gaseous chlorine:	Disinfectant residual
Lime:	pH and alkalinity adjustment
Sodium Bisulfite	Excess ozone quenching

Source: Design Criteria (Updated July 12, 2004), CH2MHILL; Kirby, January 2006

Notes:

lbs/day = pounds per day	mgd = million gallons per day
min = minutes	mg/L = milligrams per liter
LOX = Liquid Oxygen	MG = million gallons
mJ/sq cm = millijoules per square centimeter	

Tolt Treatment Facility Design Parameters

Plant	
Type:	Direct Filtration with Raw Water Ozonation
Capacity:	120 mgd
Ozone Generation	
Type:	LOX Feed, High Concentration
Number of units:	Two duty, one standby
Capacity:	2,388 lbs/day each
Applied dose:	2.9 mg/l (average)
	4.8 mg/l (maximum)
Production	1,651 lbs/day (average)
	4,775 lbs/day (maximum)
Ozone Contacting	
Type:	Fine bubble diffusion w/baffled contactor
Number of units:	Two parallel trains
Capacity:	60 mgd each
Contact time:	31.6 minutes (theoretical), including dual-purpose flocculation/ozone contact basins
Flocculation	
Type:	Hydraulic flocculation w/baffled serpentine flow
	Pumped jet flash mix for chemical addition
Number of units:	Two parallel trains
Capacity:	60 mgd each
Detention time:	26.5 minutes (theoretical)
Filtration	
Type:	Anthracite mono-medium, with air/water backwash
Number of units:	Six (each with two bays)
Capacity:	24 mgd each
Rate:	12 gpm/sq ft
Bed depth:	72 inches
Clearwell	
Type:	Baffled concrete, cast-in-place
Number of units:	One (two equal halves)
Total volume:	7.4 MG
Washwater Recovery	
Type:	Settling/drying basins
Number of units:	Four
Capacity:	1.385 MG each
FTW/Equalization Basin	
Volume:	1.485 MG
Treatment Chemicals	
Ferric chloride:	Primary coagulant
Cationic polymer:	Coagulant aid
Anionic/nonionic polymer:	Filter aid and washwater solids settling aid
Gaseous chlorine:	Disinfectant residual
Carbon dioxide:	pH and alkalinity adjustment
Lime:	pH and alkalinity adjustment
Hydrofluosilicic acid:	Fluoride addition
Sodium bisulfite:	Excess ozone quenching

Source: Process Design Criteria (February 2001), CDM PHILIP, SPU updated in April 2006

Notes:

FTW = Filter to Waste
gpm/sq ft = gallons per minute per square foot
lbs/day = pounds per day
LOX = Liquid Oxygen
mgd = million gallons per day
mg/L = milligrams per liter
MG = million gallons

Prepared April 2006

Seattle Well Fields Treatment Facilities		
Chlorination	System	Sodium Hypochlorite
	Target Dosage	1.0 to 1.4 mg/L
Fluoridation	System	Hydrofluosilicic Acid
	Target Dosage	1.0 mg/L
Corrosion Control	System	NaOH Addition
	Target pH	8.0

Source: Updated by SPU in April 2006

Reservoir and Well Chlorination Facilities

Facilities	Year (1) Chlorination Facility Constructed	Type of Chlorination	Target Chlorine Residual (mg/l)	Redundancy	Condition
Outlet (Primary) Disinfection					
Beacon Hill Reservoir	1987	Sodium Hypochlorite	1.3	Two peristaltic pumps.Only one main storage tank	Upgraded in 2000
Maple Leaf Reservoir	1996	Sodium Hypochlorite	1.3	Excellent facility backup - two main storage tanks, peristaltic sodium hypochlorite injection equipment.	Facility is fairly new. Everything is in good shape.
Myrtle Reservoir	1957	Chlorine gas 150-lb cylinders	1.2	Only one chlorinator, to be removed in 2006 and replaced with on-site hypogeneration.	Treatment equipment is in good shape. Supplier supports equipment.
Roosevelt Reservoir	1996	Sodium Hypochlorite	1.35	Excellent facility backup - two main storage tanks, peristaltic sodium hypochlorite injection equipment.	Facility is fairly new. Everything is in good shape.
Volunteer Reservoir	1954	Chlorine gas 150-lb cylinders	1.3	Has one chlorinator and no sodium hypochlorite injection equipment or storage tanks.	Treatment equipment is in good shape. Supplier supports equipment.
West Seattle Gate House	1998	Sodium Hypochlorite	1.0	Excellent facility backup - two main storage tanks, peristaltic sodium hypochlorite injection equipment.	Facility is fairly new. Everything is in good shape.
West Seattle Reservoir	1998	Sodium Hypochlorite	1.3	Excellent facility backup - two main storage tanks, peristaltic sodium hypochlorite injection equipment.	Facility is fairly new. Everything is in good shape.
Residual Maintenance (Secondary) Disinfection					
Bitter Lake Reservoir	2001	On-site hypo generation	0.9	No redundancy/peristaltic with a spare on shelf. Can add calcium hypochlorite as a back up method.	Treatment equipment is in good shape.
Boulevard Park Well	1987	Sodium Hypochlorite	1.0	Well can be shut down if a disinfection equipmentfailure occurs.	Condition of the equipment is good. The sodium hypochlorite storage tanks were recently rebuilt.
Eastside Reservoir	1987	Sodium Hypochlorite	0.6	None. Can add calcium hypochlorite as a back up method of disinfection.	Treatment equipment is in good shape.
Lake Forest Park Reservoir	2002	On-site hypo generation	0.9	Two peristaltic pumps. Can add calcium hypochlorite as a back up method of disinfection.	Treatment equipment is in good shape.
Lincoln Reservoir	2004	On-site hypo generation	0.9	Two peristaltic pumps. Can add calcium hypochlorite as a back up method of disinfection.	Treatment equipment is in good shape.
Magnolia Reservoir	1994	Sodium Hypochlorite	0.9	Two storage tanks and two metering pumps.	Facility is fairly new. Good condition.
Riverton Well	1987	Sodium Hypochlorite	1.0	Peristalic pumps. Well can be shut down if a disinfection equipment failure occurs.	Condition of the equipment is good. The sodium hypochlorite storage tanks were recently rebuilt.

Source: Reimer, 1999; Capron, 2006; Green, 2006

(1) In some cases, the year constructed is approximate.

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

II. WATER QUALITY AND TREATMENT

APPENDIX B
ADMINISTRATIVE RULES FOR CROSS-CONNECTION CONTROL PROGRAM

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Seattle Public Utilities - Policy & Procedure

Subject: ADMINISTRATIVE RULES FOR THE CROSS-CONNECTION CONTROL PROGRAM		Number: SPU-CS-105
		Effective: 5-18-2006
		Supersedes: 400P-64-50, 4001-64-53, 4001-64-56, 4001-64-59
Approved: Chuck Clarke	Department: SPU	Page(s): 1 of 16

1.0 PURPOSE

1.1 To establish administrative rules for the implementation of a program of cross-connection control in Seattle Public Utilities' direct service water supply area to protect the health of water consumers and the potability of the public water system. This rule supersedes three Department (SPU) Operating Instructions, 4001-64-53, Cross-Connection Inspection; 4001-64-56, Pier and Waterfront Inspection; and 4001-64-59, Backflow Prevention Device Installation and Testing, which are hereby rescinded.

2.0 ORGANIZATIONS AFFECTED

2.1 Seattle Public Utilities (SPU)

2.2 Public Health – Seattle King County (PHSKC), formerly Seattle-King County Department of Public Health

2.3 Seattle Department of Planning and Development (DPD)

2.4 City of Shoreline

3.0 REFERENCES

3.1 City of Seattle Cross-Connection Control Ordinance, Council File No. 115660, May 28, 1991. (See Appendix 1.)

3.2 2000 Uniform Plumbing Code (Chapter 6) and City of Seattle Amendments (Ordinance No. 14712, effective October 23, 1989).

3.3 Land Use Code, Zoning Code, SMC Titles 23 & 24.

3.4 WAC 246-290-490, Department of Health (DOH) Drinking Water Regulations, Cross-Connection Control.

3.5 WAC 296-24-12005, Department of Labor and Industries (DLI) Boilers and Unfired Pressure Vessels Law, Backflow Protection.

3.6 Cross-Connection Control Manual: Accepted Procedure and Practice, prepared by the Cross-connection Control Committee of the Pacific Northwest Section, American Water Works Association, Latest Edition.

3.7 Manual of Cross-Connection Control published by the Foundation for Cross-Connection Control and Hydraulic Research , University of Southern California (USC), Latest Edition.

3.8 Cross-Connection Joint Program Memorandum of Understanding with PHSKC and SPU, effective July 2001.

3.9 Backflow Prevention Assemblies Approved for Installation in Washington State, Washington State Department of Health, Latest Edition.

3.10 SPU Standard, Connection, and Administrative Charges Rule (Standard Charges), latest version.

4.0 POLICY

4.1 It is the policy of Seattle Public Utilities to protect the public water supply and its water users as required and intended by state regulations by controlling each potential cross-connection as close to its source as practical.

5.0 DEFINITIONS

5.1 Approved Backflow Prevention Assemblies: Assemblies that are approved by the State and appear on their published approval list and that are approved for use in the SPU direct service area; specifically, Reduced Pressure Backflow Assemblies (RPBA), Double Check Valve Assemblies (DCVA) and Pressure Vacuum Breaker Assemblies (PVBA). This applies to assemblies that, at time of original installation, were approved by the State, appeared on their published approval list current at that time, and were approved for use in the SPU direct service area. (See the definitions and descriptions provided in the Cross-Connection Control Manual: Accepted Procedure and Practice, Pacific Northwest Section, American Water Works Association, Latest Edition.)

5.2 Backflow: The flow of any foreign liquids, gases or other substances from any source, back into the potable water supply within a facility and/or public water supply. Backflow may occur due to either backsiphonage or backpressure.

5.3 Backflow Assembly Tester (BAT): A person holding a BAT certificate issued in accordance with WAC 246-290.

5.4 Backpressure: Backflow caused by positive pressure (above the supply pressure) in the piping system downstream of the supply piping.

5.5 Backsiphonage: Backflow caused by a negative pressure (vacuum) or reduced pressure in the supply piping.

5.6 Call-back Inspection: A follow-up inspection of a direct service customer's premises, performed by SPU to monitor the customer's activities toward achieving compliance subsequent to the cross connection inspection.

5.7 Contamination: Any impairment of the quality of the water from any substance which may adversely affect the health of the consumer.

5.8 Controlled Cross-Connection: A connection between the SPU water system and any non-potable water system with an approved backflow prevention assembly properly installed and maintained so that it will continuously afford the protection commensurate with the degree of hazard.

5.9 Cross-Connection: Any physical arrangement whereby a public water supply is connected, or has the potential for being connected, directly or indirectly, with anything that does not exclusively contain or convey potable water from a Washington State Department of Health-approved source.

5.10 Cross-Connection Inspection: An inspection of a direct service customer's premises, performed by SPU, expressly for purposes of evaluating and locating cross-connection potential inherent in supplying that customer's water system.

5.11 Degree of Hazard: The degree of hazard is derived from an evaluation of the potential risk to public health and the adverse effect of the hazard upon the potable water system. Hazards may include:

5.11.1 Health Hazard: Any condition, device or practice in the water supply system and its operation which, in the judgment of SPU, could create a danger to the health and well-being of the water customer.

5.11.2 System Hazard: An actual or potential threat to the physical properties of, or to the potability of water in SPU's water system or the customer's potable water system, which would constitute a nuisance or be aesthetically objectionable or could cause damage to the system or its appurtenances, but would not be dangerous to health.

5.12 Seattle Public Utilities (SPU): SPU, the Director of SPU, his designee or his authorized agents. Authorized agents include the Customer Service Deputy Director, the Director of Utility Service Teams, the Supervisor of Utility Service Inspection, and Senior Utility Service Inspectors.

5.13 Direct Service Water Customer (or Water Customer): Those customers receiving water through a meter installed by SPU for end uses directly from the SPU distribution system and classed as direct service or retail for billing purposes.

5.14 Pollution: Any impairment of the quality of the water which may adversely affect the aesthetic characteristics of the water.

5.15 Potable Water Supply: Any water supply system intended or used for human consumption or other domestic uses and which must meet Washington State Department of Health Public Water System Rules and Regulations.

5.16 State: Washington State Department of Health, Office of Drinking Water.

5.17 Temporary Usage Connections: Any vehicle to which a tank or container is affixed for containing water and/or chemicals or materials, or any temporary use of water for construction, cooling, testing, or other non-domestic purposes which are capable of imparting contamination or pollution to the public water supply through a cross-connection between such points of usage and the water supply via a fire hydrant or other temporary connection.

5.18 Water Service Connection: The terminal end of a service connection from the SPU water system; the city union, i.e., where SPU loses jurisdiction and sanitary control over the water at its point of delivery to the customer's water system. Service connection shall also include water service connections from a fire hydrant and all other temporary or emergency water service connections from the public potable water system.

5.19 Water System: For the purpose of this policy and procedure, the water system is considered to be made up of two parts: the SPU system and the customer's system. The SPU system shall consist of the source and transmission facilities and the distribution system, and shall include all those facilities of the water system under the complete control of SPU, up to the point where the customer's system begins. The customer's system shall include those parts of the facilities beyond the termination of SPU's distribution system which are utilized in conveying SPU-delivered water to points of use.

6.0 RESPONSIBILITIES

6.1 Seattle Public Utilities

6.1.1 SPU, through the Utility Service Inspection Unit of its Customer Service Branch, shall prevent contamination of the water distribution system and maximize protection of on-property water consumers by maintaining surveillance over new and existing plumbing within buildings to meet the requirements of the state regulations in cross-connection control. SPU has no responsibility or authority beyond the farthest downstream installed and operable backflow assemblies.

6.2 Water Customer

6.2.1 The water customer shall be responsible for eliminating cross-connections or controlling them through the installation, regular testing and maintenance of approved backflow prevention assemblies.

6.2.2 The water customer shall be responsible for providing the necessary information, obtaining required permits (including change of use permits) and providing entry and access for inspection, to allow a determination of the cross-connection, potential and the necessary control methods.

6.2.3 The water customer is responsible for notifying SPU of any assemblies which the customer believes are no longer required.

6.2.4 The water customer is responsible for all costs associated with the installation, testing, repair and replacement of backflow prevention assemblies.

6.2.5 The water customer is responsible for providing signs at all water takeoff points downstream of backflow prevention assemblies.

7.0 PROCEDURES

7.1 The following procedures represent minimum cross-connection control operating policies:

7.1.1 General

7.1.1.1 Applicability of Regulations and References

7.1.1.1.1 The control or elimination of cross-connections shall be in accordance with the State of Washington Administrative Code on Cross-Connection Control (WAC 246-290-490) and the 2000 Edition of the Uniform Plumbing Code, Chapter 19.27 RCW, and subsequent additions.

7.1.1.1.2 The policies, procedures and criteria for determining appropriate levels of protection shall be in accordance with the Cross-Connection Control Manual: Accepted Procedure and Practice, Pacific Northwest Section, American Water Works Association, Latest Edition, and The Manual of Cross-Connection Control, Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California (latest edition), with the following major exceptions:

7.1.1.1.2.1 Double Check Detector Assemblies and Reduced Pressure Detector Assemblies are approved for use in SPU's direct service area only as backflow assemblies and are not intended to take the place of any bypass meters retired on water services.

7.1.1.1.2.2 Services (fire/domestic) to buildings over three (3) stories or over 30 feet in height shall be protected with DCVAs. Backflow protection will not be required on service lines to existing systems exceeding three stories or 30 feet in height on a retrofit basis, unless, in the judgment of SPU, significant modifications to the customer's water system, such as an increase of the service size, installation of booster pumps, or other changes that result in an increased ability to provide water flow, are being made during rehab construction.

7.1.1.1.2.3 Fire services constructed of materials which are not approved in the Uniform Plumbing Code or the City of Seattle Amendments for use in potable water piping systems shall be protected with DCVAs.

7.1.1.1.2.4 A Reduced Pressure Backflow Assembly or Air Gap is required for all Table #9 High hazard customers as referenced and required by WAC 246-290. In-premise protection is required by the City of Shoreline and PHSKC per the Cross-Connection Joint Program Memorandum of Understanding.

7.1.1.1.2.5 An Air Gap or Reduced Pressure Backflow Assembly is required on any aspirator-type equipment capable of introducing any substance into the water line downstream of such equipment.

7.1.1.2 Guidelines for Type and Location of Protection

7.1.1.2.1 Type: The type of backflow protection required shall depend on the degree of hazard.

7.1.1.2.1.1 An air gap (AG) or Reduced Pressure Backflow Assembly (RPBA) shall be used if industrial waste or other similar toxic contamination is present that would cause a health or system hazard.

7.1.1.2.1.2 A double check valve assembly (DCVA) would be required if objectionable pollution (not hazardous to health) is present. Higher levels of protection, i.e., AG or RPBA, can be installed but would not be required.

7.1.1.2.1.3 A Pressure Vacuum Breaker Assembly (PVBA) and Spill-proof Vacuum Breaker Assembly (SVBA) would be required if objectionable pollution (not hazardous to health) is present, and there is no possibility of backpressure. Higher levels of protection, i.e., AG, RPBA or DCVA can be installed, but would not be required.

7.1.1.2.1.4 Any assembly required by these Administrative Rules shall be a model approved by the State of Washington Department of Health.

7.1.1.2.2 Location of Protection: The backflow protection shall be located as close to the hazard as practical and as required by WAC 246-290-490 and SPU. If access for inspection by SPU is denied by the water customer, in lieu of denying water service, and with the approval of PHSKC or the City of Shoreline, SPU may require that an AG or RPBA be installed at the property line or at agreed location with PHSKC or the City of Shoreline. An AG and RPBA would be required in those instances where SPU suspects sewage connected plumbing.

7.1.1.3 Personnel Certification

7.1.1.3.1 At least one SPU staff member must be certified by the state as a Cross-connection Control Specialist (CCS). Normally, the Supervisor of the Utility Service Inspectors and two Senior Inspectors will have such certification.

7.1.2 Plan Review of New and Rehab Construction

7.1.2.1 SPU's representative will review all new and rehab construction plans submitted to the Seattle Department of Planning and Development (DPD) that, by the description provided by the owner, may require cross-connection control. The cross-connection control requirements will be written on the Cross-Connection Plan Review form with attachments and returned to the architect or designer submitting the plans for review.

7.1.2.2 Water service will not be provided to new construction until the cross-connection control requirements are addressed.

7.1.2.3 NOTE: Owners are required by DPD to obtain Master Use Permits whenever the use of a building or lot changes in a way which would be regulated differently than the current use.

7.1.3 Consultation

7.1.3.1 SPU representatives in the Utility Service Inspection Unit of the Customer Service Branch are available to review plans and interpret State Regulations and SPU Administrative Rules to assist water customers in meeting the cross-connection control ordinance and minimize retrofits and revisions.

7.1.4 Inspection of Installations and Initial Assembly Testing

7.1.4.1 A SPU inspector shall jointly inspect all new installations of backflow preventers on Table # 9 for high hazard water customers as referenced by WAC 246-290-490, and outlined in the Joint Program Memorandum of Understanding with PHSKC. All new backflow assemblies will be inspected after assemblies have been tested, and test report provided by a Washington State licensed Backflow Assembly Tester (BAT). (See Section 7.3.3 for annual testing requirements.) The owner and or installer is responsible for notifying SPU, City of Shoreline, or PHSKC of newly installed assemblies requiring inspection.

7.1.4.2 A SPU inspector shall inspect premises after the removal of any assembly which provides premise isolation. PHSKC will inspect in-premises assemblies no longer needed. An assembly no longer needed and for which the site was inspected, will be removed from SPU's records.

7.1.5 Temporary Usage Inspections

7.1.5.1 A SPU inspector shall inspect equipment or processes for which a hydrant permit (see SPU's hydrant use policy and procedures) for temporary water service that has been requested and which poses a cross-connection potential, e.g., spray and tank trucks.

7.1.5.2 Corrections of deficiencies cited at the time of inspection must be completed before a hydrant permit will be issued.

7.1.5.3 Temporary users of water requesting a hydrant permit and whose use constitutes a cross-connection hazard, must produce an inspection certificate showing a current annual inspection, certified by SPU before a hydrant permit will be issued.

7.1.6 Regular Inspections of High Hazard Sites

7.1.6.1 The Utility Service Inspection Unit shall assign priorities to and schedule high-hazard site inspections with special emphasis placed on the types of facilities listed in WAC 246-290-490. The Senior Utility Service Inspector shall notify the responsible party of the premises scheduled for inspection, and if possible, arrange a time that is convenient to the water customer.

7.1.6.1.1 NOTE: IF DURING THE INSPECTION, A CROSS-CONNECTION IS FOUND THAT PRESENTS, IN THE OPINION OF THE INSPECTOR, AN IMMINENT THREAT TO PUBLIC HEALTH, WATER SERVICE TO THE SITE SHALL BE IMMEDIATELY TERMINATED, AND SHALL REMAIN OFF UNTIL THE HAZARD IS CORRECTED.

7.1.6.2 After the inspection is complete, the Senior Utility Service Inspector shall notify the responsible party on the premises by a Site Survey letter listing the cross-connections found and requesting their correction within a specified time. If an approved backflow prevention assembly is required on the customer's system, the type and location of the assembly shall be specified. A copy of the Site Survey shall be sent to PHSKC or the City of Shoreline, depending on the site location.

7.1.6.3 The water customer shall notify SPU at the completion of the work and a follow-up inspection will occur. If the work has been completed satisfactorily, then the Site Survey is abated and no further action will be needed.

7.1.6.4 If the water customer does not complete the work required in the letter of citation within the time specified, a second, certified letter will be sent requiring the water customer to complete the work within a shorter specified time (generally 10 days) and reminding the water customer that it is SPU's responsibility to deny water service to anyone who does not comply with backflow protection requirements.

7.1.6.5 If the water customer does not complete the work within the time specified in the second letter or does not make special arrangements with SPU for an alternate compliance date based on extenuating circumstances, SPU will give notice to the water customer of its intention to shut off water to the property on a specified date. On that date, the water service meter will be shut off and remain off until the backflow protection work has been completed.

7.2 The following represents required backflow prevention assembly installation practices.

7.2.1 General

7.2.1.1 The criteria for assembly installation practices shall be in accordance with the Cross-Connection Control Manual: Accepted Procedure and Practice, Pacific Northwest Section, American Water Works Association, Latest Edition.

7.2.1.2 All new installations shall be inspected by SPU, the City of Shoreline, or PHSKC (per the Cross-Connection Joint Program Memorandum of Understanding).

7.2.1.3 Assemblies shall be accessible for testing and maintenance. They shall be installed no higher than five (5) feet above the floor or ground surface to the center line of the assembly, or be provided with an Occupational Safety and Health Administration (OSHA) approved work platform for assembly maintenance and testing.

7.2.1.4 Assemblies shall be protected against freezing, flooding and mechanical damage.

7.2.1.5 Assemblies shall not be installed in any enclosure or area containing fumes which are corrosive or toxic.

7.2.2 Air gap

7.2.2.1 An approved air gap shall mean a physical separation, unobstructed by guards, shields, or any other coverings, between the potable water supply system, measured vertically from the terminal point of the supply pipe to the overflow rim of the receiving vessel. This vertical, physical separation must be at least twice the diameter of the supply pipe but in no case shall this distance be less than one inch.

7.2.3 Reduced Pressure Backflow Assembly and Double Check Valve Assembly

7.2.3.1 RPBAs and DCVAs shall be installed per Washington State Department of Health List of Approved Backflow Assemblies.

7.2.3.2 RPBAs and DCVAs shall be installed with minimum clearances of 6 inches in front of test cocks, check valves, and relief valve covers to facilitate testing and maintenance. If an assembly is installed in an area with limited accessibility, such as a crawl space or pipe chase, a minimum of 24 inches clearance in front of test cocks shall be provided.

7.2.3.3 RPBAs and DCVAs shall be installed a minimum of 12 inches above ground or flood level, whichever is higher.

7.2.3.4 RPBAs shall not be installed in a below grade pit, vault, box, or chamber.

7.2.3.5 RPBAs shall be installed in a location where discharge from the relief port will not be objectionable, and shall be provided with an air-gapped drain which will reasonably handle the full discharge.

7.2.3.6 DCVAs shall be installed per WAC 246-290-490 Washington State Department of Health Approved Assemblies.

7.2.4 Pressure Vacuum Breaker Assembly (PVBA) and Spill-proof Vacuum Breaker (SVBA)

7.2.4.1 Shall be installed in accordance with the Cross-Connection Control Manual: Accepted Procedure and Practice, Pacific Northwest Section, American Water Works Association, Latest Edition, with the following major exception:

Vacuum breakers shall not be installed where there are any chemical addition capabilities, e.g., dishwasher supply lines with automatic detergent dispensing, chemical proportioners or aspirators, etc.

7.3 The following represents backflow prevention assembly testing requirements.

7.3.1 General

7.3.1.1 Annual testing of backflow assemblies shall be per WAC 246-290-490.

7.3.1.2 Backflow assembly testing procedures shall be in accordance with WAC 246-290-490 and the Cross-Connection Control Manual: Accepted Procedure and Practice, Pacific Northwest Section, American Water Works Association, Latest Edition.

7.3.2 Initial Inspection

7.3.2.1 As indicated in Section 7.1.4, initial inspection of new assemblies shall be conducted by SPU per Table # 9 WAC 246-290-490 and the Cross-Connection Joint Program Memorandum of Understanding with PHSKC and SPU.

7.3.3 Annual Testing

7.3.3.1 All mechanical assemblies (RPBA, DCVA, PVBA, SVBA) shall be tested annually by a certified Backflow Assembly Tester. Testers are to follow the acceptable testing procedures approved by Washington State Department of Health. Notification of the requirement for testing will be done annually by the department to all water customers responsible for annual testing of their assemblies. Results of the test must be forwarded to SPU within 30 days of the date of the notification.

7.3.3.2 If no test results have been received within 30 days of notification, a second letter will be sent, requesting testing reports be forwarded to the Department within 10 days.

7.3.3.3 If no test results have been received within 30 days of notification, a late fee will be charged to the water account, based on SPU Standard Charges.

7.3.3.4 Water service may be terminated unless action is satisfactorily taken to test the backflow assembly(ies) and service may be discontinued until testing is completed and test reports provided to SPU.

7.3.4 Testing After Repair or Replacement

7.3.4.1 Testing after repair or replacement is required by WAC 246-290-490 & the Uniform Plumbing Code, chapter 6.

7.3.5 Quality Control Assurance Program

7.3.5.1 Testing reports require at a minimum: BAT certification number; test kit accuracy verification and/or calibration; test kit identification number; tested assembly make, model, serial number, and size; assembly location; and site hazard. SPU shall check BAT certification and proof of test kit accuracy.

7.3.5.2 SPU staff, certified as BAT, shall conduct periodic, random field verification of water customer's BAT assembly test results and reporting.

7.4 Incident Response

7.4.1 Water quality complaints concerning possible cross-connection incidents (e.g., gasoline, petroleum smell, blue water, etc.) will be responded to jointly by SPU, and either PHSKC or the City of Shoreline, depending on site location.

7.4.1.1 SPU will lead the off-premises investigation.

7.4.1.2 SPU will test the water at the meter.

7.4.1.3 PHSKC or the City of Shoreline, depending on the site location, will lead the investigation inside the facility to determine the problem.

7.4.2 SPU shall have a utility service inspector on-standby at all times to respond to potential incidents. SPU shall maintain 24-hour telephone call center with access to inspectors.

7.4.3 SPU shall maintain 24-hour contact information for PHSKC and the City of Shoreline.

7.5 Education

7.5.1 SPU shall educate consumers about cross-connection control through customer publications and community outreach.

7.6 Recordkeeping

7.6.1 SPU shall maintain a database for recordkeeping.

7.6.1.1 The database shall include at a minimum: listing of backflow prevention assemblies, assembly address and location, details of assemblies installed, site hazards, customer contact information, and inspection and testing information and results.

7.6.1.2 SPU and PHSKC shall be responsible for entering their own data into the SPU database.

7.6.2 SPU shall maintain on file backflow incident reports and program summary reports as required by WAC 246-290-490.

8.0 APPENDIX

1) City of Seattle Cross-Connection Control Ordinance, Council File No. 115660, May 28, 1991.

AUG 2 1991

APPENDIX 1

ORDINANCE: 115660

SEATTLE WATER DEPARTMENT

AN ORDINANCE relating to the Water Department, authorizing the Superintendent of Water to administer a cross-connection control program and to issue administrative rules therefor, and amending SMC 21.04.070 to provide authority to administer such program.

WHEREAS, a cross-connection is any physical arrangement whereby a public water supply is connected, directly or indirectly, with anything that does not exclusively contain or convey potable water from a State-approved source; and

WHEREAS, Section 284-54 of the Washington Administrative Code Rules and Regulations governing Public Water Supplies requires that all cross-connections are to be eliminated or controlled; and

WHEREAS, Section 248-54 of the Washington Administrative Code requires that in order to eliminate or control cross-connections, every water purveyor is to establish a cross-connection control program; and

WHEREAS, Seattle Water Department is the water purveyor (retail supplier) for the City of Seattle and for some adjacent unincorporated areas of King County; and

WHEREAS, the Seattle Water Department must demonstrate administrative and enforcement authority for the purpose of establishing a cross-connection control program acceptable to the Department of Health; Now, Therefore,

BE IT ORDAINED BY THE CITY OF SEATTLE AS FOLLOWS:

Section 1. The Superintendent of Water is authorized and directed to administer a cross-connection control program to protect the health of water customers and the potability of the public water system and to comply with the requirements of Washington law in connection therewith. The Superintendent of Water is authorized and directed to promulgate pursuant to SMC 3.02 rules and regulations to implement a cross-connection control program consistent with this authority. Said rules and regulations shall include but not be limited to:

1. Minimum cross-connection control operating policies;
2. Backflow prevention assembly installation practices; and
3. Backflow prevention assembly testing procedures.

Section 2. That SMC 21.04.070 (Ord. 65877 § 5 (part), 1935) be amended as follows:

21.04.070 Cross Connections

A. ~~In no case shall any cross connection be allowed between two or more City-service connections, or between any City service connection and pipe supplying water from any other source.~~ Cross connections as defined in Section 248-54 of the Washington Administrative Code (1991), or as may be amended, shall be eliminated or controlled in accordance with the administrative rules of the Water Department and any applicable rules of the State of Washington Department of Health or any other applicable City, State, or federal laws.

B. As a term and condition of all water service, the Superintendent of Water or his/her duly authorized representatives shall have a right to access at all reasonable times to all parts of the buildings or premises supplied by water from the City for the purpose of ascertaining the need to eliminate or control cross-connections.

C. The Seattle Water Department shall deny or discontinue water service to any customer failing to cooperate in the elimination of cross-connections or the control of cross-connections through the installation, maintenance, testing or inspection of backflow prevention assemblies required by the Seattle Water Department.

D. When in the discretion of the Superintendent of Water appropriate circumstances so warrant, the Superintendent may charge the account of any customer who violates any applicable rules and regulations concerning cross connections for all costs, including service calls,

<u>and any damages incurred by the Water Department in</u>
<u>relation to such violation.</u>

Section 3. Any act taken pursuant to the authority and prior to the effective date of this ordinance is hereby ratified and confirmed.

Section .... This ordinance shall take effect and be in force thirty days from and after its passage and approval, if approved by the Mayor; otherwise it shall take effect at the time it shall become a law under the provisions of the city charter.

Passed by the City Council the 28th ... day of May .... , 1991

and signed by me in open session in authentication of its passage this 28th ...... day of May ...., 1991.

[illegible signature]
President........... of the City Council.

Approved by me this 4th ...day of June ...., 1991.

Norman B Rice
Mayor.

Filed by me this 4th ...... day of June ...., 1991.

Norward J. Brooks
Attest: ....
City Comptroller and City Clerk.

(SEAL)

Published.................................

By Margaret Carter
Deputy Clerk.

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

II. WATER QUALITY AND TREATMENT

APPENDIX C
COMPREHENSIVE DRINKING WATER QUALITY MONITORING PLAN

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Seattle Public Utilities
Comprehensive Drinking Water Quality Monitoring Plan
October 2006

1.0 Overview

Providing public health protection is a primary concern in the operation and maintenance of a public drinking water system. Determining the adequacy of this protection is accomplished with a comprehensive monitoring program that covers the source of supply, treatment systems, the distribution system, and customers' taps. Sampling requirements are established by federal regulations, such as the Safe Drinking Water Act (SDWA), which are in most cases adopted by the state. Seattle Public Utilities (SPU) conducts monitoring in accordance with the Safe Drinking Water Act and Washington State Department of Health requirements, Chapter 246-290 WAC.

This monitoring plan addresses the following:

- Monitoring requirements under state and federal drinking water regulations;
- Future regulations, which are currently under development at the federal level;
- Non-regulatory monitoring, which SPU conducts for informational purposes and to assist in operating the water system;
- Sampling procedures;
- Laboratory Information Management System (LIMS); and,
- All parameters, locations, and frequency of monitoring conducted by SPU. Monitoring locations include source, treatment, transmission and distribution system, and customer taps.

A summary of SPU's monitoring requirements is shown in Table 1. This table includes source water and distribution system monitoring required by regulation. Monitoring of treatment operations required by the Surface Water Treatment Rule or Lead and Copper Rule is not included in Table 1, but is discussed below, and is reflected in Table 2.

Table 2 is a summary of the monitoring currently conducted by SPU and is organized by sampling locations, frequencies, and parameters. This table includes monitoring required by regulations, and monitoring conducted for operational or informational purposes (non-regulatory). All monitoring shown is directly related to the drinking water supply. Monitoring related to special studies, customer inquiries, disinfection of new mains, construction of facilities, environmental compliance when dewatering facilities, wellhead protection, aquifer recharge, source development, treatment chemicals, or other monitoring conducted for purposes other than drinking water quality compliance is not included in this document.

DOH has the authority to grant waivers for certain parameters, depending on vulnerability and previous sampling results. If a system is considered to have low vulnerability to contamination from a certain chemical or group of chemicals, the State may waive the requirements for sampling, or reduce the amount of samples required. The State issued waivers for SPU for Volatile Organic Chemicals (VOCs) and Synthetic Organic Chemicals (SOCs) for the 2002 to 2004 monitoring period. SPU has applied for waivers for the 2005 to 2007 monitoring period. There are also several area-wide waivers in effect for several of the SOCs. These waivers apply to all systems within the designated area.

SPU operates its own State-certified laboratory for a majority of the parameters monitored. This includes total coliform, fecal coliform, HPC, most inorganic chemicals, trihalomethanes, haloacetic acids, lead, copper, and all SWTR parameters. Samples for VOCs, SOCs, asbestos, some inorganics, and *Cryptosporidium* and *Giardia* are sent to other laboratories certified by the state or EPA for the analysis.

Adjustments to monitoring are often required based on operational considerations, detection of organic chemicals, construction projects, or as required by the state based on a public health concern. SPU will work with the State to determine appropriate changes to the monitoring program to address any concerns that may arise.

2.0 Monitoring Requirements

The following summarizes the monitoring requirements for existing and future regulations. Existing regulations include those finalized by EPA and published in the Federal Register under 40 CFR Part 141. Any regulation the state has adopted into Chapter 246-290 WAC with changes or additions are also discussed under existing regulations. Future regulations include those currently proposed by EPA.

2.1 Existing Regulations

The existing regulations discussed below are organized by their common name with a reference to the appropriate federal and state section numbers.

Total Coliform Rule (40 CFR 141.21 and WAC 246-290-300 (3))

SPU collects and analyzes coliform samples from representative points throughout the direct service area as outlined in SPU's Coliform Monitoring Plan (attached without appendices). These samples are collected at designated sample stands according to established routes assigned by the Senior Water Quality Analyst or designee. Routes are designed to cover both the Cedar and Tolt service areas each day; with most sample stands being sampled weekly. To meet regulatory requirements, SPU must collect at least 189 coliform samples from its direct service area each month. The chlorine residual is also analyzed in the field at the time of coliform sample collection as required by state regulations. Temperature is also measured, although not required.

For any sample found to be positive for total coliform, or invalidated, follow-up action is taken according to state and federal regulations, as described in SPU's Coliform Monitoring Plan. This follow-up action may include additional sample collection, additional analyses such as fecal coliform, *E. Coli*, or HPC, and notification to the state. SPU's Coliform Monitoring Plan lists all sample locations, schedules, test methods used, follow-up sampling requirements, and notification requirements.

Surface Water Treatment Rule (40 CFR 141.70-75 and WAC 246-290 Part 6)

The Surface Water Treatment Rule (SWTR) requires a significant amount of monitoring for SPU's filtered surface water supply, the South Fork Tolt River. This includes raw water, treated water, and distribution system water monitoring as follows.

Raw Water Monitoring – Continuous monitoring of turbidity at the inlet to the Tolt Treatment Facility occurs as required by the SWTR. Samples analyzed for fecal coliform density are collected at the inlet to the Tolt Treatment Facility daily, for at least 24 days a month.

Treated Water Monitoring – Treated water monitoring for the SWTR consists of monitoring required to determine the effectiveness of the disinfection process. This includes monitoring to determine log reduction of *Giardia* cysts and viruses. To determine the log reduction for virus, the pH, chlorine residual, temperature, clearwell volume, and peak hourly flow rate must be recorded. For the Tolt system, this monitoring is continuous, but is reported once a day at peak hourly flow. To determine the log reduction for *Giardia*, the pH, ozone residual at multiple locations along the contact chamber, temperature, and peak hourly flow are recorded. CT is calculated for each section of the ozone contact chamber. Ct is reported to the state for both the peak hourly flow and at minimum daily CT.

In addition, continuous chlorine residual monitoring for water entering the distribution system occurs at the outlet of the Tolt Treatment Facility. Turbidity is also monitored continuously at each individual filter unit and from the combined filter effluent.

Additional monitoring is conducted at the treatment plant to meet the requirements of the Service Agreement with the DBO contractor. This monitoring is summarized in Table 3.

Distribution System Monitoring – Residual disinfectant concentration is measured at the same time and location that a routine or repeat coliform sample is collected within the distribution system.

Limited Alternative to Filtration (WAC 246-290-691)

Beginning in November 2004, the Cedar water supply system was designated a Limited Alternative to Filtration status. As such, the source and treated water monitoring requirements are slightly different than an unfiltered surface water source subject to the SWTR. This includes raw water, treated water, and distribution system water monitoring as follows.

Raw Water Monitoring – Continuous turbidity monitoring occurs at the Cedar Water Treatment Facility for the raw water coming from Lake Youngs. Fecal coliform samples are also collected at this location once per day for a minimum of 24 days a month.

Treated Water Monitoring – Treated water monitoring consists of monitoring to determine inactivation of Giardia, Cryptosporidium, and viruses. This monitoring is conducted continuously for the ozonation system, UV treatment, and chlorination. For ozone inactivation of Giardia and viruses, monitoring includes temperature, pH, initial ozone concentration, ozone decay, and flow rate. For inactivation of Giardia and Cryptosporidium with UV, monitoring consists of flow rate through each reactor, UV transmission, UV dose, lamp power, and lamp hours. For inactivation of viruses with chlorine, monitoring includes flow rate, clearwell volume, pH, chlorine residual, and temperature.

Finished water entering the system is continuously monitored for chlorine residual, temperature and pH. Daily samples are also analyzed for coliform, although this is not required by regulation. Additional monitoring is required to meet the Service Agreement with the DBO contractor. Service Agreement monitoring is summarized in Table 3.

Distribution System Monitoring – Residual disinfectant concentration is measured at the same time and location that a routine or repeat coliform sample is collected within the distribution system.

Disinfectants/Disinfection By-Products Rules (40 CFR 141.130-135, 141, 142) and WAC 246-290-300 (7)

Current regulations (Stage 1) require trihalomethane (THMs) and haloacetic acids (HAAs) monitoring in the distribution system. SPU is required to collect two samples each quarter at existing sample stands within the direct service area under an approved reduced monitoring schedule. One of these stands is generally served by Cedar water and one is generally served by Tolt water. These two samples are collected at sample stands that are considered to represent the maximum residence time in the system for each source. Currently, sample stands G2 and B4 are considered to represent the maximum residence time for the Cedar and Tolt, respectively. SPU elects to collect two additional THM and HAA samples each quarter for informational purposes. The other two sites used are J-3 and A-3. These are considered average residence time and generally represent higher HAA levels.

Monitoring for chlorine residual currently conducted at total coliform sample sites in the direct service area are reported under the Stage 1 rule. Bromate and bromide monitoring are conducted for the Tolt and Cedar supplies now that ozonation facilities for each supply are in operation. The monitoring for bromate is conducted monthly at the entry to the distribution system. The bromide monitoring was conducted monthly for the source water prior to any treatment during the first year of operation of the Tolt and Cedar Treatment Facilities.

Stage 2 DBP Rule was finalized in January 2006. This new rule will require increased monitoring for DBPs, including a one year study of DBP levels at 24 distribution system locations in the direct service area. A monitoring plan must be submitted in October 2006, with monitoring beginning in 2007. Routine DBP monitoring under Stage 2 will likely require quarterly sampling at 12 locations

Lead and Copper Rule (40 CFR 141.80-91)

SPU has conducted monitoring for lead and copper at customers' taps according to the regulations and a Bilateral Compliance Agreement with DOH. Two rounds of samples were collected at 375 homes in 2003 and 2004 after completion of a corrosion control optimization study for the Tolt. Two more rounds of samples were collected at 400 homes in 2005. These homes were selected based on criteria in the Lead and Copper Rule. For the last two rounds, the homes were divided into sub regions. One hundred samples were collected from the Seattle direct service area, 100 were collected from Bellevue, 100 were collected from the participating wholesale providers receiving water from the Cedar supply, and 100 were collected from the participating wholesale providers receiving water from the Tolt supply. Compliance was based on the 90^{th} percentile for each sub-region. The next round of monitoring will be conducted in 2006. Based on previous rounds, each sub-region qualifies for reduced monitoring, which requires 50 samples per sub-region. Eventually, each sub-region will likely be required to collect 50 samples once every three years. Monitoring requirements would change if the lead or copper action levels were exceeded.

Water quality parameter monitoring is also now required for the lead and copper rule. This monitoring currently includes collecting 25 distribution system samples each month and analyzing the samples for pH and alkalinity. Under reduced monitoring, 10 locations will likely be required.

Inorganic Contaminants, VOCs, SOCs (40 CFR 141.23-23, 40 and WAC 246-290-300 (4) and (7))

Primary and Secondary inorganic contaminants (IOCs) including arsenic, volatile organic chemicals (VOCs), and synthetic organic chemicals (SOCs) are monitored according to state and federal requirements. IOCs for the Cedar and Tolt supplies are monitored on an annual basis and VOCs are monitored once every three years, with the samples collected from the entry point to the distribution system, after treatment. This frequency assumes a state waiver has been granted for VOCs. The Riverton and Boulevard Park Wells are sampled once every three years (or when in operation) for IOCs and VOCs at the entry point to the distribution system prior to the first customer. SOCs are monitored as directed by the state, and the frequency is dependent on waiver status. SPU currently has a waiver for SOC monitoring through the year 2004.

Radionuclides (40 CFR 141.26 and WAC 246-290-300 (9))

The new radionuclides rule (effective December 2003) requires monitoring for gross alpha, radium 226, radium 228, and uranium. This monitoring is conducted for each source at the entry point to the distribution system. Frequency is dependent on results. After initial monitoring, samples will likely be required once every 9 years. Two consecutive quarterly samples will be required before December 2007 for initial monitoring.

Fluoride (WAC 246-290-460)

As required by state regulations, fluoride is monitored daily at each point of fluoride addition and a report is submitted to the state monthly. In addition to fluoride monitoring at the treatment plants, a grab sample is collected daily and analyzed at SPU's Water Quality Laboratory as a check.

Unregulated Contaminants Rule (40 CFR 141.35, 40)

The Unregulated Contaminants Rule, effective January 1, 2001, required additional monitoring for SPU's source waters. Four quarterly samples were collected at the entry point to the distribution system in 2002. If future UCMR regulations require monitoring sources in the future, SPU will be prepared.

2.2. Future Regulations

The future regulations discussed below are organized by their currently accepted common name (may change in the future). *Federal Register* citations are provided for rules which have been published, either in draft or final form.

Proposed Radon Rule (40 CFR 141.20)

Monitoring for radon will be required in the future as a result of the new Radon Rule, proposed in October 1999. A final rule is expected in late 2007. This regulation may have the greatest impact on SPU's ground water supplies, as previous monitoring has not detected radon in the surface water supplies. SPU will be prepared to conduct any required monitoring for radon as a result of the new rule.

Groundwater Rule

This regulation is expected to be final in late 2006, with an effective date sometime in 2009. Additional monitoring of the disinfection treatment for the Riverton and Boulevard Park wells may be required due to this rule or a hydrogeological assessment and source water monitoring. It is not expected to have a significant impact on SPU's monitoring program.

Cryptosporidium Monitoring for LT2SWTR (40 CFR Parts 9, 141, and 142)

SPU currently conducts monthly source water monitoring for *Giardia* and *Cryptosporidium* for the Cedar and Tolt supplies. This monitoring is currently voluntary, but crypto monitoring will be required beginning in late 2006. The results of *Cryptosporidium* monitoring are reported in the annual Drinking Water Quality Report sent to customers each year. Currently, samples are collected from three locations: Landsburg forebay, Tolt Regulating Basin outlet, and Lake Youngs outlet prior to treatment.

2.3. Non-Regulatory Monitoring

Non-regulatory monitoring discussed below includes monitoring performed for informational purposes or to assist in making operational decisions. This monitoring is not required by regulation at this time, but may be required at some time in the future.

Limnology

Monthly and quarterly monitoring of various limnological parameters is conducted at Lake Youngs, Chester Morse Lake, the Tolt Reservoir proper and reservoir tributary streams, and Cedar River tributary streams upstream of Landsburg. In addition, samples are collected occasionally from the Tolt Regulating Basin. This data is collected for informational purposes, and is not required by state or federal regulations. Sample collection occurs at multiple locations and depths in Lake Youngs, Chester Morse Lake, and the Tolt Reservoir. Some of the parameters included in sampling include temperature, dissolved oxygen, transparency, turbidity, conductivity, alkalinity, calcium, pH, phosphorous, iron, manganese, ultra-violet light absorption, total organic carbon, phytoplankton, zooplankton, taste and odor, geosmin, and MIB.

Taste and Odor

Taste and Odor are analyzed on a weekly or bi-weekly basis for each of SPU’s large in-town reservoirs, the source waters, and other locations as needed. This monitoring is used to make operational decisions, but is not currently required by state or federal regulations.

Reservoir Protection

Each of SPU’s in-town open reservoirs, and five closed reservoirs, currently have chlorination at the outlet, prior to entry to the distribution system. The chlorine residual is monitoring continuously to ensure adequate treatment occurs at all times. In addition, weekly check samples are collected and analyzed by laboratory staff for chlorine, total coliform, fecal coliform, and HPC from the reservoir outlet and mid-reservoir. Treatment staff check each open reservoir treatment system daily. As required by WAC 246-290-470, SPU maintains and operates the open reservoirs according to a DOH approved Open Reservoir Protection Plan. In addition, DOH has approved SPU’s Reservoir Covering Plan, which will replace, cover, or abandon all open reservoirs by 2018.

Treatment Processes

Existing source water treatment consists of ozonation, UV light, chlorination, fluoridation, and corrosion control on the Cedar supply. Treatment for the Tolt supply consists of ozonation, coagulation, flocculation, filtration, corrosion control, chlorination and fluoridation. Each of these processes is monitored continuously to ensure adequate treatment is maintained at all times. Portions of this monitoring are required by the regulations discussed above. Significantly more monitoring is required to meet the requirements of the Service Agreements for each DBO contractor operating the treatment plants. This monitoring is summarized in Table 3.

2.4 Sampling Procedures

Proper sample collection is important for accurate results. All laboratory assistants and other staff collecting samples in the field are trained in appropriate sample collection techniques based on parameter. Written sample collection procedures for bacteriological analyses such as total coliform are included in SPU's Coliform Monitoring Plan. Sample collection methods for all regulatory compliance samples follow standard procedures or methods listed in *Standard Methods*. In addition, training for laboratory staff conducting the analyses occurs on a regular basis.

2.5 Laboratory Information Management System (LIMS)

Beginning in 2006, SPU's Water Quality Laboratory implemented a new Laboratory Information Management System (LIMS). All water quality samples analyzed at the lab, or samples analyzed by outside laboratories for SPU's drinking water are entered into LIMS. This system provides the means to track sample status, record and validate results, and produce reports. Data from LIMS can then be extracted to other computer programs for long-term storage, analysis, or report formatting.

Table 1
Seattle Public Utilities
Summary of Drinking Water Quality Monitoring Requirements (Regulatory)
Dated: January 20, 2006

Parameter	Locations	Frequency	Monitoring Year	Lab Used	Waivers	Comments
Inorganic Chemicals						
Antimony	SO1 at CLT-4, 5	Annually for Cedar and Tolt	Every Year for SW	SPU		EPA and State allow waivers.
Arsenic	SO2 at T-FINISH			SPU		State has not granted any to date.
Barium	SO4 at BPW-T	Once every three years for wells	2007 for GW or when	SPU		
Beryllium	SO6 at RHW-T		operating	SPU		
Cadmium				SPU		
Chromium				SPU		
Copper				SPU		No MCL, AL = 1.3 mg/L
Cyanide				Outside		
Fluoride				SPU		
Lead				SPU		No MCL, Al = 0.015 mg/L
Mercury				Outside		
Nickel				SPU		
Selenium				SPU		
Sodium				SPU		Health Advisory Level = 20 mg/L
Thallium				SPU		
Nitrate Nitrite	CLT-4, 5, T-FINISH, RHW-T, BPW-T	Annually for SW and GW	Every Year, wells if operated	Outside		Sample during quarter with previous highest result (SW).
Asbestos	8426 36th Ave. SW (Cedar) 2033 NE 103rd St. (Tolt)	Once every nine years	Once in 2002-2011 period	Outside		Must be at a tap served by AC pipe. State waiver through 12/2001
Lead Copper	At 100 customer taps (almost 400 including purveyors)	After further optimization of Tolt corrosion control 2 rounds	2003 - 2004	SPU	BCA	We do roughly 100 for Tolt and 100 for Cedar
Radionuclides						
Gross Alpha Emitters Radium 226 Radium 228 Uranium	CLT-4, 5 T-FINISH, RHW-T, BPW-T	Initially 2 consecutive quarters, then frequency depends on results. Possibly once every 9 years.	By 2007 for SW Next time Wells are used.	Outside		State Not Enforcing???
Organic Chemicals						
VOCs	CLT-4, 5, T-FINISH, RHW-T, BPW-T	Once every three years	2005-2007	Outside	Yes	State waivers for some
SOCs (Includes herbicides, general pesticides, & insecticides)	CLT-4, 5, T-FINISH, RHW-T, BPW-T	Depends on waiver	??	Outside	Yes	Waiting for waiver status from state
Dioxin, endothall, Diquat, Glyphosate, EDB & other Soil Fumigants						State waivers
Bacteriological						
Total Coliform Rule	62 distribution system sample stands	240 samples per month	sampling conducted daily	SPU		Reduced monitoring for SPU may start soon
Chlorine Residual	Same locations as coliform	240 samples per month	sampling conducted daily	SPU		
Disinfection By-Products						
Trihalomethanes	G2, J3 for Cedar, A3, B4 for Tolt	Quarterly	Every Year	SPU		One sample is from extreme end of each source.
HAAs (future)	G2, J3 for Cedar, A3, B4 for Tolt	Quarterly	Every Year	SPU		Reduced monitoring for Stage 1 requires only one sample per quarter. Stage 2 IDSE in 2007/08.
Secondary Contaminants						
Chloride	CLT-4, 5, T-FINISH, RHW-T, BPW-T	Annually for Cedar and Tolt	Every Year for SW	Outside		
Color		Once every three years for wells	2007 for GW	SPU		
Fluoride				SPU		
Hardness				SPU		
Iron				SPU		
Manganese				SPU		
Silver				SPU		
Specific Conductivity				SPU		
Sulfate				Outside		
Total Dissolved Solids				SPU		Only done if conductivity > 700 μmhos/cm
Zinc				SPU		
Surface Water Treatment Rule (Tolt)						
Turbidity	TPR-5S 5N, T-CFE, T-FINISH, each filter	Continuous				All Part of DBO Contract
Fecal coliform	TPR-5S 5N	Daily, at least 24 days per month		SPU		
Chlorine Residual	T-FINISH	Continuous				
CT Complaince	Ozone contactors and clearwell	Continuous				For Giardia and Virus inactivation
Limited Alternative to Filtration (Cedar) - LAF						
Turbidity	C1-RAW, C1-FIN, C2-FIN	Continuous				All Part of DBO Contract
Fecal coliform	C1-RAW	Daily, at least 24 days per month		SPU		
Chlorine Residual	C1-FIN, C2-FIN	Continuous				
CT Complaince	Ozone contactors, UV units, and clearwell	Continuous				For Crypto, Giardia, and Virus inactivation

Table 2

Seattle Public Utilities

Drinking Water Quality Monitoring Conducted – by Parameter

Required and Optional

Parameter	Source	Monitoring Frequency and Location: Continuous	Daily or M-F	Weekly or Biweekly	Monthly	Quarterly	Annually
Turbidity	Cedar	CPR-1, C1-RAW, C1-FIN, C2-FIN	CPR-1, CT-2	Open reservoirs and checkpoints (6 sites)	10 sites on CMR, 11 sites on Lake Youngs	Part of QTR 8 sites	
	Tolt	TPR-5S 5N, T-FINISH, T-CFE, ea. Filter at plant, reclaimed water	TPR-4, TT-1, 2		10 sites Tolt Reservoir		
pH	Cedar	C1-RAW, C1-CWI, C1-FINISH	CPR-1, CLT-4, 5, CT-1, 2, 3,	Open reservoirs and checkpoints, Soos tanks, RVR-1, 41 TCR sites	CT-4, 10 sites on CMR, 11 sites on LYS, field pH at 25 TCR sites	4 DBP sites	
	Tolt	TPR-5S, T-FINISH, T-CWI	TT-1, 2, 11	TT-3, TT-22,	TPR-4, 10 sites Tolt Reservoir		
Conductivity	Cedar	WSP-1???	CPR-1, CLT-4, 5, CT-1, 2, 3,	Open reservoirs and checkpoints, Soos tanks, RVR-1, 41 TCR sites	CT-4, 10 sites on CMR, 11 sites on LYS, field pH at 25 TCR sites	4 DBP sites	
	Tolt		TT-1, 2, 11	TT-3, TT-22,	TPR-4, 10 sites Tolt Reservoir		
Fluoride	Cedar	CPT-00	CPT-00, CT-2	5 sample stands	Average of 11 seepage samples, 4 purveyors check samples	8 QTR sites	
	Tolt	T-FINISH	TT-1, 2	2 sample stands, TT-3, T-FINISH			
Chlorine Residual	Cedar	CPT-00, 4 location at CWTF, ESR, MGR, open reservoirs, Ballard firehouse	CLT-4, 5, CT-1, 2, 3, open reservoirs, CPT-00 2/shift	Closed tanks, standpipes, and reservoirs, open reservoirs and checkpoints, WSP-1, CPT-04, CT-4, almost 200 TCR sites DSA and WSA	25 PBCU sites	4 DBP sites, QTR sites	
	Tolt	T-FINISH, LFP, BLR	TT-1, 2, 11				
Total Coliform - PA	Cedar		CLT-4,5, CT-1, 2, 3, C1 and C2-FIN	Closed tanks, standpipes, and reservoirs, open reservoirs and checkpoints, CT-4, TT-3, WSP-1, almost 200 TCR sites (DSA and WSA)			
	Tolt		T-FINISH TT-1, 2, 11				

Table 2
Seattle Public Utilities
Drinking Water Quality Monitoring Conducted – by Parameter
Required and Optional

Parameter	Source	Monitoring Frequency and Location: Continuous	Daily or M-F	Weekly or Biweekly	Monthly	Quarterly	Annually
Total Coliform – Colisure QT	both		CPR-1, C1-RAW, TPR-5S	Open Reservoirs	10 sites LYR, 6 sites CMR		
Fecal Coliform	Cedar		CPR-1, C1-RAW, C1-FIN, C2-FIN	Open Reservoirs			
	Tolt		TPR-5S				
HPC	Cedar		CPR-1, C1-RAW, CLT-4, 5	Closed tanks, standpipes, and reservoirs, open reservoirs and checkpoints, WSP-1	Average of 120 TCR sites (SPU and WSA)		
	Tolt		TPR-5S, TT-1, 2, 11, T-FINISH				
Temperature	Cedar	C1-RAW, C1-FIN, C2-FIN	CPR-1, CLT-4, 5, CT-1, 2, 3, C1-FIN, C2-FIN	Closed tanks, standpipes, and reservoirs, open reservoirs and checkpoints, CT-4, TT-3, T-CFE, almost 200 TRC sites (DSA and WSA)	Pb/Cu sites (25)	DBP sites	
	Tolt	TPR-5S, 5N	TT-1, 2, 11, TPR-5S 5N, T-FINISH				
UVA	Both	CPR-1	CPR-1	TPR-5S, T-CFE	CLR-2, C1-RAW, CPT-4, CMR sites, Tolt Res sites		
TOC	Both			CPR-1, TPR-5S, T-CFE	6 sites CMR, 10 sites Tolt Res, 10 sites LYR		
Taste and Odor	Both			CPR-1, CT-2, C1-RAW, C1-FIN, C2-FIN, T-FINISH, open reservoirs	CPT-04, 05		
Giardia/Crypto	Both				CPR-1, C1-RAW, TPR-4		
Alkalinity	Both			TT-3, TT-22, T-FINISH	25 Pb/Cu sites	8 QTR sites	
Inorganics	Both					2 sample stands, CPR-1, C1-RAW, CLT-4 - 5, TPR-4, T-FINISH CMR-1	CLT-4 -5, T-FINISH

Note: Sampling for Riverton and Boulevard Park Wells is not included in this table.

Table 3 Seattle Public Utilities **Drinking Water Quality Monitoring Conducted by DBO Contractors** Continuous Monitoring						
Parameter	**Tolt Treatment Facility**					
	Reclaimed Water	**Raw Water**	**Ozone Contactors**	**Filter Effluents**	**Combined Filter Effluent**	**Clearwell Effluent**
Turbidity	X	X		X	X	X
Temperature		X				
pH		X			X	X
Particle Count		X		X(1)	X	
Ozone Concentration			X			
Chlorine Residual					X	X
Fluoride					X	X
Parameter	**Cedar Water Treatment Facility**					
	Raw Water	**Ozone Contactors**	**UV Reactors**	**Clearwell Influent**	**Clearwell Effluent**	**Finished Water**
Turbidity	X					X
Temperature	X					X
pH	X			X	X	X
Ozone Concentration		X				
UV Transmission, UV Dose			X			
Chlorine Residual				X	X	X

Tolt grab sample parameters include coliform, alkalinity, bromate, iron, sodium, taste and odor, TTHMs and HAAs SDS, Color, TOC, and UVA.
Cedar grab sample parameters include coliform, bromate, iron, chlorophyll, sodium, and taste and odor.

Seattle
Public
Utilities

Coliform Monitoring Plan

Direct Service Area

Seattle Public Utilities
Water Quality Laboratory
800 S. Stacy Street
Seattle, WA 98134

December 2005

Table of Contents

Appendices

Background

Regulatory Background and Requirements

In 1974 the US Congress enacted the Safe Drinking Water Act (SDWA) which established national drinking water standards. The SDWA set maximum levels for particular contaminants and established monitoring requirements. In 1986 Congress expanded the SDWA to include regulation of coliforms, resulting in promulgation of the Total Coliform Rule (TCR) in 1989. State regulations were then revised to incorporate the TCR (WAC 246-290, Part 4).

Coliform testing is required on a monthly basis with the number of samples based on the population served. All samples are tested for total coliform. If total coliform is present, the sample is also tested for either fecal coliform or *E. Coli* and repeat samples are collected. In addition, chlorine residual must be tested and reported with each coliform sample.

A water quality violation occurs under any of the three following conditions: 1) more than 5 percent of samples in a month are positive for total coliform (non-acute MCL violation); 2) a total coliform positive sample that also tests positive for fecal coliforms/*E. Coli* is followed by a positive coliform repeat sample (acute MCL violation); or 3) a coliform positive sample is followed by a coliform and fecal coliform/*E. Coli* positive repeat sample (acute MCL violation).

What is Coliform Bacteria?

Total coliforms are a broad group of bacteria that is used as an indicator of possible contamination in the water system. Total coliform bacteria are usually not harmful themselves, but their presence indicates the possible presence of other, disease-causing organisms. While many total coliform bacteria are found in the intestinal tract of warm-blooded animals, other total coliform bacteria grow in aquatic and soil environments and these bacteria are not related to intestinal contamination.

If a sample is tested positive for total coliform, the sample is then also tested for fecal coliform or *E. Coli*. Fecal coliform and *E. Coli* are much more likely to have come from fecal material than total coliform; thus the presence of fecal coliform and *E. Coli* indicates a greater likelihood for the presence of disease-causing organisms.

Purpose of the Plan

A coliform monitoring plan is required by the federal TCR as adopted into state regulations (WAC 246-290-300). The purpose of this plan is to ensure that SPU's coliform testing meets or exceeds regulatory requirements. This plan identifies routine and repeat sample collection sites, provides a schedule for collection of samples, and explains how sampling locations and schedule cover the water system. This plan only covers the direct service area of SPU; it does not cover the wholesale water service areas. A separate Regional Coliform Monitoring Plan covers issues of monitoring and coordination by SPU and most of its wholesale customers.

Overview of the Water System

Seattle Public Utilities (DOH ID#77050Y) provides water to approximately 1.3 million people via direct and wholesale service. Within its direct service area, SPU serves a population of about 628,000 residents through approximately 180,000 metered service connections (2005 data). An overview of the water system facilities follows. Please refer to the water system plan for further description.

Sources of Supply

SPU operates two main sources of supply: the Cedar River and the South Fork Tolt River. In addition, the Riverton Heights Wellfield and Boulevard Park Well provide water during some peak seasons and serve as a backup supply to the river sources. The individual sources are listed in Table 1 below.

Table 1. SPU Sources of Supply

DOH Source No.	Source Name	Source Category
SO1	Cedar River	Surface
SO2	Tolt River	Surface
SO3	Riverton Heights #1	Well in a well field
SO4	Boulevard	Well
SO5	Riverton Heights #2	Well in a well field
SO6	Riverton Heights WF	Wellfield

The Cedar River supply is an unfiltered surface water that provides approximately 70 percent of the drinking water for SPU and the wholesale customers. The South Fork Tolt River supply is a filtered surface water that provides the remaining 30 percent of the drinking water. The Riverton Heights and Boulevard Wells are considered a seasonal supply and can supply up to 10 mgd.

The Cedar River begins within a protected watershed on the west side of the Cascade Mountains and eventually drains into the south end of Lake Washington. The watershed area totals about 79,700 acres of which 99.7 percent is owned by SPU. The Cedar River water supply system also consists of Chester Morse Lake, the Landsburg Facilities, the Cedar Supply Pipelines, Lake Youngs, the Cedar Water Treatment Facility, the Lake Youngs Tunnel and Pump Station, and Control Works.

The South Fork Tolt River watershed has a drainage area of approximately 12,100 acres in northeastern King County. The south fork of the river eventually flows into the Snoqualmie River. The watershed is controlled by SPU, which owns 69 percent of the area. The remainder is owned by the US Forest Service. The Tolt River water supply system consists of the Tolt Reservoir, the Tolt Penstock, the Regulating Basin, the Tolt Treatment Facilities, and the Tolt Pipelines.

The Cedar and Tolt supplies enter the system from opposite ends (south and north, respectively). Generally each supply feeds a specific distribution area, though some areas receive blended water depending on operations and demand. The wells are located south of the city limits.

Treatment

The Cedar River supply is diverted at Landsburg, where chlorine and fluoride are currently added, and discharged into Lake Youngs. Facilities installed in 2004 pump Lake Youngs water and disinfect it with ozone, ultraviolet light, and chlorine. Lime is then added for corrosion control. With the new facilities, the Cedar supply is operated as an unfiltered surface water source under a Limited Alternative to Filtration. (Prior to installation of the new facilities, treatment consisted of primary chlorination and fluoridation at Landsburg and secondary chlorination and lime addition at the Lake Younds outlet.)

The Tolt River supply is treated with ozonation, direct filtration, chlorination, fluoridation, and lime and carbon dioxide addition. (Prior to 2001, the Tolt was operated as an unfiltered surface water supply.)

The Riverton Heights and Boulevard Park wells are treated with hypochlorite for disinfection, fluoride, and sodium hydroxide for corrosion control.

See below for a description of rechlorination facilities at the reservoirs.

Pressure Zones

The service area served directly from SPU is maintained with 31 distinct pressure zones. Some of these pressure zones may be at the same elevation, but are not physically connected. There are 18 pressure zone elevations.

Finished Water Storage Facilities

The SPU system has 6 operational open reservoirs, 9 covered reservoirs, 9 standpipes, and 7 elevated tanks as listed in Table 2 below. The total volume of the finished water storage facilities listed below is 507 million gallons. SPU has a plan on file with DOH for covering, replacing, or abandoning all the open reservoirs by the year 2018. The Lake Forest Park and Bitter Lake reservoirs each have floating covers. The Lincoln reservoir is currently being reconstructed with a concrete lid.

Each open reservoir is rechlorinated at the outlet to maintain a disinfection residual in the distribution system served by the reservoir. The rechlorination facilities have been kept at the Lake Forest Park, Bitter Lake, and Lincoln reservoirs. The Eastside and Magnolia reservoirs also have rechlorination systems that can be used.

Pumping Stations and Pressure Regulating Stations

The SPU distribution system contains 31 pumping stations with a total of 96 individual pump units. There are also 176 pressure regulating stations within the service area that are separate from the pumping stations.

Table 2. SPU Distribution Storage Facilities

Storage Facility	Capacity (MG)	Storage Facility	Capacity (MG)
Open Reservoirs		Standpipes	
Beacon Hill - North	61	S.W. Barton	1.4
Beacon Hill - South[1]	49	S.W. Charleston	1.5
Green Lake	50	Foy	1.0
Maple Leaf	59	Queen Anne #1	0.3
Myrtle	7	Queen Anne #2	0.9
Volunteer Park	20	S.W. Trenton - North	1.2
West Seattle	68	S.W. Trenton - South	1.2
		Volunteer Park	0.9
		Woodland Park	1.0
Covered Reservoirs		Elevated Tanks	
Eastside	32	Beverly Park	2.0
Magnolia Manor	5.5	Magnolia Bluff	1.0
Riverton Heights	20	Maple Leaf	1.0
Soos (2)	13	S.W. Myrtle #1	0.5
View Ridge	2.5	S.W. Myrtle #2	1.0
Lake Forest[2]	60	Richmond Highlands #1	1.0
Bitter Lake[2]	21.5	Richmond Highlands #2	2.0
Lincoln Park[3]	21		

[1]Currently not in use. [2]Floating covers. [3]Under reconstruction.

Sampling Plan

Population Estimates

The number of coliform samples required per month is based on the population served by the water system. The estimated residential population for the SPU direct service area in 2005 is 628,000. DOH has indicated that non-residential population is required in this plan for determining coliform monitoring requirements. Non-residential population is estimated for the direct service area using census data for place of residence and place of work. Consistent with the SPU regional coliform monitoring plan, non-residential population is counted for people who travel from outside the SPU wholesale service area. The 2005 non-residential population estimate for the direct service area is 158,000. Thus, the 2005 total population estimate, including residents and non-residents, is 786,000.

Sampling Requirements

Under the regional coliform monitoring plan, SPU is required to collect 70 percent of the number of coliform samples from WAC 246-290-300, Table 2. Based on the total population of 786,000, the number of coliform samples from WAC 246-290-300, Table 2 is 270. With participation in the regional coliform monitoring plan, the required number of monthly coliform samples is 189.

Typically, SPU will collect more than the required number of samples. The current schedule is for 270 samples per month. In the future, SPU will likely revise the sampling schedule to a number between 189 and 270. In the past, the additional samples beyond the regulatory requirement have provided added coverage of the water system, created some flexibility in scheduling, and allowed for unexpected problems to occur while still meeting regulatory requirements.

If a routine test is positive for total coliform, then the sample must also be analyzed for fecal coliform or *E. Coli* and 3 repeat samples must be collected. Repeat samples are collected at the following locations: 1) site of previous sample with coliform presence; 2) within five service connections upstream of the site of sample with coliform presence; and 3) within five service connections downstream of the site of sample with coliform presence. Repeat samples are used to confirm the original sample results and to help determine the cause of the coliform presence. When a repeat sample has coliform presence, an additional set of repeats is required.

Chlorine residual measurement is required at the same time and location of coliform sample collection (WAC 246-290-451).

Sampling Locations

Routine Sampling Locations

SPU has 65 dedicated sample stands used for routine coliform monitoring sites. (Two of the 65 samples stands, one in downtown and one in Laurelhurst, are planned for installation following approval of this monitoring plan.) The sites are shown in Figure 1 (see separate map) and listed in Appendix A. Site locations have been based on the following criteria:

- Population sub-areas represented
- Spatially distributed throughout system
- All major pressure zones represented
- Site representative of typical piping configuration and normal operational condition
- Not on dead ends
- Safe location for staff to park and collect sample
- Close to drainage to avoid erosion, surface flow on streets
- Tapped into 8" distribution line or smaller

Further description of the first three criteria is provided below.

Population: Sub-area Representation. Seattle is divided into population sub-areas based on census tracts as shown in Figure 2. An evaluation of the population and number of sample stands in each sub-area of the SPU distribution system is shown on Table 3. Each of the 15 sub-areas has at least two sample stands, except the Shorewood Apartments, which has a relatively small population. Based on the sampling schedule, the sub-areas are sampled at a rate of 0.19 to 0.48 samples per 1000 population per month. The sampling rate for the North sub-area is unusually low at 0.19 samplers per 1000. This is because the odd shape of the Northwest sub-area happens to include sample stand C-5, but C-5 is actually more representative of the North sub-area. Generally, the range of sampling rates is due to other considerations, such as spatial distribution and coverage of pressures zones, as described below. This sampling is based on typical collection of 270 routine samples each month as mentioned above. If SPU chooses to reduce the schedule closer to the 189 monthly samples required, the balance of sample collection for spatial and population based representation will be maintained.

Spatial Distribution and Pressure Zones. A visual inspection of the sample stand map (Figure 1) shows that the 62 sample sites used for routine TCR sample collection are relatively equally spaced throughout the distribution system. Sample stands within the same pressure zone are located at least 10 blocks apart, but no more than 25 blocks apart. Each major pressure zone has at least one sample stand. The distribution of sample sites by pressure zone is shown in Appendix B. Some of the small pressure zones served by pressure reducing valves do not have their own sample stand, but are served by a pressure zone that has a sample stand. It is estimated that these small pressure zones represent less than one percent of the population.

Appendix C contains a series of schematics showing the pressure zones, storage facilities, and associated sample stands. These schematics are not to scale, but show how each pressure zone and storage facility is represented by at least one sample stand.

Repeat Sampling Locations

Repeat samples are taken in follow up to a positive coliform sample. In addition to the original site of the sample with coliform presence, repeat samples are taken within five services upstream and five services downstream of the original sample. Appendix D contains a list of routine and repeat coliform sampling locations.

Table 3. Allocation of Sample Stands by Sub-Area Population

Sub-area	Residential Population*	Non-Residential Population†	Total Population	Land Area (Acres)	Number of Sample Stands**	Number of Samples Collected per Month	Samples per 1000 Total Pop.
Ballard	43,068	7,900	50,986	3,677	5	16	0.31
Capitol Hill	46,170	11,850	50,020	2,494	5	20	0.34
Central	31,443	11,850	43,293	2,070	2	12	0.28
Downtown	21,745	31,600	53,345	1,147	4	16	0.30
Duwamish	41,286	23,700	64,986	7,820	7	31	0.48
Lake Union	26,895	7,900	34,795	1,939	3	12	0.34
North	38,427	3,950	42,377	3,777	2	8	0.19
Northeast	71,270	15,800	87,070	5,972	8	33	0.38
Northwest	64,437	7,900	72,337	5,781	7	32	0.44
Q. Anne/Magnolia	53,543	7,900	61,443	5,107	4	16	0.26
Southeast	46,286	7,900	54,186	4,337	4	17	0.31
West Seattle	78,804	7,900	86,704	9,665	7	31	0.36
Shoreline	34,857	7,900	42,757	NA	4	17	0.40
South Unincorp.	15,000	3,950	18,950	NA	2	8	0.42
Shorewood Apts	1,600	–	1,600	NA	1	1	0.63
Totals	**614,974**	**158,000**	**772,831**	**53,786**	**65**	**270**	**0.35**

*Population data is based on 2000 census, except for South Unicorporated and Shorewood Apartments.

†Non-residential population is distributed based on zoning.

**Includes one new sample station each in Ballard, Downtown, and Northeast.

Sampling Schedule and Routes

The coliform sampling schedule is generally set for one sample per week per stand. Most samples are collected Monday through Friday, though about 10 percent of samples are collected on weekends so that the distribution system is sampled every day. A basic monthly sampling schedule is presented in Appendix A. The sampling schedule does vary slightly each month depending on which day of the week that the first of the month falls and the number of days in the month.

A series of set routes are followed for sample collection covering both the SPU direct and wholesale customer service areas. A detailed listing of routes is presented in Appendix E; note that the route schedule not only includes wholesale customers, but also non-compliance sample stations. The same routes are followed the first three weeks of the month. Altered routes are followed in the fourth and fifth weeks.

The current sampling schedule and routes represent collection of 270 samples per month. In the future, SPU may choose to reduce samples collected to a number closer the 189 required monthly samples. The same general approach to scheduling would be followed.

Sample Stands and Sampling Procedures

SPU utilizes dedicated sample stands for all routine coliform sampling. The purpose of the stands is to have sample points that: provide water representative of that in the distribution system; are under the control of SPU; are easily accessible 7 days per week; reduce time for collection; and can be located throughout the distribution system. To avoid stagnation and freezing of water in the sample lines, the sample stands flow continuously at about 1/2 gallon per minute.

Handheld field computers are used for identifying sample bottles with sample stand locations and for management of field data. Data from the field computers is then downloaded into the laboratory information management system (LIMS). Procedures for collection and transport of samples are provided in Appendix F. Details on the construction and maintenance of the sample stands are provided in Appendices G and H.

Sample Analysis

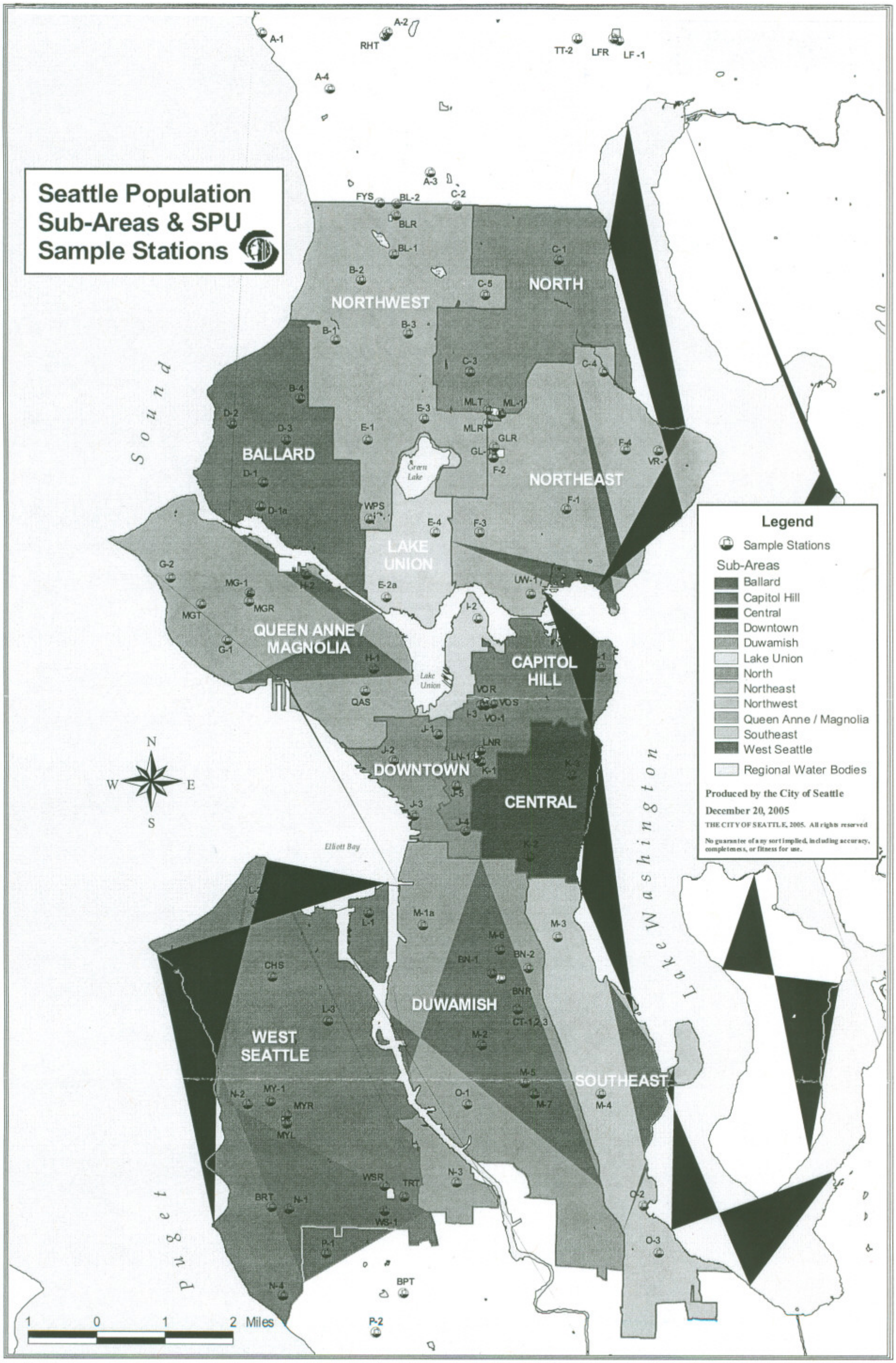
The SPU Water Quality Laboratory is certified by the State for the following total coliform, fecal coliform, and *E. Coli* analytical methods:

- Colisure (MMO/MUG, Standard Method 9223B)
- Colilert (MMO/MUG, Standard Method 9223B)
- Membrane Filtration (Standard Methods 9222B and 9222D)

Chlorine residual tests are conducted on site with the collection of each coliform sample. SPU typically tests for Heterotrophic Plate Counts (HPCs) on samples with chlorine residual less than 0.2 mg/L.

Non-Routine Sampling and Analysis

In addition to the coliform compliance monitoring, SPU routinely performs a number of non-compliance microbiological tests for water quality in the distribution system. The additional testing provides a greater level of knowledge than coliform testing alone and can aid in assessing possible problems that could arise. Open reservoirs are regularly tested for total and fecal coliform, heterotrophic plate counts (HPCs), and *Pseudomonas*. Closed storage facilities are regularly tested for total and fecal coliform and HPCs. The testing results are used to evaluate microbial activity in the reservoirs and the efficacy of operational techniques on improving water quality. Multiple coliform samples are collected daily from both the Tolt and Cedar transmission systems. SPU also conducts daily HPC testing at other distribution locations selected randomly. For additional information, the SPU laboratory has the capability of performing bacterial speciation of water samples, both by the traditional biochemical method (i.e., API 20e) and by the use of a rapid automated system of carbon utilization patterns (i.e., Micro station by BioLog Inc.).



Seattle Population Sub-Areas & SPU Sample Stations
NORTHWEST
NORTH
BALLARD
NORTHEAST
LAKE UNION
QUEEN ANNE / MAGNOLIA
CAPITOL HILL
DOWNTOWN
CENTRAL
DUWAMISH
WEST SEATTLE
SOUTHEAST
Puget Sound
Lake Washington
Green Lake
Lake Union
Elliott Bay
N
S
E
W
1 0 1 2 Miles
Legend
Sample Stations
Sub-Areas
Ballard
Capitol Hill
Central
Downtown
Duwamish
Lake Union
North
Northeast
Northwest
Queen Anne / Magnolia
Southeast
West Seattle
Regional Water Bodies
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December 20, 2005
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A-1
A-2
RHT
TT-2
LFR
LF-1
A-4
A-3
FYS
BL-2
C-2
BLR
BL-1
C-1
B-2
C-5
B-3
B-1
C-3
C-4
B-4
MLT
ML-1
E-3
MLR
D-2
D-3
E-1
GLR
GL-1
F-4
VR-1
F-2
D-1
F-1
D-1a
WPS
E-4
F-3
G-2
MG-1
H-2
E-2a
UW-1
MGR
MGT
I-2
G-1
H-1
QAS
VOR
VOS
I-3
VO-1
J-1
J-2
LNR
LN-1
K-1
J-5
J-3
J-4
K-3
K-2
L-2
L-1
M-1a
M-3
M-6
BN-1
BN-2
CHS
BNR
L-3
CT-1,2,3
M-2
M-5
N-2
MY-1
MYR
O-1
M-7
M-4
MYL
WSR
TRT
N-3
BRT
N-1
O-2
WS-1
P-1
O-3
BPT
N-4
P-2

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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

II. WATER QUALITY AND TREATMENT

APPENDIX D
WATER TREATMENT CHEMICALS

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Water Treatment Chemicals
May 2006

Facility	Chemical
Tolt Treatment Facility	Liquid Oxygen
	Carbon Dioxide
	Chlorine
	Ferric Chloride
	Hydrofluorosilicic Acid
	Lime
	Cationic Polymer
	Anionic Polymer
	Sodium Bisulfite
	Sodium Hydroxide
Cedar Treatment Facility	Liquid Oxygen
	Chlorine
	Lime
	Sodium Bisulfite
	Sodium Hydroxide
Landsburg Diversion & Pre-Treatment Facility	Chlorine
	Hydrofluorosilicic Acid
Seattle Wellfields*	Sodium Hypochlorite
	Carbon Dioxide
	Sodium Hydroxide
	Hydrofluorosilicic Acid
In-Town Reservoirs: Chlorination and Hypochlorination Facilities	Sodium Hypochlorite
	Carbon Dioxide
	Salt (used for on-site hypochlorite generation)
	Chlorine Gas

Notes:

* Indicates the facility is only used seasonally during the high demand period. Chemicals are not stored on site during the off season.

--Tolt and Cedar information provided by Tolt and Cedar Treatment Facility managers in April 2006. Other information in this table was provided by SPU staff at the same time.

--Myrtle Reservoir Chlorination Facility (currently out of service for reconstruction) will be rebuilt as a sodium hypochlorite facility instead of gaseous chlorine.

--The following facilities no longer exist since the 2001 Water System Plan was produced: 1) SW Trenton Pump Station Chlorination Facility, and 2) West Seattle Reservoir Chlorination Facility

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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

III. TRANSMISSION

APPENDIX A
TRANSMISSION SYSTEM ASSETS INVENTORY

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Transmission Pipelines

Pipeline Name	Upstream Endpoint	Downstream Endpoint	Type (>500 feet)	Dominant Size (inches)	Maximum Size (inches)	Length (feet)
Raw Water Pipelines						
Tolt Pipe Line #1 (TPL1)	Tolt Regulating Basin	Tolt Treatment Facility (TTF)	Concrete, Steel	42-66	66	8,331
Tolt Pipe Line #2 (TPL2)	Tolt Regulating Basin	TTF	Steel	66-87	87	8,565
Landsburg Tunnel & Aqueduct	Landsburg	Tunnel Valve House	Concrete	96	96	10,131
Lake Youngs Supply Line #4 (LYSL4)	Tunnel Valve House	Dog Legs	Steel	78,92	92	35,570
Lake Youngs Supply Line #5 (LYSL5)	Tunnel Valve House	Dog Legs	Steel	78	78	35,511
South Fork Tolt Supply Line	SF Tolt Reservoir	Tolt Regulating Basin	Steel, concrete	24	72	27,465
Tolt Penstock	SF Tolt Reservoir	Tolt Regulating Basin	Steel	54-68	68	26,600
				Approximate Total Length:		**152,173**
Treated Water Pipelines						
Finish Water Pipeline #5 (FWPL5)	Cedar Clearwells	Connection to LYT	Steel	78	78	2,516
Lake Youngs Tunnel (LYT)	Connection to FWPL5	Control Works	Concrete	96	96	15,703
Finish Water Pipeline #4 (FWPL4)	Cedar Clearwells	Control Works	Steel	78	78	15,775
Cedar River Pipeline #4 (CRPL4)	Control Works	WSPL	Concrete, Steel	60	72	57,195
West Seattle Pipe Line (WSPL)	Augusta Gatehouse	West Seattle Reservoir	Steel	48	54	26,284
Cedar River Pipeline #1 (CRPL1)	Control Works	Beacon	Steel	66	72	62,822
Cedar River Pipeline #2 (CRPL2)	Control Works	Beacon	Steel, Concrete, DI	51.5	60	62,765
Cedar River Pipeline #3 (CRPL3)	Control Works	Beacon	Steel	66	72	64,302
Cedar River Pipeline #1 (old CRPL2)	Beacon	18th & Prospect	Steel	54	54	23,338
Cedar River Pipeline #2 (old CRPL1)	Beacon	12th & Olive	Steel	42	42	19,355
Cedar River Pipeline #3 (CRPL3)	Beacon	18th & Prospect	Steel	66	66	22,336
Cedar River Pipeline #3 (CRPL3)	18th & Prospect	Volunteer Reservoir	Steel	66	66	1,755
Maple Leaf Pipeline (MLPL)	18th & Prospect	Maple Leaf Reservoir	Steel	54	54	26,109
550 Pipeline	Lake Forest Park Reservoir	Maple Leaf Reservoir	Steel	66	66	45,738
Tolt Pipe Line #1 (TPL1)	TTF	Harris Creek LV	Concrete, Steel	66	66	18,673
Tolt Pipe Line #1 (TPL1)	Harris Creek LV	Duvall LV	Steel	81	81	19,945
Tolt Pipe Line #1 (TPL1)	Duvall LV	Welcome Road LV	Concrete, DI, Steel	54	66	13,905
Tolt Pipe Line #1 (TPL1)	Welcome Road LV	TESS Junction	Steel, DI	54	66	35,497
Tolt Pipe Line #1 (TPL1)	TESS Junction	Lake Forest Park Reservoir	Concrete, Steel	54	60	32,012
Tolt Pipe Line #2 (TPL2)	Duvall LV	Trilogy LV	Steel	75	81	12,538
Tolt Pipe Line #2 (TPL2)	Trilogy LV	104th LV	Steel	60	81	29,922
Tolt Pipe Line #2 (TPL2)	104th LV	TESSL	Steel, Concrete	54	54	12,550
Tolt Pipe Line #2 (TPL2)	TESS Junction	Lake Forest Park Reservoir	Steel	54	60	34,353
Tolt Tieline	Welcome Road LV	Trilogy LV	Steel	43.5	43.5	7,865
Tolt East Side Supply Line (TESSL)	TESS Junction	TPL2	Concrete, Steel	48	54	24,267
Tolt East Side Supply Line (TESSL)	TPL2	SE 16th	Concrete	36	42	29,346
TESSL Extension	SE 16th	Eastside Reservoir	Concrete, Steel	48	48	12,602
Cedar East Side Supply Line (CESSL)	Cedar Wye	SE 16th	Concrete	36	72	54,613
Mercer Island Pipeline (MIPL original)	CESSL	Mercer Island	Concrete, Steel	30	30	16,628
MIPL (new, across slough)	Lake WA Blvd	Enatai	Steel	16	16	3,808
MIPL (new, E Channel Bridge)	E side of E channel	W side of E channel	DI	16	20	2,541
Bow Lake Pipeline	CRPL4	Des Moines Way Pipeline	Concrete, DI	36	36	5,857
Burien Feeder	CRPL4	Burien Pump Station	Concrete	30	30	5,241
8 Ave S Feeder	Burien PS	Bow Lake Ppeline	Concrete	24	24	4,721
Des Moines Way Pipeline	Bow Lake Pipeline	end	Concrete	24	24	21,305
				Approximate Total Length:		**844,182**

Source: GIS data (March 2006)

Notes:

LV = Line Valve

DI = Ductile Iron

Regional and Sub-Regional System Standpipes and Elevated Tanks													
Facilities	Capacity (MG)	Year Const.	Base Elev.[1] (feet)	Overflow Elev. (feet)	Diameter (feet)	Tank Height on Riser (feet)	Tank Material	Date of Last Inspection	Interior Coating		Exterior Coating		Seismic Upgrade (or Date Scheduled)
									Type[a]	Date Applied	Type[b]	Date Applied	
Standpipe													
Foy	1.00	1933	495	590	46	-	Riveted Steel	Feb 98	Vinyl	1980	Lead base	1980	To be determined
Elevated Tanks													
Beverly Park	2.00	1959	460	585	105	35	Welded Steel	Oct 98	CTE/epoxy	1985	Zn/Alkyd	1985	To be determined
Myrtle #1	0.50	1919	506.5	584.5	46	NA	Riveted Steel	Feb 96	vinyl	1982	Lead base	1983	2003
Myrtle #2	1.00	1946	506.5	584.5	84.25	NA	Riveted Steel	Jan 99	CTE/epoxy	1982	Lead base[2]	1983	2003
Richmond Highlands #1	1.00	1954	492.5	590	86	25	Welded Steel	Nov 99(2)	CTE	1954	Lead base[2]	1981	1993
Richmond Highlands #2	2.00	1958	488.5	590	86	35	Welded Steel	Nov 98	CTE	1958	Lead base[2]	1981	1994
Others													
Control Works NE Tank	0.34	1925	437	512	NA	-	Riveted Steel	Oct 97	p-urethane	1994	epoxy/urethane[5]	1994	1994
Control Works SW Tank	0.34	1925	437	512	NA	-	Riveted Steel	Nov 97	p-urethane	1994	epoxy/urethane[5]	1994	1994

All elevations based on NAVD 88.
a CTE = Coal Tar Enamel; p-urethane = Monolithic polyurethane lining
b epoxy = NSF epoxy primer and intermediate co: Zn/Alkyd = Zinc yellow primer and silicone alkyd enamel top coat
1. Top of concrete base.
2. Richmond Highlands: 1993 seismic upgrade added all new steel to legs and riser, and coated legs and riser with a non-lead alkyd enamel paint system. The bowls still have the lead based primer as noted.
3. Myrtle #2 has an intermediate layer of aluminum or SS flake alkyd paint.
4. Float inspected in 1990.
5. Base of tank in building. Above the roof: epoxy prime coat and polyurethane top coat (in 1994); Inside the bldg: moisture cured polyurethane primer and top coats (in 1998).

Prepared April 2006

Regional and Sub-Regional System Reservoirs					
Reservoir	**Total Capacity (MG)**	**Year Constructed**	**Overflow Elev. (feet)[1]**	**Under-Drain**	**Construction Type**
Covered Reservoirs					
Eastside	31.9	1989/90	560	Yes	Reinforced concrete tank. Below grade.
Lake Forest Park	59.9	1961/62	550	Yes	Hyplon-lined, reinforced concrete slab. Floating cover added in 2003.
Riverton Heights	20.5	1979/80	465	Yes	Reinforced concrete tank. Part below grade.
Soos North	6.5	1989/90	640	Yes	Reinforced concrete tank. Above grade.
Soos South	6.5	1989/90	640	Yes	Reinforced concrete tank. Above grade.
Open Reservoirs					
Maple Leaf	59.1	1910	430	Yes	Unreinforced concrete slab. Hypalon liner.
West Seattle	68.1	1932	440	No	Unreinforced concrete slab. Hypalon liner.

Source: Albarracin and Stumpf, July 1999 and Capron and Mantchev, April 2006.

1. All elevations based on North American Vertical Datum (NAVD).

Prepared April 2006

Regional and Sub-Regional System Pump Stations

Pump Station	Pump #	Manufacturer	Model	Design Flow (gpm)	Head (feet)	Speed (rpm)	Horse-Power	Comments
Augusta	1	Aurora	411 BF	300	102	1,750	15	Pumps 1 and 2 are continuous
	2	Aurora	411 BF	300	102	1,750	15	duty; alternating daily
	3	Aurora	411 BF	1,200	102	1,750	40	
	4	Aurora	411 BF	2,400	113	1,750	100	Fire flow only
Bothell Way	1	De Laval	T36/30	38,200	80	450	900	
Burien	1	Allis Chalmers	209-648-501	2,000	180	1,760	125	Emergency pump connections
	2	Allis Chalmers	209-732-501	3,000	180	1,760	200	for diesel pump.
	3	Worthington	10-LNHS-18	6,000	180	1,775	350	
Control Works	1	De Laval		1,200		1,760	25	Standby use only
Eastgate	1	Byron Jackson	18-KXH-1-STG	4,250	145	1,770	200	
	2	Byron Jackson	18-KXH-1-STG	4,250	145	1,770	200	
	3	Byron Jackson	18-KXH-1-STG	4,250	145	1,770	200	
Fairwood	1	Aurora	411 BF	750	220	1,750	75	Emergency pump connections for
	2	De Laval	A0615L	2,000	215	1,750	150	diesel pump.
Foy	1	Ingersoll Rand	10 LR 18A	6,000	165	1,785	300	
	2	Ingersoll Rand	8 LR-18S	4,440	165/290	1,778	400	165 ft. head with 15.43";
	3	Ingersoll Rand	8 LR-18S	4,440	165/290	1,778	400	290 ft. head with 18" impeller
Highland Park	1	Worthington	10 LNH 18	5,500	175	1,775	300	Can be powered by diesel generator.
	2	Worthington	10 LNH 18	5,500	175	1,775	300	
	3	Ingersoll Rand	6 AFV	1,400	140	1,770	60	
Lake Hills	1	Peerless	8AE17A	5,000	160	1,780	250	New 1999 Emergency pump connections
	2	Peerless	8AE17A	5,000	160	1,780	250	New 1999 for diesel pump
Lake Youngs	1	Fairbanks Morse	7000 AW	7,700	182	1,185	500	
	2	Fairbanks Morse	7000 AW	7,700	182	1,185	500	
Maple Leaf	1	Patterson	18X14 MAC	10,300	156	1,180	500	Can be powered by diesel generator
	2	Patterson	18X14 MAC	7,200	156	1,180	350	
Maplewood	1	Worthington	20 LN 28	17,750	108	720	600	Standby use only, low hours
North City	1	Worthington	12 LN 14	6,500	113	1,775	250	
	2	Worthington	12 LN 14	6,500	113	1,775	250	
	3	Worthington	12 LN 14	6,500	113	1,775	250	
Trenton	1	De Laval		1,000	225	1,845		Water Turbine Powered
	2	De Laval		3,000	225	1,200		Water Turbine Powered
TESS	1	Worthington	8 LP 13	1,600		1,770	100	Emergency pump connections for diesel pump

Notes:
gpm = gallons per minute
rpm = revolutions per minute
Vert. = vertical

Prepared April 2006

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

III. TRANSMISSION

APPENDIX B

ACCESS TO SEATTLE WATER SYSTEM GUIDELINES

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Access to Seattle Water System Guidelines

Operating Board Approved on July 8, 2003

BACKGROUND

Seattle Public Utilities owns, maintains and is responsible for the reliability and water quality provided by its regional water supply system. Under the new Full and Partial Requirements contracts, the cost of regional assets are shared between Seattle and the Wholesale customers.

Seattle's existing sources of supply include the Cedar River, South Fork of the Tolt River and the Highline Well Field. The major sources of supply come from surface water sources and are protected by watershed management programs that prohibit public access and water quality degradation. This level of watershed protection has allowed Seattle to avoid the need for filtration of the Cedar supply. Seattle's groundwater supply comes from the Highline well field and is used as a backup supply predominately during peak periods and is a combination of Cedar River injected water and water from the aquifer. There is a wellhead protection program that ensures water quality for when the source is used.

Seattle's sources are managed in order to accommodate in-stream flows for fish while providing a 98% level of supply reliability for all of Seattle's customers. In order to accomplish these goals, SPU's resource managers must be able to manage the sources as needed and rely on the transmission system's capacity to provide water from any of the sources, conjunctively throughout the region in a seamless manner.

Other large surface water sources in the region include Tacoma's Green River water and Everett's Sultan River water, both of which include protected, undeveloped watersheds. Most of the region's remaining sources of water supply consists predominately of medium and small groundwater systems.

ISSUE

The advent of additional growth in the region and competing needs for water resources has caused Seattle and other utilities to independently evaluate their water supply operations and availability. At the same time, a number of factors combine to prevent water from existing supplies from being available to people and the environment when and where it is needed. Efforts are underway in various forums to overcome regulatory obstacles blocking solutions to these problems, and individual utilities need to determine their role in the regional framework for this to be successful. Regardless of the result of these efforts, one significant issue that needs addressing is how it would be possible to move new sources through the existing SPU regional water system to a utility that is interested in receiving water that is not part of the SPU water supply.

Engineered solutions to delivering water supply are the easiest of the issues to resolve for making water available. Maximizing existing regional sources and moving water to places in need involves more than engineered solutions; it requires working out issues related to ownership of assets, access to assets, customer responsibilities, maximization of conjunctive use possibilities and coordination of operations. Seattle does not have policies related to access to its system or for service delivery to customers by other water suppliers in its water service area. This paper reviews options that are available to Seattle for allowing access to the regional water system for the purpose of moving new sources to areas in need within SPU's service area.

OPTIONS

There are several options for enabling the delivery of new sources of water to areas in need. In all cases, guidelines are needed to establish the role Seattle will take in allowing access to the regional water system to get water to these customers. While each new source and service delivery would be evaluated for its unique characteristics, guidelines for decision-making are identified for each option. These options are discussed here.

Full Access

Generally the most cost-effective means of delivering water supply to a needy customer, not located near the source, is to use existing infrastructure. Allowing access to excess pipeline and other system infrastructure capacity usually entails blending with the existing source in the system.

Under this full access scenario, the introduction of new sources into the regional water system adds new levels of risk and responsibility for Seattle. The following minimum guidelines should be considered:

Water Quality
Exhibit I identifies the minimum water quality guidelines to be considered prior to introduction of a source into Seattle's existing system.

Operations
- No adverse impact on Seattle's ability to manage the operation of its existing sources.
- No impairment to delivery for existing and planned customers, unless agreed upon by all parties.
- Flows need to be metered to track usage and provide billing information.

Finance
- Evaluation and commitment to pay for risk and cost of regulatory mandates imposed and operating risks as a result of source introduction.
- Establishment and payment of access charges.
- Analysis of infrastructure needs / costs and plan for cost recovery of infrastructure funded by the regional system.

Other
- Enter into contractual arrangement outlining terms and conditions. Consider safeguards such as requiring the utility granted access to the system to build a separate pipeline if an extreme water quality problem occurred from blending water supplies.
- Reach agreement on how regional system would be operated in regards to drought management, conjunctive use, and peaking.
- Public process and consideration of acceptability by customers receiving the new source or blended water.
- Completion of an Environmental Impact Statement, if needed.
- Supplying system has an approved Water System Plan (WSP), or if exempt from preparing a WSP, the utility would have an Operations and Maintenance Plan as required by WAC 246-290-415.

Partial Access

Water from a new source may be introduced into the regional system, but only delivered to a segment of the customer base in a more limited geographic area. In this case, part of the regional system would be isolated from the rest of the system and result in limited or no blending of the new source with existing sources. However, partial access to the regional water system may have an impact on the operational configuration and flexibility of managing the overall system. Specifically, the ease of flow through the system could be impaired by the need to "compartmentalize" the new source. As a result, system modeling would be required. Furthermore, guidelines related to operations would be more central to assessing the impact of this approach and determining if it would be detrimental to the operation of the overall system.

Water Quality
Each utility is responsible for meeting water quality standards within their own distribution area. Since the water from the new source would be delivered only to the utility or utilities that want or consent to receive the new source, water quality guidelines would be of primary interest to the utilities receiving the water. SPU would only allow water that meets state and federal water quality regulations to be wheeled through the regional system.

Operations
- Flow reversal protection and monitoring would be required.
- No impairment to delivery for existing and planned customers, unless agreed upon by all parties.
- Transmission system reliability and operational impacts could not be significantly impaired.
- Flows need to be metered to track usage and provide billing information.

Finance
- Establishment and payment of access charges, which are separate from any agreed upon charges for risk factors associated with allowing access to the system.
- Analysis of infrastructure needs and costs and plan for cost recovery of infrastructure funded by the regional system.

Other
- Consent by purveyors whose customers will receive the new source or may receive blended water.
- Reach agreement on how regional system would be operated in regards to drought management, conjunctive use, and peaking.
- Completion of an Environmental Impact Statement (may not be needed if no blending is involved).
- Enter into contractual arrangement outlining terms and conditions. Consider insurance, mitigation, indemnification as needed to reduce risk to the regional water system.
- Supplying system has an approved Water System Plan, or if exempt from preparing a WSP, the utility would have an Operations and Maintenance Plan as required by WAC 246-290-415 (may not be needed if no blending is involved).

No Access

A wholesale utility could receive a new source of supply without utilizing Seattle's regional supply system. This could be accomplished in several ways:
1) a new source is introduced directly into the local distribution system of the receiving utility;
2) one wholesale customer wheels water to another; or
3) the utility developing/securing a new source constructs its own, separate, transmission facilities from the new source to its customers.

Under any of these scenarios, the impact on the Seattle regional system would be limited to ensuring there is no adverse impact on delivery to existing and planned wholesale customers.

Exhibit I

Minimum Water Quality Guidelines for Full Access to Seattle Water Supply System

1. The new water source complies with all EPA, DOH and Seattle drinking water standards, including secondary aesthetic standards.
2. Source water complies with expectations of existing customers regarding hardness, pH, and taste. The source must complete a flavor rating analysis of no more than 3.0 as tested by Seattle's Flavor Profile Panel according to the methodology described by the American Water Works Association, or its successor.
3. Source protection plan (watershed or wellhead) has DOH approval.
4. Treatment is appropriate for the quality of the source, and together with source protection provides the same degree of public confidence in the supply, and is equivalent to public health protection and regulatory compliance experienced with the Tolt, Cedar, and Highline Wellfield sources and treatment. Contaminants of emerging concern (e.g., endocrine disrupters and pharmaceuticals) factor into the evaluation. For example, sources that are down stream of a wastewater discharge facility would not be considered acceptable. Unprotected sources may also be undesirable, but would be considered on a case-by-case basis.
5. Treatment is compatible with existing treatment of water in the Seattle regional supply system, including fluoridation, type of disinfectant residual, and method of corrosion control.
6. Chlorine residuals and chlorine demand of project water are acceptable by Seattle and Seattle's wholesale customers.
7. Disinfection By-Products (DBP) levels and precursors of project water are acceptable by Seattle and Seattle's wholesale customers.
8. Project water quality is stable and the water is available for a predictable portion of the year, to facilitate blending and prevent disruption of conditions in retail distribution facilities(e.g., rusty water from dissolution of scale in pipes).
9. The supplier shall provide Seattle with satisfactory results from a blending study to determine the compatibility of the source with existing sources already in the regional water supply system, the appropriate method and level of treatment and the probable distribution of the new supply within the regional system.

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

IV. DISTRIBUTION

APPENDIX A
DISTRIBUTION SYSTEM ASSETS INVENTORY

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Distribution System Reservoirs

Reservoir	Total Capacity (MG)	Year Constructed	Overflow Elev. (feet)[1]	Under-Drain	Construction Type
Covered Reservoirs					
Bitter Lake	21.3	1956/57	509	Yes	Reinforced concrete slab. Hypolon liner and floating cover added in 2001.
Lincoln	12	2004	326	Yes	Reinforced concrete reservoir. Below grade.
Magnolia	5.5	1993/94	330	Yes	Reinforced concrete tank. Part below grade.
View Ridge	2.5	1977/78	276	Yes	Reinforced concrete tank. Below grade.
Beacon[2,3]	50	1911	326	Yes	To be constructed as below-grade reinforced concrete reservoir.
Myrtle[3]	5	1946/47	498	Yes	To be constructed as below-grade reinforced concrete reservoir.
Open Reservoirs					
Roosevelt	50.3	1910	326	Yes	Unreinforced concrete slab. HDPE liner.
Volunteer	20.5	1901	430	No	Unreinforced concrete slab.

Source: Albarracin and Stumpf, July 1999, and Mantchev and Capron, 2006

1. All elevations based on North American Vertical Datum (NAVD).
2. Beacon South has been empty since March 1976; information not shown.
3. Scheduled for demolition and replacement beginning April 2006; data shown for replacements.

Prepared April 2006

Distribution System Pump Stations								
Pump Station	**Pump #**	**Manufacturer**	**Model**	**Design Flow (gpm)**	**Head (feet)**	**Speed (rpm)**	**Horse-Power**	**Comments**
Bitter Lake	1	Gould	3405	4,000	162	1,775	200	
	2	Gould	3405	4,000	162	1,775	365	Diesel standby use only
	3	Gould	3405	4,000	162	1,775	200	
Broadway	1	Fairbanks Morse	2844C	4,700	245	1,781	400	
	2	Fairbanks Morse	2844A	2,800	237	1,784	250	
	3	Fairbanks Morse	K65226	4,000		1,150	300	
Dayton Ave.	1	De Laval	56064	1,400	110	1,750	50	
	2	MP		100	100	3,450	5	
First Hill[1]	3	Fairbanks Morse	2824C	2,800	180	1,775	200	Computer link with Broadway
	4	Fairbanks Morse	2824C	4,900	190	1,775	350	Pump Station pumps 1 and 2
Green Lake	1	De Laval	98851	900	331	1,750	93	Water Turbine Powered
Interbay	1	Worthington	10 LN 18	3,500	110	1,185	125	Low service
	2	Worthington	8 LA 4	3,500	230	1,785	300	High service
Lincoln	1	Worthington		3,900	117	1,540	125	Water turbine powered
Northgate	1	Allis Chalmers	205-603-502	5,500	182	1,760	300	
	2	Allis Chalmers	205-603-501	5,500	182	1,760	300	
Roosevelt	1	Allis Chalmers	201-052-501	3,000	110	1,760	100	
	2	Allis Chalmers	201-052-501	3,000	110	1,760	100	
Scenic Heights	1	Aurora	411 BF	450	95	1,750	20	
	2	Aurora	411 BF	450	95	1,750	20	
	3	Aurora	411 BF	1,100	100	1,750	40	
	4	Aurora	411 BF	1,100	100	1,750	40	
SW Spokane	1	Allis Chalmers	207-52-510	4,000	290	1,760	400	New starters and transfer switch in
	2	Allis Chalmers	207-52-510	4,000	290	1,760	400	1997; can be powered by diesel gen.
Viewridge	1	Layne		2,500		1,750	100	To 316 zone
	2	Layne		3,500		1,750	350	To 520 zone
Volunteer	1	Allis Chalmers	201-194-502	4,000	108	1,760	125	
	2	Allis Chalmers	201-194-501	4,000	108	1,760	125	
Warren Ave.	1	Allis Chalmers	207-521-510	4,000	265	1,770	350	Can be powered by diesel generator.
	2	Allis Chalmers	207-521-509	4,000	265	1,770	350	
West Seattle	1	Ingersol Rand	10 AFV	4,500	62.3	1,750	100	
	2	Ingersol Rand	11 AFV	4,500	62.3	1,750	100	

Footnote:
(1) First Hill pump station has two pumps, they are labeled 3 and 4. The pumps work in conjunction with pumps 1 and 2 and the Broadway pump station.
Notes:
gpm = gallons per minute
rpm = revolutions per minute
Vert. = vertical

Prepared April 2006

Distribution System Standpipes and Elevated Tanks

Facilities	Capacity (MG)	Year Const.	Base Elev.[1] (feet)	Overflow Elev. (feet)	Diameter (feet)	Tank Height on Riser (feet)	Tank Material	Date of Last Inspection	Interior Coating		Exterior Coating		Seismic Upgrade
									Type[a]	Date Applied	Type[b]	Date Applied	(or Date Scheduled)
Standpipe													
Barton	1.40	1927	277	326	80	-	Riveted Steel	Jan 98	CTE	1960	Lead base	1981	To be determined
Charlestown	1.26	1996	424	498	58	-	Welded Steel	Feb 99	epoxy	1996	epoxy/urethane	1996	Not needed
Queen Anne[6]	2.00	2007	460	530	75	-	Welded Steel	N/A	epoxy	2007	To be determined	2007	N/A
North Trenton	1.19	1932	296	330	92	-	Riveted Steel	Jan 98	Vinyl	1979	Lead base[2]	1990	Not needed
South Trenton	1.19	1932	296	330	92	-	Riveted Steel	Oct 98	Vinyl	1979	Lead base[2]	1990	Not needed
Volunteer Park	0.88	1907	460	530	50	-	Masonry/Riveted Steel	Apr 99	Vinyl	1981	Lead base	1981	To be determined
Woodland Park	1.00	1925	356	430	50	-	Riveted Steel	Oct 98	Vinyl	1984	Lead base	1980	To be determined
Elevated Tanks													
Magnolia Bluff	1.00	1947	369	480	86	25	Welded Steel	Mar 99	epoxy	1988	Zn/Alkyd[3,4]	1988	1993
Maple Leaf	1.00	1949	431	530	84.25	25	Welded and Riveted	Jan 98	epoxy	1988/95	Lead base[5]	1988	2002

Source: Jacobsen, June 1999, and Mantchev 2006.

All elevations based on NAVD 88.

a CTE = Coal Tar Enamel; p-urethane = Monolithic polyurethane lining

b epoxy = NSF epoxy primer and intermediate coats; anc Zn/Alkyd = Zinc yellow primer and silicone alkyd enamel top coat

1. Top of concrete base.
2. Trenton tanks were power tool cleaned and overcoated with an urethane/epoxy/urethane paint system in 1990.
3. Magnolia Bluff was commercially blasted and coated with a non-lead alkyd system. Some lead remains on the tank.
4. 1993 seismic upgrade added all new steel to legs and riser, and coated legs and riser with a non-lead alkyd enamel paint system. The bowls still have the lead based primer as noted.
5. Maple Leaf has some remaining red lead primer then coated with moisture cured urethane primer and top coats.
6. Queen Anne Tanks #1 and #2 scheduled for replacement with single tank in 2007.

Prepared April 2006

Meters by Classification

Classification	Meter Size 3/4	1	1-1/2	2	3	4	6	8	10	12	16	20	24	Total
Residential	139,204	15935	1,140	434	1	5	0	2	0	0	0	0	0	156,721
Commercial	6,958	5201	3,413	4387	357	1797	1214	641	25	1	0	0	0	23,994
Key Accounts	461	359	285	654	129	255	284	208	45	15	0	2	0	2,697
Total	146,623	21,495	4,838	5,475	487	2,057	1,498	851	70	16	0	2	0	183,412

Source: Water Meter Count by Billing Size (Run Date 2/21/06); Lanning

Prepared Feburary 2006

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

IV. DISTRIBUTION

APPENDIX B
SYSTEM DESIGN STANDARDS

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This appendix to the *2007 Water System Plan* summarizes standards used by Seattle Public Utilities (SPU) for design or analysis of the water system serving retail customers. These standards are generally the same as those included in the *2001 Water System Plan Update*. The only significant changes are those related to the System Pressure.

1. Average Day, Maximum Day, and Peak Hour Demands

The average day demand values used in the SPU hydraulic network models are based on actual billing records from 2005. To simulate peak hourly demand (PHD) and maximum day demand (MDD) conditions, the 2005 ADD models were set up and calibrated to simulate actual records from the year 1998 peak demand day, July 27, 1998. The 1998 peak day had a total system consumption of 264 million gallons (MG). The PHD peaking factors are taken from the maximum demand hour from the simulation, and the MDD peaking factors are taken from the overall average for that day.

2. Storage Requirements

Hydraulic modeling of various scenarios proved to be an effective way to evaluate storage needs in the complex Seattle system. Scenarios representing peak week conditions, as well as a range of emergency conditions, provided the basis for the analysis. The suite of modeling scenarios provides a benchmark for storage needs of the water system. The attached July 14, 2004 paper “Seattle’s Reservoir Replacement Program” provides more detail on this analysis of storage needs.

3. Fire Flow Rate and Duration

Both the City of Seattle and King County have adopted the International Fire Code (IFC), and the fire flow rates and duration specified in the IFC are used in the analysis of distribution hydraulics and storage requirements.

4. Minimum and Maximum System Pressure

Minimum pressure criteria for new water mains are 30 pounds per square inch (psi) under peak hour demand conditions, and 20 psi when flows are a combination of average maximum day demand and required fire flow. In no case shall pressure at the customers meter be less than 20 psi. Pressures within distribution mains are not limited to a set maximum. All new services with static pressure above 80 psi require a pressure-reducing valve (PRV) per plumbing code requirements.

5. Hydraulic Modeling Process for Direct Service Area

Since the *2001 Water System Plan Update*, SPU has completed a reconnaissance-level analysis of the Direct Service pressure zones using EPANET-based models as the main tool for the analysis. The work produced a calibrated, working hydraulic network model of each pressure zone; identification of areas not meeting planning-level pressure and fire flow requirements; and identification of possible system improvements and related costs. The results of the hydraulic analysis were used to develop policies on low and high pressures in the Direct Service Area.

The hydraulic models are periodically updated to reflect system changes, and their calibration is improved as more field data is gained from fire flow tests and other opportunities. The models are used to determine fire flow availability and developer-required improvements, as well as for other special analyses of the distribution system.

6. Distribution Water Mains and Appurtenances

SPU design standards for water mains and related distribution system appurtenances are described in the attached memorandum. These standards include minimum pipe sizes, valve and hydrant spacing requirements, and other applicable standards.

7. Telemetry Systems

SPU has replaced its analog tone telemetry SCADA system with a PC-based frame relay system and is in the process of expanding the number of monitoring locations. After the first phase of SCADA expansion is completed, the standard information collected by type of facility will include the following:

- Source treatment plants: Clearwell level, inflow, outflow, chlorine residual, pH, turbidity, fluoride
- Reservoirs: Level, inflow, outflow, control valve position
- Reservoir hypochlorite treatment plants: Chlorine residual concentration, hypochlorite feed rates
- Tanks and standpipes: Level
- Pump stations: Flow, suction pressure, discharge pressure, pump status
- Control valves: Flow, upstream pressure, downstream pressure, valve position
- Transmission pipelines: Pressure
- Pressure zones (more than 500 service connections): Pressure

8. Standby Power

SPU's water system largely serves its customers by gravity flow. Therefore, the need for standby power is limited to the source treatment plants, open reservoir outlet treatment plants, the control center, and some pump stations that raise water to the higher elevations in the system that cannot be served by gravity flow. These situations are diverse enough that a single set of standards does not apply. SPU's approach is best illustrated by specific examples.

New chlorination facilities at the outlets of open reservoirs are equipped with emergency generators to support full treatment capacity during power outages. The Tolt Treatment Facility has emergency generator capacity to operate critical components of the facility, allowing it to meet the quantity and quality performance standards of the design-build-operate (DBO) service agreement. The Cedar Treatment Facility has emergency generator capacity to produce average day demands in accordance with the performance criteria of the DBO service agreement. The Cedar Treatment Facility also provides standby power for the Lake Youngs Pump Station, which serves Cedar River and Soos Creek Water Districts.

Higher elevations in the distribution system can typically receive water from one of several pump stations, some of which are equipped with hydraulically-powered pumps unaffected by power outages. Combined with the reliability of the electric grid within city limits, the probability of losing all pumps serving a particular pressure zone is relatively low. Where this assumption cannot be made, an emergency generator connection or a diesel-driven pump is provided.

A service reliability analysis was done in preparation for the Y2K turnover. A new diesel drive pump was added at Bitter Lake Reservoir. Otherwise, the analysis found SPU has portable emergency generator capability to supply vulnerable areas in response to a regional power failure.

Seattle's Reservoir Replacement Program

The System Storage and Reliability Analysis and its Application

July 14, 2004 AMC Session

<u>Introduction</u>

This paper describes the development and evolution of the plan for covering open reservoirs from its beginning in the mid-1990's. It describes the drivers and summarizes the analysis that helped shape the plan, and is organized into three parts:

Development of the Reservoir Burying Plan and Current Status of the Reservoir Burying Program

Determining Storage Requirements – the System Storage and Reliability Analysis (SSRA) as an objective benchmark of Water System Reliability

Issues for Further Analysis

Appendix 1 – Additional Detail on the Reservoir Burying Program

Appendix 2 - Non-storage Recommendations from the SSRA Analysis

<u>Objectives and Desired Outcomes</u>

1. Brief the AMC on the Reservoir Burying Plan recently adopted by City Council;

2. Brief the AMC on the analysis and rationale that the plan is based on, in particular, the proposed reductions in reservoir volumes;

3. Lay the ground for PDPs of projects spawned by the SSRA, in particular, the Maple Leaf Gate House Improvements;

4. Concur with the need to develop and present to the AMC within six months a clear and concrete plan to begin "trying it out" without Roosevelt and Volunteer Reservoirs;

5. Confirm that no individual PDPs will be prepared for each reservoir replacement project. Possible (partial) exceptions may include:

    - In case significant disagreements arise internally over significant project elements, those may be brought to the AMC for resolution

    - In case project costs increase more than 10 percent

Development of the Reservoir Burying Plan and Current Status of the Reservoir Burying Program

The plan for covering the open reservoirs has evolved since it was first formulated in the mid-1990's in response to a new Department of Health rule. The initial plan was to cover most of the reservoirs with relatively inexpensive floating covers, which would retain most of the existing storage volume. Primarily because of increased concerns about security, the current thinking is to replace most of the storage with new underground concrete reservoirs. To control costs, some of the new underground reservoirs will be significantly smaller than the open reservoirs they replace, and some open reservoirs may be de-commissioned without a covered replacement.

1996 Plan to Cover Open Reservoirs

In 1994, the Washington Department of Health adopted a rule requiring water systems with open distribution reservoirs to develop before January, 1996 an acceptable plan and schedule for covering or replacing these facilities. This rulemaking was significant for Seattle because its then nine open reservoirs, totaling 369 million gallons, represented about 90 percent of the storage in its distribution system.

In December 1995, with the endorsement of the Mayor and City Council, SPU submitted a preliminary plan and schedule to DOH. It called for the covering or replacement of the nine open reservoirs in a phased approach over 25 years, with the details to be developed in the ongoing updates of the Capital Improvement Program and Water System Plan.

The plan identified factors that would require further investigation and likely cause the covering plan to evolve during its implementation. These included:

- Update of storage needs of the distribution system.
- Community involvement and expectations.
- Schedule and budget of other capital projects.
- Condition of existing reservoirs.
- Schedule for conversion to hypochlorite disinfection.
- Maintaining system reliability during construction

In developing a preliminary sequence for covering the reservoirs, the 1996 covering plan used eight criteria, including:

- Need for reservoir rehabilitation.
- Need for eliminating chlorine gas disinfection.
- Turnover time of reservoir contents
- Chlorine contact time downstream of reservoir.
- Whether water came from Tolt source.
- Proximity to urban villages.
- Availability of open space nearby.
- Amount of bird-related contamination.

Based on these criteria, the preliminary sequence for covering the open reservoirs was:

By 2003: Bitter Lake, Lake Forest, and Lincoln
2003 to 2010: Beacon, Maple Leaf, and Volunteer
2010 to 2020: Roosevelt (formerly Green Lake), Myrtle, and West Seattle.

The plan described three covering technologies, (1) floating covers, (2) lightweight rigid covers, and (3) new underground concrete reservoirs. The plan estimated the cost of applying each of the cover types to the existing volume at each open reservoir, but did not propose a cover type for each site.

April 2001 Water System Plan

As anticipated in the 1996 covering plan, the April 2001 update of the Water System Plan (WSP) further refined the covering plan. The list of evaluation criteria was modified to include security and the urban village and open space criteria were combined into a single land use criterion:

- General condition
- Security
- Chlorination
- Water turnover
- Chlorine contact time
- Source of supply
- Land use
- Contamination from birds.

The WSP also modified slightly the covering sequence:

- By 2003: Bitter Lake, Lake Forest, and Lincoln
- 2003 to 2010: Volunteer, Beacon, and Myrtle
- 2010 to 2020: Roosevelt (Green Lake), Maple Leaf, and West Seattle.

The WSP also expressed a long-term goal to replace all of these reservoirs with new underground structures. In the near-term, only Lincoln and Volunteer would have such replacements. Because of financial conditions, the remainder would be covered with floating covers.

Post 9/11

Council Resolution 30422, adopted in November 2001, directed SPU to accelerate its reservoir covering program using a combination of floating covers and undergrounding two reservoirs, completing the program by 2005. In May 2002, the Mayor proposed an alternative Council resolution to underground all six of the City's remaining open reservoirs and thereby create 76 acres of open space. The Mayor proposed to finance the $245M (nominal dollars) program from water rates and complete it by 2011. In place of adopting the Mayor's proposal, in August 2002 Council adopted Ordinance 120899 authorizing SPU to proceed with undergrounding the Volunteer Park and Beacon reservoirs and directing the Executive to study and submit to Council a range of funding options for covering the four remaining open reservoirs (Myrtle, West Seattle, Maple Leaf, and Roosevelt). The Ordinance required SPU to consider an option that would limit the amount to be paid through water rates to the cost of installing floating covers, with any additional amounts necessary to construct underground replacement reservoirs provided through alternative funding sources. Other conditions of the ordinance are listed in Appendix 1.

Since 2003, the Adopted Water CIP has budgeted funds to underground the City's remaining six open reservoirs. The 2004 Adopted Budget included a proviso that prohibited spending any 2004 Water Fund appropriation on burying five of these remaining six reservoirs – Maple Leaf, West Seattle, Beacon South, Myrtle, or Roosevelt – until authorized by ordinance.

On April 19, 2004 the Council passed an Ordinance (Council Bill Number 114861) removing the restriction on the 2004 Budget, revising the schedule for individual burying projects, and amending SPU's 2004 - 2009 Capital Improvement Program to reflect the new schedule. Table 1 shows this revised schedule. The Council took this action after reviewing additional information provided by SPU, as summarized below.

Impact of Asset Management on the Reservoir Program

In 1997, SPU completed a detailed and sophisticated study (described in detail further on in this paper) which found that significant volume reductions could be possible and economical if reservoirs were buried. The decision at the time to put floating covers on the reservoirs made the issue of volume reductions moot as it was cheaper to cover the existing large reservoirs with floating covers than to bury them at the smallest possible size identified by the study. In addition, downsizing the existing reservoirs while installing floating covers would not result in savings due to the costs to reconfigure the structural berms to create the smaller containment.

The current policy direction away from floating covers in favor of new buried reservoirs, and SPU's adoption of Asset Management as a business model, warrant a reconsideration of reservoir sizes.

SPU continues to explore downsizing opportunities as identified by the 1997 study. Based on additional modeling completed recently (see below), the **preferred option** now calls for significant reductions at several reservoirs (Beacon, West Seattle, and Volunteer), and for the decommissioning of Roosevelt Reservoir. This makes the whole program more affordable while still meeting pre-defined performance criteria under various emergencies.

Additionally, SPU plans to further explore the possibility of retiring Volunteer Reservoir.

A decision to retire a major facility has far reaching implications, and could not be easily reversed. It could only be made after a thorough and deliberate analysis, and to the extent possible, confirmed by real-time operational experience over several years. SPU will perform further analytical work (see below) to assess how the water system would perform in a wide range of normal, unusual, and emergency conditions without these reservoirs. Subsequently, SPU would actually operate the water system without the reservoir(s) for several years before a final decision is made. Nonetheless, SPU has a high degree of confidence that at least one of the two reservoirs would be decommissioned.

Consistent with asset management principles, SPU has examined the life-cycle costs of the floating covers over the existing reservoirs versus new buried reservoirs. In general, floating covers have lower initial installation costs and higher maintenance and security costs. Floating covers also have a shorter useful life and must be replaced several times over the span of the life-cycle analysis. Despite their higher maintenance costs, the life cycle cost of a floating cover is lower than the option of burying a reservoir. On the other hand, buried reservoirs provide acres of open space, a higher level of security, and little if any visual intrusion into the neighboring community. Looking at both benefits and costs suggests that the preferred option is to bury the remaining reservoirs.

Revising the Sequence of Reservoirs to be Buried

The original Executive proposal from May 2002 called for the buried reservoirs to be constructed in pairs, starting with Beacon and Volunteer, followed by Roosevelt and Myrtle, and West Seattle and Maple Leaf at the end. A commitment to explore retirement opportunities for Volunteer and Roosevelt reservoirs triggers a need to move them to the end of the program in order to provide sufficient time for verification and operational testing. This in turn triggers a need to revise the overall sequencing of the individual projects so as to maintain the pace of the program.

New buried reservoirs at Volunteer and Myrtle would be the same size, and have the similar cost estimates. Myrtle is also the last remaining reservoir whose disinfection facility still uses gas chlorine, a public safety issue. Myrtle was therefore moved up into the first pair of reservoirs to take the place vacated by Volunteer. This works well operationally, and maintains near term revenue requirements unchanged.

If Beacon and Myrtle are the first pair, and Volunteer and Roosevelt are the last, it leaves Maple Leaf and West Seattle reservoirs as the middle pair to be constructed.

While construction at Maple Leaf and West Seattle reservoirs is not proposed to begin until 2007, SPU believes significant design efficiencies and savings could be captured if a portion of the design of all four reservoirs that are certain to be buried is done concurrently. Given that, SPU proposes to take the first four reservoirs - Beacon, Myrtle, Maple Leaf and West Seattle - concurrently through predesign and up to about 60 percent design by mid-2005. (Roosevelt and Volunteer would not be included in this effort.) This approach would also maintain the option to do alternative contracting for any combination of the four reservoirs.

The Reservoir Projects and Park Development Issues

While a new buried reservoir has already been addressed by community and parks master planning for the **Beacon Reservoirs** property, at all other sites it is a new opportunity that has not been through any community involvement and open space planning process. At each site, a new buried reservoir prevents the unattractive industrial look of a floating cover, and creates open space. How this newly created open space is planned, developed, and paid for is a question the City and the communities face.

The larger reservoir sites - **Maple Leaf, West Seattle, and Roosevelt** - can support any combination of active and passive recreational use. In fact, they are large enough to accommodate multiple play fields as well as some passive use.

The much smaller **Myrtle** Reservoir property is not big enough for a ball field, and could only be developed into a neighborhood mini park, and some funding is available ($860k from the 2000 Parks Levy) for park development.

Ordinance 120899 limits the above ground improvements that may be funded from water rates to grass and low maintenance landscaping. Funding from other sources for recreational facilities over the buried reservoirs has not been secured yet, and may not be available for some time into the future. While ideally reservoir burying and parks development would occur as one seamless project, lack of assured funding for the parks at this time, and a need to move ahead with the reservoir burying projects may necessitate that reservoir construction and parks development occur several years apart. The fact that parks uses at some sites have not yet been defined further supports separating the two projects.

Ordinance 120899 actually requires that each underground reservoir shall be designed to accommodate “a reasonable range” of future active recreational and passive park uses on the cover. To assure that the new reservoirs are designed so as not to preclude future beneficial parks uses, SPU and Department of Parks and Recreation (DPR) have agreed to the following approach:

1. Park related work for Beacon and Myrtle Reservoirs is funded from the 2000 Pro-parks Bond Levy. DPR will work with SPU to assure the new reservoirs fit in with park improvements to be funded by the bond levy, and fund its effort from the bond levy;

2. SPU will pay Parks (on an hourly basis) for design review of the Maple Leaf and West Seattle reservoir designs to ensure that SPU's plans can support a reasonable range of active and passive uses on these sites in the future. It is anticipated this may be as much as 1/2 an FTE of work in the next year and a half.

3. To the extent that community engagement is required for the reservoir burying projects, and to determine appropriate "interim uses" on these sites, SPU will lead that process and will offer two choices (fence around perimeter or open and passive). Any screening or buffers will be done in consultation with Parks to preserve future design alternatives;

4. SPU may share in the planning and design of parks over the buried reservoirs at these sites in the future, to the extent that is necessary to protect SPU's interests in long term operation of these reservoirs.

These principles would be reflected in a brief MOU between SPU and DPR.

Determining Storage Requirements

The System Storage and Reliability Analysis (SSRA) and setting an objective benchmark of Water System Reliability

This part summarizes the analysis of storage needs that has supported the plan for covering reservoirs. It begins with a discussion of how the criteria and context for sizing storage facilities have changed since the early 1900's when the majority of the open reservoirs were constructed. It then describes the innovative approach of using a hydraulic model of the water system and emergency scenarios to analyze future storage requirements.

Historic Perspective

The majority of the open reservoirs (Beacon North and South, Roosevelt, Lincoln, Maple Leaf, and Volunteer) were designed and constructed about a century ago under much different conditions. Reservoir size was then and still is primarily driven by the need to provide adequate flows for fire fighting and to ensure water supply during source or transmission emergencies. Fire and emergency storage needs, as well as the cost of constructing distribution storage, have changed significantly for the Seattle system during the last 100 years.

Fire flows. Construction of the water system began in the late 1800's in direct response to the Great Seattle Fire. Providing fire storage to prevent a repeat of this disaster had to have been a primary factor in sizing storage at that time. Today, modern building and fire codes (e.g., fire sprinklers in buildings) make such a fire highly unlikely. Accordingly, even the highest fire flow required by today's standards (8000 gallons per minute for 4 hours) can be provided from about 2 million gallons of storage.

Source emergencies. The most likely source emergency for the early water system would have been the need to shut down the Cedar source due to excess turbidity at the intake. Although strict EPA limits on turbidity did not then exist, the active logging of the watershed at that time would have produced turbidity levels of sufficient aesthetic concern to warrant closure of the intake. Before Lake Youngs was placed in service in 1928, the system would have depended entirely on the in-city storage during these events. Later addition of the Tolt source, the Highline wellfield, and the Tolt treatment plant provided additional source reliability. Although the 10 MGD capacity of the wellfield may not seem significant, during a week-long emergency it would be the functional equivalent of a 70 million gallon reservoir.

Transmission emergencies. The early water system was fed through wood-stave transmission lines along a single corridor from the Cedar. Today, the system is fed through steel and concrete pipes in two different corridors located at opposite ends of the system.

Economics. Given the above reasons for providing abundant storage in the early water system, the cost of constructing the storage was not a serious limitation. Land was cheap, and construction basically consisted of digging a hole and lining it with concrete panels. Modern requirements for covered reservoirs and seismic design result in much greater unit storage costs.

Overview of System Storage and Reliability Analysis (SSRA)

The 1996 covering plan identified the need for an updated evaluation of the storage needs of the distribution system. As discussed above, the open reservoirs were designed as much as a century ago, under much different conditions, and their present size is unlikely to match the current and future needs of the water system. Because covered storage is expensive, it was prudent to support the covering program with an up-to-date evaluation of the storage needs of the distribution system.

In late 1995, SPU began an evaluation of the storage needs with the assistance of a consultant. The System Storage and Reliability Analysis (SSRA) approached the analysis in an innovative way. It used a PC-based hydraulic model of the water system to determine how it would perform with various amounts of storage under a range of normal and emergency conditions and demand levels projected for the year 2020 by the 1993 Water Supply Plan, or an average day demand (ADD) of 199 MGD for the entire system. Because of recent conservation efforts, this level of demand is now projected for beyond 2080 using the 2004 official long-range demand forecast.

The use of modeling has several advantages over traditional methods for evaluating storage and reliability, especially in larger water systems. The traditional approach has been to size storage as some function of average or peak day demand for the system, with allowance for reducing storage if multiple sources of supply exist. This works well for small water systems with relatively simple configurations, but is less effective with large systems with many pressure zones. Large systems typically have many pressure zones linked in complex ways, and some of the larger pressure zones may be served by multiple storage facilities.

The traditional method is not helpful in determining how to best distribute multiple facilities within a single pressure zone, nor in evaluating how individual pressure zones reinforce each other, much in the way interties between individual water systems improve reliability. However, unlike individual water systems with a single intertie, pressure zones within a large system are linked in multiple ways, usually through a complex mix of pump stations, gravity feeds, pressure reducing valves, and check valves. In the Seattle system, an additional complexity is that some reservoirs function as part of both the regional transmission system and the distribution system of the direct service area. By effectively incorporating all of these features, a model-based evaluation provides the greater analytical capability needed to address these complexities.

Analyzing performance with a model is simple in concept. After the model is constructed and calibrated, it is used to evaluate how the system would perform with various storage configurations (locations and volumes) during a representative set of emergency scenarios. A storage configuration is considered acceptable if, during all emergency scenarios, system pressures are maintained and some water is maintained in all storage facilities. Various acceptable storage configurations may be compared by examining the amount of water left in storage at the end of each scenario and how well it is distributed in the system.

SSRA Emergency Scenarios

A panel of SPU staff, the Reservoir Advisory Panel (RAP), developed the emergency scenarios. The RAP included representatives of all portions of the utility concerned with storage, including: engineering, water quality, community relations, planning, finance, water supply, maintenance, and operations. The scenarios recommended by the RAP for hydraulic modeling were:

- S1 – Tolt Supply Line failure with Maple Leaf Pump Station out of service.

- S2 – Cedar Control Works failure.

- S3 – Cedar River Pipelines (CRPL's) 1, 2, and 3 failure below Wye.

- S4 – 550 Pipeline failure with CRPL 4 out of service.

- S5 – 550 Pipeline failure with Maple Leaf Pipeline out of service.

- S6 – 550 Pipeline failure with Maple Leaf Pipeline and Volunteer Reservoir out of service.

- S7 – CRPL 4 failure with West Seattle Pipeline out of service.

- S8 – Spokane Street Pump Station failure with West Seattle Low Service Pump Station out of service.

- S9 – Cedar Supply shutdown for water quality event.

- Peak Week "2020" (currently 2050 or beyond)

In general, the emergency scenarios were based on an assumption that a major system component would fail unexpectedly while another major system component is unavailable due to major maintenance or repair.

The emergency scenarios actually used in the hydraulic modeling differed somewhat from the recommended list. Through preliminary analysis, the modelers determined that Scenarios 4 and 8 were not severe enough to stress storage, that Scenarios 5 and 6 were similar enough to be combined, and that Scenario 3 had two sub-scenarios that required separate analysis. The final list for hydraulic modeling was:

- S1 - Tolt Supply Line failure with Maple Leaf Pump Station out of service.

- S2 - Cedar Control Works failure.

- S3a - Cedar River Pipelines 1, 2, and 3 between the Wye and Interstate 405 while the Maple Leaf Pipeline is out of service for rehabilitation.

- S3b - Cedar River Pipelines 1, 2, and 3 downstream from Interstate 405 while the Maple Leaf Pipeline is out of Service for rehabilitation.

- S5&6 - 550 Pipeline near 195th Street while the Maple Leaf Pipeline and Volunteer Reservoir are out of service.

- S7 - Cedar River Pipeline No. 4 with the West Seattle Pipeline out of service.

- S9 - Cedar supply shutdown due to a water quality problem

- Peak Week 2020

Duration of the Emergencies – Restoration Times

The RAP defined the emergencies as having a duration of seven (7) days, with the exception of S9, which assumed a duration of three (3) days. It is reasonably conservative to assume that within such period of time at least one of the unavailable system components would be at least partially brought back in service. For example, the repairs to the Tolt Pipeline No. 1 when it failed unexpectedly in 1987 took only three days to complete; however, no other system component failed/was unavailable during that time. Another example would be the 2003 Tolt Treatment Facility Failure, during which Scenario S1 was virtually realized but only for a period of about four (4) hours when electrical failure took Maple Leaf Pump Station out of service; it was, however, quickly repaired.

Customer Demands to be met during the Emergencies

Demands to be met during the emergencies were assumed to be unrestricted indoor water use at 0.8 times Average Daily Demand (ADD), or 160 MGD (0.8 times 199 MGD) for the entire system. This is equivalent to winter usage levels, which could be achieved by banning outdoor water use. Based on the 2004 official long-range demand forecast, this level of demand is not expected until at least 2080.

It is important to note that normal winter demands of Seattle's wholesale customers were included in the demand to be met during the emergency. This is a conservative assumption since each water purveyor is expected (if not required) to have at least 1-2 average days of emergency storage in its distribution system. Furthermore, use of local sources of supply by those customers that have them could be maximized to reduce demand on the regional system. Finally, Seattle wholesale customers adjacent to water utilities not served by Seattle could activate emergency interties and thereby reduce demand on the Seattle system.

Analytics

EPANET software, a modeling tool available at no cost from the Environmental Protection Agency and in wide use by utilities and consultants, was used to create the hydraulic models. It has been adopted as a de facto standard by SPU for hydraulic modeling.

The analysis synthesized alternative storage configurations by varying storage size in increments of 10 million gallons at each open reservoir site. This approach resulted in over 21,000 different configurations, which were too many to evaluate with hydraulic modeling. To resolve this problem, the consultant developed a spreadsheet-based model to pre-screen the configurations. It screened out unsuitable configurations by identifying those that were short on storage and thus had no possibility of meeting the emergencies when the additional constraints of pipes and pump stations would be taken into account with hydraulic modeling.

It was found that the storage configurations passing the screening process were in a group that could be described by a few equations or rules. These included:

- Maple Leaf + Roosevelt > 35 million gallons (MG)
- Beacon > 48 MG
- Beacon + Myrtle + West Seattle > 85 MG
- Bitter Lake + Maple Leaf + Roosevelt > 85 MG
- West Seattle + Myrtle > 25 MG

- Lincoln + Volunteer + Maple Leaf + Beacon > 120 MG

Strict application of these rules results in a storage reduction from 369 mg to 238 MG, or 35 percent of the original volumes.

Selection of a specific storage configuration for hydraulic modeling was further influenced by the findings of a parallel study. This study looked at the state-of-the-art in the technology of reservoir covering. In particular, it found that floating covers had improved to where SPU could consider them as a viable method for covering.

As a result, the configuration selected for modeling assumed most of the open reservoirs would be covered with floating covers at their present volumes. The exceptions were a reduction from 20 to 10 million gallons at both Lincoln and Volunteer, and a reduction from 60 to 49 million gallons at Beacon. At Lincoln and Volunteer, limited setback distance would make floating covers subject to vandalism. At Beacon, a value of 49 million gallons was used to be conservative, since this is the volume of the smaller reservoir at the site, and a decision had not been made on which of the two reservoirs will be covered for future use. Table 2 summarizes the storage assumed in the model. Table 3 shows the minimum reservoir level reached during the hydraulic modeling as a percent of the reservoir capacity.

The rules derived from the pre-screening spreadsheet model and the minimum reservoir levels reached during hydraulic modeling suggest that the actual amount of storage needed by the system is less than the reservoir volumes assumed in the hydraulic modeling. However, for budgetary reasons the SSRA did not attempt to identify this absolute minimum through additional hydraulic modeling.

Current Status

Because of the heightened concern for security since September 2001, the current plan is to bury or decommission all open reservoirs, except for Bitter Lake and Lake Forest Park, which have new floating covers. To help compensate for the greater cost of buried structures, reduced storage volumes are planned at some of the sites. Table 2 compares the new assumptions with current storage volumes and the capacities assumed in the SSRA hydraulic modeling. The new sizes specified in column 3 satisfy the sizing rules generated from the spreadsheet model. However, the adequacy of these volumes needed to be confirmed by additional analysis with the SSRA hydraulic model.

Table 2
Summary of Storage Volumes for Reservoir Covering

Reservoir	Open Reservoir (MG)	SSRA Value (MG)	New Concept (MG)
Bitter Lake	22	22	22
Lake Forest Park	60	60	60
Lincoln	20	10	12
Volunteer	20	10	0
Beacon	61	49	50
Myrtle	7	7	5
Roosevelt	50	50	0
Maple Leaf	60	60	60
West Seattle	68	68	30
Total	369	336	239

Updated SSRA Modeling

Because analysis with the hydraulic model is time consuming, it was felt important to begin with the scenario or scenarios most likely to be constraining with the reduced reservoir volumes. The results of these scenarios would then be used to help determine if modeling of the remaining scenarios should occur.

Table 4 shows the data used to identify the priority scenarios. For each of the spreadsheet-based rules, it shows the total amount of drawdown that occurred during the original SSRA work in the reservoirs referenced in the rule. The shaded cells are the cases where the total drawdown exceeded the quantity that the rule suggested was adequate. This does not necessarily indicate a fatal flaw, since the model could possibly be run in a way that would reduce the draw on the particular reservoirs and increase the draw on other reservoirs with greater reserve.

Table 4 indicates that Scenarios 2, 7, and 9 could be constraining, and Scenarios 2 and 7 were selected for hydraulic modeling. Scenario 9 was not selected because it is quite similar to Scenario 2, as verified by the almost identical reservoir drawdowns shown in Table 4 for the two scenarios.

The hydraulic modeling results have the greatest disparity in the case of the rule specifying Myrtle + West Seattle > 25 million gallons. The three scenarios mentioned above result in total drawdowns over twice this amount. Intuitively, these two reservoirs seem the most likely facilities to show a discrepancy in results between the spreadsheet-based rules and hydraulic modeling. The spreadsheet model assumes that water can be readily transferred between portions of the system, while the hydraulic model incorporates the constraints posed by the actual pipes and pumps linking the system. The West Seattle portion of the water system is relatively isolated from the remainder of the system, especially under certain scenarios.

Subsequent hydraulic modeling of Scenarios 2 and 7 verified that the reduced amounts of storage were adequate. Table 5 summarizes the results of the modeling. The minimal levels of storage remaining after Scenario 2 shows that the reduced storage configuration currently being planned may be close to the minimum amount required by the system.

Hydraulic modeling also identified new facilities, such as valves, that would be important in operating the system with this reduced storage. These are summarized in <u>Appendix 2.</u>

Issues for Further Analysis

De-commissioning certain reservoirs and reducing the size of others will result in a modified system with different operational considerations. Construction of new reservoirs will also provide opportunities for improvements in the valving, piping, and controls at the sites. The planning and design of the reservoir burying program needs to address these factors and adapt as necessary. Various discussions have identified the following issues as possibly requiring further analysis:

Issues Specific to some Reservoirs

1. When would be the optimum time to remove Roosevelt and Volunteer from continuous operation? This decision must consider the security needs at those sites and other changes taking place in the system (i.e., the new Cedar Treatment Facility and the temporary elimination of storage at other sites for construction of the replacement reservoir). Working out the details of the schedule would require a meeting of staff knowledgeable in the various factors that need to be considered. These factors would include the timing of other system changes and the security needs at these sites.

2. Does Volunteer Reservoir act as an important distribution system vent (pressure relief) for the portion of the 430 Pressure Zone located south of the Ship Canal? If so, how will this function be accomplished if the reservoir is de-commissioned? This function could be met by using either the old Cedar River Pipeline No.2 or the Maple Leaf Pipeline to provide a low head loss connection between the Volunteer 430 zone and Maple Leaf Reservoir.

3. The outlet piping at Beacon Reservoir appears to make it possible to construct the new reservoir with a bottom elevation 5 feet lower than the bottom of the existing reservoir at the site. Would this be cost effective? This is being considered since it would reduce the “footprint” of the new reservoir and the associated excavation costs.

4. Will de-commissioning of Roosevelt make it more difficult to maintain adequate chlorine residuals in the Ballard area? EPANET modeling could address this question. Modeling could investigate the alternative of feeding Ballard from Bitter Lake Reservoir through the 430 Pressure Zone. Three factors to consider: (1) The Ballard re-lining pilot project may make this a moot point by demonstrating that re-lining can mitigate the chlorine residual problem. (2) Feeding the Ballard 326 zone from Bitter Lake would require significant modifications to the distribution system. (3) The potential for a chlorine residual problem can be checked when Roosevelt is out of service, and alternative solutions evaluated if necessary. One alternative would be to maintain the Roosevelt hypo-chlorination plant and use it to re-chlorinate water from Maple Leaf when it reaches the Roosevelt site.

5. In the past, the open reservoirs have been a convenient place to route the large volumes of water resulting from flushing and disinfection of transmission lines. Will loss of Roosevelt and Volunteer Reservoirs require alternative means of accomplishing this in some situations? How expensive would the alternatives be? The existing drain lines can be maintained at the two sites, and a de-chlorination chamber can be added to the drain lines as part of the de-commissioning of the reservoirs.

General Reservoir Issues

1. What criteria will be used to decide if a new reservoir should be single-cell or double-cell? The criteria will be to maintain redundancy of storage within a pressure zone. If the new storage configuration will result in a pressure zone having only one large reservoir, then that reservoir will be double-celled. (For single celled reservoirs, a partial "dual cell" functionality will be provided for seismic events by placing outlets at two levels, with the lower outlet equipped with a seismic shut-off valve.)

2. Will the new storage configuration be compatible with new 180 MGD flow limit from the Cedar Treatment Facility? SSRA modeling indicates that the reduced storage will be satisfactory during the emergency scenarios with a 180 MGD Cedar supply. Although the original SSRA modeling assumed a 275 MGD capacity for the Cedar, the demands were such that maximum draw on the Cedar was 180 MGD. If there is a constraint, it may be during the peak week scenario. The SSRA peak week model should be re-run with the reduced storage configuration both under current demands and 180 mgd Cedar capacity, and "ultimate" demands and 275 mgd Cedar capacity.

3. What impact would the reduced storage have in the event of a sudden loss of the Cedar supply - which would typically require a rapid increase in the output of the Tolt source? While the Tolt is brought up to full capacity, water would be drawn from in-town storage that could have otherwise come from the Tolt. For example, if the Tolt were furnishing a typical 60 MGD, every hour delay in bringing the Tolt to its full 120 MGD capacity would draw an extra 2.5 MG from in-town storage that would have otherwise come from the Tolt. The reduced storage volumes will add urgency to bringing the Tolt up to capacity. Hydraulic modeling could assist development of SOP's for a rapid transition to full Tolt production. Periodic drills with the SOP's on the actual system could then help maintain operator proficiency.

Appendix 1

Additional Detail on the Reservoir Burying Program

Conditions of Ordinance 120899

Other conditions set forth in the ordinance include:

- The replacement reservoirs shall be designed and constructed so that the chlorine facilities and other essential access best serve the reliability and safety of the water supply system, as determined by SPU.
- Each underground reservoir shall be designed to accommodate "a reasonable range" of future active recreational and passive park uses on the cover.
- The open space created is not subject to the restrictions of Initiative 42 applicable to other parklands.
- SPU and the Water fund are responsible for an earth covering over the reservoir lid and grass or low maintenance plantings to allow for passive public use. SPU can contract with DPR for lawn mowing.
- DPR and its fund sources are responsible for master planning, designing, constructing and maintaining any additional landscaping or recreational amenities including an irrigation system or a water feature.
- Development of active recreational uses cannot be funded by water rates.
- SPU is required to commission a study and consider using design-build contracting as a cost-saving approach for reservoir replacement projects. The study should recommend a schedule for completing the reservoir projects by 2020.
- In January 2006, SPU is required to provide a report to Council, which details the cost and project experience to date on the reservoirs.

Updates to Cost Estimates and Schedules since August 2002

In early 2003, SPU advertised the Lincoln Reservoir project for construction. Bids received were well under the engineer's estimate, which provided current and reliable information to re-assess the estimated costs of other reservoir burying projects.

Given the cost information from Lincoln Reservoir, and the higher degree of certainty with regards to scope and public process based on Ordinance 120899, SPU revised its estimates for the reservoir program in August 2003. The program was then estimated to cost **$173 million** (nominal dollars), which was a reduction of **$72 million** from the $245 million May 2002 estimate. The currently adopted Water CIP is based on the August 2003 update, and budgets funds to bury all reservoirs (including Roosevelt), and construct a 50 MG reservoir at West Seattle.

As discussed above, SPU has since then completed an evaluation of the feasibility to further reduce the size of West Seattle Reservoir (25 MG instead of 50 MG), and to decommission Roosevelt Reservoir.

This lowers the total program cost from $173 million to $151 million (nominal $). The reduction in nominal dollars is somewhat less than the reduction in 2003 constant dollars since the duration of the program has been extended by one year to reflect the impact of unanticipated program deliberations.

Cost and schedule details for the preferred option by reservoir and by year can be found in Table 1. On this schedule, the estimated cost in nominal dollars to bury the remaining five open reservoirs where work has yet to begin is $120 million. The remaining $31 million have already been spent or committed to for the floating covers at Bitter Lake and Lake Forest reservoirs, and for the burying of Lincoln Reservoir.

Alternative Contracting for the Reservoirs

SPU initiated a consultant-led study to identify any cost saving opportunities, as well as other possible benefits from alternative contracting and/or packaging of the reservoir projects. The study culminated with a day-long expert panel discussion with representatives from utilities that have used alternative contracting on similar projects, several contractors, engineering firms, and academia. An effort was made to invite representatives with experience and interests in alternative contracting as well as traditional contracting. The conclusions of the study are summarized below:

- With regards to **cost savings, due to the conventional nature of the facilities to be built**, alternative contracting is not likely to come even close to the 15 percent savings threshold specified in Ordinance 120899. Savings are more likely to be in the 3-6 percent range, which is within the margin of error of the assessment . The study therefore concluded that a decision to proceed with a design-build approach can not be based primarily on cost.

- With regards to **quality** of the constructed reservoirs, design-build has a slight edge given that only larger and more experienced contractors are likely to compete under such a contracting approach. The owner-contractor relationship in a design-build is also more cooperative. High quality under design-built can only be assured if the owner is relatively prescriptive with regards to major project elements, design criteria, and equipment specifications. This amounts to taking the project to at least 60 percent design before soliciting proposals.

- With regards to **owner control** of the project and process, traditional contracting is better. Clear definition of the "project" in terms of performance criteria, and a high degree of scope certainty by the owner are critical to the success of design-build. Unless such scope certainty can be attained, design-build should not be attempted as the premium paid for changes is likely to be more than the potential savings, with the project costing more in the end.

- Regardless of contracting method, no more than two reservoirs should be **packaged** into a single contract due to operational constraints which allow no more than two reservoirs may be out of service at the same time. Due to these constraints, the entire program is of considerable length. Contracting for work that would occur several years in the future carries a market uncertainty premium that is unlikely to be offset by economy of scale savings.

Given the somewhat ambiguous outcome of the alternative contracting study, SPU is proposing an approach for the first two reservoirs (Beacon and Myrtle) that defers the contracting decision until early 2005 while allowing the projects to proceed without any delay or extra cost. Taking the projects to a 60 percent design between now and mid-2005 would provide an opportunity to better define the scope of the projects, and if certainty with respect to community issues can be attained, design-build may be used. Otherwise traditional contracting would be used without additional delay or cost. Finally, if bids received under a possible design-build are found to be high, they could be declined and the projects could be easily re-directed to the traditional bidding process.

Appendix 2

Status of Non-Storage Recommendations of the System Storage and Reliability Analysis (SSRA) July 7, 2004

Introduction

The System Storage and Reliability Analysis study produced a series of reports that described how the water system would respond to a representative set of emergency conditions. The descriptions were based on the use of computer hydraulic models to simulate the various emergencies. In the course of the modeling, the study found that certain non-storage improvements would improve the reliability of the system by either improving redundancy or by facilitating the operation of the system during an emergency. This appendix summarizes the original 1997 recommendations, listed according to their status of July 2004.

Improvements Completed

1) Remote control valves at the inlets of the following reservoirs:

    a) Lincoln Reservoir, both directly from CRPL2 and through the turbine(s).

    b) Lake Forest Reservoir, on restored 72 inch inlet. Also install new inlet flow meter and provide for automatic operation of control valve as a pressure sustaining valve and a flow control valve.

    c) West Seattle Reservoir.

2) Remote control on the 36-inch ball valve on TPL at TESS Junction, and on the west 24-inch valve into TESSL. Keep east 24-inch valve normally closed or provide remote control to it as well.

3) Upgrade Lake Hills and Maplewood Pump Stations.

4) Upgrade facilities to transfer Tolt water from TESSL into CESSL at or near Lake Hills PS while minimizing headloss.

Project Underway

1) Piping and control valve improvements around Maple Leaf Reservoir, the Maple Leaf Pipeline, and the terminus of the 550 PL at Maple Leaf Reservoir Gatehouse.

Projects Requiring Additional Analysis

1) Remote control valves at the inlets of the following reservoirs:

    a) Beacon Reservoir, between the inlet line and CRPL1 and CRPL2 (in addition to the existing reservoir inlet valve, which is downstream of the above connections).

    b) Volunteer Reservoir

    c) Green Lake Reservoir, from the MLPL.

    d) Maple Leaf Reservoir, from the MLPL.

2) Remote control on the valve between CRPL1 and the MLPL at 18th & Prospect.

3) Remote control on Foy Pump Station bypass valve.

4) Remote control valve between the end of CRPL1, and the 430 Pipeline at Volunteer reservoir.

5) Upgrade TESS Junction Pump Station (to 10 MGD).

6) Line valve in the 550 Pipeline between North City PS and Lake Forest Reservoir.

7) Line valves or equivalent functionality on one of CRPLs 1, 2, and 3 south of Augusta Gatehouse to allow isolation of the section through Renton while still delivering water north from the WSPL into that CRPL.

8) Line valve on CRPL1 or CRPL3 just south of the branch line to Beacon Reservoir inlet.

9) Pressure relief valves at Lake Hills PS or somewhere along CESSL or the Mercer Island Pipeline to allow robust operation of the CESSL system without the Control Works surge tanks while using the 24-inch BV in Kamber Road to drop Tolt water into CESSL.

Alternative Proposal for the Reservoir Program - Bury ALL Remaining Reservoirs, Decommission Roosevelt

Reservoir	TOTAL	thru end of 2002	2003 (Actual)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
		Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4	Q1 Q2 Q3 Q4
Bitter Lake Reservoir Cover [3]	3,860	3,855	5												
Lake Forest Reservoir Cover [3]	7,651	7,256	395												
Lincoln Reservoir[4] - 12 MG	19,822	6,592	7,007	6,223											
Beacon Reservoir - 50 MG	30,000	300	384	250	1,000	316 / 6,500	18,250	3,000							
Myrtle Reservoir - 5 MG	6,000	180	17	250	953	100 / 2,000	2,500								
West Seattle - 30 MG	20,600	155	9	250	500	261	300	300 / 5,000	10,000	3,825					
Maple Leaf Reservoir - 60 MG	32,000	147	13	250	500				257	400	100 / 11,000	18,000	1,333		
Volunteer Reservoir - 10 MG	14,000	75	19							231	1,000	500	250 / 3,550	6,905	1,470
Roosevelt Reservoir - Retired	150	135	15												Decommissioned
TOTAL Capital Costs - 2003 Constant $	134,083	18,695	7,864	7,223	2,953	9,177	21,050	8,300	10,257	4,456	12,100	18,500	5,133	6,905	1,470
TOTAL Capital Costs - Nominal $	154,604	18,695	7,864	7,425	3,121	9,970	23,508	9,529	12,105	5,406	15,091	23,720	6,766	9,356	2,048

Notes:

1. ONLY costs that are consistent with provisions of Ord. 120899 have been included.
2. All detailed costs shown are in thousands 2003 constant dollars.
3. Projects at Bitter Lake and Lake Forest Reservoirs completed; floating covers installed, and covered reservoirs are in service. Enhanced security systems to be installed separately under the Water System Security Program.
4. Lincoln Reservoir Project currently under construction. Reservoir is out of service.

Table 3 Minimum Reservoir Levels in Percent for Each SSRA Scenario												
Storage Facility	Original Size (MG)	SSRA Size (MG)	Current Proposed Size (MG)	Emergency Scenario								Peak Week
				# 1	# 2	# 3a	# 3b	# 5&6	# 7	# 9		
Bitter lake	22.5	22	22	75	37	60	60	37	60	37		40
Maple Leaf	60	60	60	79	96	92	96	75	79	96		77
Volunteer	21	10	0	79	13	86	16	95	81	27		67
West Seattle	68	68	30	90	26	49	89	90	21	22		74
Myrtle	7	7	5	60	45	60	80	60	32	45		37
Lincoln	20.5	10	12	82	28	70	28	71	69	29		62
Roosevelt	50	50	0	75	16	83	46	71	81	16		48
Beacon	60	49	50	83	22	81	23	82	93	24		63
Lake Forest	60	60	60	15	51	85	88	96	94	46		31
TOTAL	369	336	239									

Scenario Failures:

1 - Tolt Pipeline while the Maple Leaf Pump Station is out of Service for Major Rehabilitation

2 - Cedar Control Works

3a - Cedar River Pipelines 1, 2, and 3 between the Wye and Interstate 405 while the Maple Leaf Pipeline is out of service for rehabilitation.

3b - Cedar River Pipelines 1, 2, and 3 downstream from Interstate 405 while the Maple Leaf Pipeline is out of Service for rehabilitation

5&6 - 540 Pipeline near 195th Street while the Maple Leaf Pipeline and Volunteer Reservoir are out of service

7 - Cedar River Pipeline No. 4 with the West Seattle Pipeline out of service

9 - Cedar supply shutdown due to a water quality problem

Table 4 Spreadsheet-Based Rules and Hydraulic Model Results											
Rule from Spreadsheet Model	SSRA Total (MG)	Current Proposed Total (MG)	Hydraulic Model Drawdown Totals (MG)								Peak Week
			# 1	# 2	# 3a	# 3b	# 5&6	# 7	# 9		
Maple Leaf + Roosevelt > 35	110	60	25	45	13	29	29	22	44	40
Beacon > 48	49	50	9	38	9	38	9	4	37	18
Beacon + Myrtle + West Seattle > 85	124	85	18	92	47	46	18	62	95	40
Bitter Lake + Maple Leaf + Roosevelt > 85	132	82	31	58	22	38	43	31	58	53
West Seattle + Myrtle > 25	75	35	10	54	37	9	10	59	57	22
Lincoln + Volunteer + Maple Leaf + Beacon > 120	129	122	25	56	19	56	27	22	54	39

Note: Shaded cells show cases where 1997 hydraulic modeling results did not confirm the spreadsheet-based rule.

Scenario Failures:
1 - Tolt Pipeline while the Maple Leaf Pump Station is out of Service for Major Rehabilitation
2 - Cedar Control Works
3a - Cedar River Pipelines 1, 2, and 3 between the Wye and Interstate 405 while the Maple Leaf Pipeline is out of service for rehabilitation.
3b - Cedar River Pipelines 1, 2, and 3 downstream from Interstate 405 while the Maple Leaf Pipeline is out of Service for rehabilitation
5&6 - 540 Pipeline near 195th Street while the Maple Leaf Pipeline and Volunteer Reservoir are out of service
7 - Cedar River Pipeline No. 4 with the West Seattle Pipeline out of service
9 - Cedar supply shutdown due to a water quality problem

Table 5 Minimum Reservoir Levels in Percent for Updated SSRA Scenarios 2 and 7				
Storage Facility	SSRA Size (MG)	Current Proposed Size (MG)	Emergency Scenario # 2	 # 7
Bitter lake	22	22	32	60
Maple Leaf	60	60	5	40
Volunteer	10	0	N/A	
West Seattle	68	25	10	40
Myrtle	7	10	44	50
Lincoln	10	12	38	67
Roosevelt	50	0	N/A	
Beacon	49	50	0	95
Lake Forest	60	60	0	92
TOTAL	336	239		

Scenario Failures:

2 - Cedar Control Works

7 - Cedar River Pipeline No. 4 with the West Seattle Pipeline out of service

Seattle Public Utilities

MEMORANDUM

DATE: February 10, 2006

TO: File

FROM: Charles Oppelt, Capital Projects Coordinator, SPU Engineering Division

SUBJECT: Design Standards and Definition of Standard Water Main

Attached is a new version of the Design Standards for Distribution Water Mains memorandum. This document updates the May 12, 1987 Water Department memo from Walter Anton that SPU provided as an appendix to the 2001 Water System Plan (WSP). The following document includes all of the information in the 1987 memo with the following updates. The updates include changes to the Standard Plan numbers, revisions to the text for Department reorganization from Seattle Water Department to Seattle Public Utilities and Superintendent to Director of said Departments, updating of AWWA Standards to the current versions used by SPU *(see Attachment 1 below)* and changes to the desirable watermain pressure standards resulting from the February 1, 2005 SPU Policy on Distribution System Water Service Pressure – Number: SPU-RM-006.

The Definition of Standard Water Mains *(see Attachment 2)* below, required no updates from the 1987 version.

CAO
Attachments
cc: Michael Brennan
Charlie Madden
Eugene Mantchev

Seattle Public Utilities Distribution Watermain Requirements & Design Standards *

Distribution Watermain Standards – 2" through 12" sizes

Pipe Standards – 2" size

Type K copper soft coil, with brass flared or compression fittings

Pipe Standards – 4" through 12" sizes

Ductile Iron Pipe Class 52 **
Restrained joint
Slip joint
Mechanical joint
Cement lined

Depth Standards

2", 4", 6" and 8" sizes – 35" of cover below established street grade as determined by the agency having control over the street involved.
10" size – 40" of cover below established street grade.

12" size – 43" of cover below established street grade.

16" to 30" – 36" of cover below established street grade.

Location Standards

Watermain in public, deeded street – Watermain may, at the option of Seattle Public Utilities, be installed in a private street or in an easement.

Platted Streets – 30' or wider (Standard Plan # 030).

10' East of centerline	North-South streets
10' North of centerline	East-West streets

Streets or Easements – 20' to 30'

5' West of margin	North-South streets
5' South of margin	East-West streets

Easements less than 20'
Location to be determined on a case by case basis, if allowed.

* All standards and requirements subject to change, modification, or use as determined by the Director of SPU in accordance with Seattle Municipal Code 3.22.30 and other Seattle Municipal Code authority.

** PVC pipe, AWWA C-900 may be used in highly corrosive soils if approved by the Director of SPU.

Minimum Size Standards

2" – Dead end streets/easements less than 400' in length, single family/duplex zoning, no fire hydrants required, maximum of 6 lots to be served, maximum metered service size allowed (1") – all service tees to be installed with the main.

4" – Dead end streets/easements less than 400' in length and no fire hydrants required. More than 6 lots to be served or zoning other than single-family/duplex.

6" – Dead end streets/easements in single family/duplex zoning or single hydrant required (1000 GPM fire flow available).

8" – Through streets and easements – residential areas.

12"- Through streets and easements – industrial, commercial and mixed use areas.

Corrosion Protection Standards

To be applied in areas where soil resistivity is less than 3000 ohm-cm, or shale rock areas, garbage fill areas, organic soil areas, or other soil where corrosive conditions exist. One or more of the following may be required:

1. Poly-wrap, Tape Coating or other protective coating
2. Select backfill – bedding
3. Joint bonding
4. Cathodic protection

Hydrant Spacing Standards

Approx. 400' on centers – residential areas

Approx. 300' on centers – industrial, commercial areas

Valve Spacing Standards

Valves located at margins of street intersections where mains intersect, and otherwise such that a break or other failure will not affect more than 1/4 mile of arterial mains, 500 feet of mains in commercial districts, or 8OO feet of mains in residential districts.

Separation Standards – Sewer/Water

In accordance with the sewer/water separation standard drawings #286 a&b.

Desirable Watermain Pressure Standards

Minimum – 30 psi for new installations.
Maximum – none

If an SPU-initiated system reconfiguration causes a permanent pressure increase of 10 psi or greater at a water service, customers expected to see resultant pressures at their meters above 80 psi shall be given written notice of the pressure increase. In addition, an offer shall be extended by SPU to cover the cost of a PRV to be installed on the private property (with any limitations on cost and what method of installation would be used – SPU contractor, property owner installation and reimbursement, etc.), when a PRV is not already pre-existing on the property water system.

Watermain Appurtenance		Standard Plan
Pipe	Connections to Existing Watermain	300a
	Connections to Existing Watermain	300b
	Connections to Existing Watermain	300c
Hydrants	Hydrant Setting Detail	310a
	Hydrant Setting Detail	310b
	Hydrant Setting Detail	311a
	Hydrant Setting Detail	311b
	Fire Hydrant Marker Layout	312
	Wall & Requirements for Hydrants	313
	Fire Hydrant Locations & Clearances	314
Valve	Cast Iron Valve Box & Operating Nut Extensions	315a
	Cast Iron Valve Box & Operating Nut Extensions	315b
Concrete Blocking	Watermain Thrust Blocking Vertical Fittings	330a
	Watermain Thrust Blocking Vertical Fittings	330b
	Watermain Thrust Blocking Horizontal Fittings	331a
	Watermain Thrust Blocking Horizontal Fittings	331b
Blow Off	2” Blow-Off Detail Non-traffic	340a
	2” Blow-Off Detail Traffic	340b
Pipe Bedding	Watermain Pipe Bedding (Special)	350
Misc. Plans	Watermain Electrolysis Test Station	360
	Type 361 Valve Chamber Ring & Cover	361
	Joint Bonding for D.I.P. Watermains	362
	Isolating Coupling	363
	Pressure Reducing Valve Assemblies	
	Pressure Relief Valve Assemblies	
	Sample Station	
	Drinking Fountain	

Water Service Installation Standards - ¾”- through 12” sizes

Domestic Services

Standard Plan No.	735-1	3/4”	Domestic
	735-1	1”	Domestic
	735-2	1 1/2”	Domestic
	735-2	2”	Domestic
	735-8	4”	Domestic Compound
	735-9	6”	Domestic Compound
	735-8	3”	Domestic Compound

Combination Fire/Domestic Services

Standard Plan No.	735-4	4”
	735-5	6”
	735-6	8”
	735-11	10”

Fire Services

Standard Plan No.	735-3	2” fire
	735-10	4” fire
	735-10	6” fire
	735-10	8” fire
	735-10	10” fire
	735-10	12” fire

Watermain Extension Applications and Agreements (Developer extensions)

Watermain Extension Application and Agreement

Miscellaneous Standards

Watermain construction and financing options – LID – Special tap charge or private contract.

The contributing properties shall be zip tone shaded (Format #7*045* or equal) and labeled “contributing properties”.

At all fittings where the watermain changes direction, and at dead-ends, concrete thrust blocking or shackles shall be shown in accordance with the appropriate standard plan(s).

A profile shall be included on all plans.

Blowoffs or hydrants on all dead-ends. Drainage course for disposal of blowoff water.

Appropriate cross or tee for future extension.

Dead-end mains shall normally extend across the full width of property served.

Plans and profiles shall show existing or proposed underground utilities within the margins of the street.

Appurtenant pipe runs to hydrants, meters, blowoffs, etc., shall have alignment perpendicular to the watermain.

<u>Other Reference Standards/Requirements</u>

City of Seattle Fire Code
City of Seattle Plumbing Code
City of Seattle Zoning and Land Use Code
City of Seattle Water Code
City of Seattle Water Department Water Service Policy and other Administrative Rules
King County Fire Code.
King County Zoning and Land Use Codes
King County Road Standards
King County Plumbing Code
King County Franchises
Washington State RCWls, especially Chapter 35
Washington State Department of Transportation Franchises
Washington State Department of Transportation 1984 Standard Specifications for Roads, Bridges, and Municipal Utilities
Washington State Department of Transportation Utilities Accommodation Policy

City of Seattle Supplement to Washington State Department of Transportation 1984 Standard Specifications for Roads, Bridges and Municipal Construction

WAC-248-54-550 through 850
Design Standards for Public Water Supplies – D.S.H.S.

Minimum Design Standards for Community Water Supply Systems – H.U.D.

Recommended Standards for Water Works – Great Lakes – Upper Mississippi River Board of State Sanitary Engineers (Ten State Standards)

AWWA Standards – American Water Works Association (primarily material standards) – See attached Standards list

Grading Schedule for Municipal Fire Protection and Guide for Determination of Required Fire Flow – Insurance Services Office

Various AWWA Manuals (e.g., M-ll, Steel Pipe Design and Installation)

Charles Oppelt
Design Standards and Guidelines Coordinator

TO FILE,
Design standards and guidelines program

ATTACHMENT 1

Current AWWA Standards - December 2005

This list includes American Water Works Standards in effect on Dec 31, 2005
WITHDRAWN standards listed are noted as such and have been retained by the SPU for Engineering Branch reference on existing systems.

Groundwater and Wells

A100-97: Water Wells

Filtration

B100-01: Filtering Material
B101-01: Precoat Filter Media
B102-04: Manganese Greensand for Filters

Softening

B200-03: Sodium Chloride
B201-03 Soda Ash
B202-02: Quicklime and Hydrated Lime

Disinfection Chemicals

B300-04: Hypochlorites
B301-04: Liquid Chlorine
B302-05: Ammonium Sulfate
B303-05: Sodium Chlorite
B304-05: (ANSI) Liquid Oxygen for Ozone Generation

Coagulation

B402-00: Ferrous Sulfate
B403-03: Aluminum Sulfate: Liquid, Ground, or Lump
B404-03: Liquid Sodium Silicate
B405-00: Sodium Aluminate
B406-97: Ferric Sulfate
B407-05: Liquid Ferric Chloride
B408-03: Liquid Polyaluminum Chloride
B451-04: Poly (Diallyldimethylammonium Chloride)
B452-98: EPI-DMA Polyamines
B453-01: Polyacrylamide

Scale and Corrosion Control

B501-03: Sodium Hydroxide (Caustic Soda)
B502-05: Sodium Polyphosphate, Glassy (Sodium Hexametaphosphate)
B503-05: Sodium Tripolyphosphate
B504-05: Monosodium Phosphate, Anhydrous
B505-05: Disodium Phosphate, Anhydrous
B510-00: Carbon Dioxide
B511-05: Potassium Hydroxide
B512-02: Sulfur Dioxide
B550-05: Calcium Chloride

Taste and Odor Control

B600-05: Powdered Activated Carbon

B601-05: Sodium Metabisulfite

B602-02: Copper Sulfate

B603-03: Potassium Permanganate

B604-96: Granular Activated Carbon

B605-99: Reactivation of Granulated Activated Carbon

Prophylaxis

B701-99: Sodium Fluoride

B702-99: Sodium Fluorosilicate

B703-00: Fluorosilicic Acid

Ductile-Iron Pipe and Fittings

C104/A21.4-03 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

C105/A21.5-05: Polyethylene Encasement for Ductile-Iron Pipe Systems

C110/A21.10-03: Ductile-Iron and Gray-Iron Fittings for Water

C111/A21.11-00: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

C115/A21.15-99: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

C116/A21.16-03: Protective Fusion-Bonded Epoxy Coatings Int. & Ext. Surf. Ductile-Iron/Gray-Iron Fittings

C150/A21.50-02: Thickness Design of Ductile-Iron Pipe

C151/A21.51-02: Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

C153/A21.53-00: Ductile-Iron Compact Fittings for Water Service

Steel Pipe

C200-97: Steel Water Pipe 6 In. (150 mm) and Larger

C203-02: Coal-Tar Protective Coatings & Linings for Steel Water Pipelines, Enamel & Tape, Hot-Applied

C205-00: Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 4 In. (100 mm) and Larger, Shop Appli

C206-03: Field Welding of Steel Water Pipe

C207-01: Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)

C208-01: Dimensions for Fabricated Steel Water Pipe Fittings

C209-00: Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipe

C210-03: Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines

C213-01: Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

C214-00: Tape Coating Systems for the Exterior of Steel Water Pipelines

C215-04: Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines

C216-00: Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fitting

C217-04: Petrolatum and Petroleum Wax Tape Coatings for Exterior of Connections and Fittings for Steel Water Pipelines

C218-02: Coating the Exterior of Aboveground Steel Water Pipelines and Fittings

C219-01: Bolted, Sleeve-Type Couplings for Plain-End Pipe

C220-98: Stainless-Steel Pipe, 4 In. (100 mm) and Larger

C221-01: Fabricated Steel Mechanical Slip-Type Expansion Joints

C222-99: Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings

C223-02: Fabricated Steel and Stainless Steel Tapping Sleeves

C224-01: Two-layer Nylon-11 Based Polyamide Coating System for Interior and Exterior of Steel Water Pipe and Fittings

C225-03: Fused Polyolefin Coating Systems for the Exterior of Steel Water Pipelines

Concrete Pipe

C300-04: Reinforced Concrete Pressure Pipe, Steel-Cylinder Type

C301-99: Prestressed Concrete Pressure Pipe, Steel-Cylinder Type

C302-04: Reinforced Concrete Pressure Pipe, Noncylinder Type

C303-02: Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type

C304-99: Design of Prestressed Concrete Cylinder Pipe

Asbestos-Cement Pipe

C400-03: Asbestos–Cement Pressure Pipe, 4 In.–16 In. (100 mm–400 mm), for Water Dist. & Trans.

C401-03: Selection of Asbestos–Cement Pressure Pipe, 4 In.-16 In. (100 mm-400 mm), for Water Dist. Sys.
C402-05: Asbestos-Cement Transmission Pipe, 18 In Through 42 In. (450 mm Through 1,050 mm) for Water Supply Service
C403-05: The Selection of Asbestos–Cement Transmission Pipe, Sizes 18 In. Through 42 In. (450 mm Through 1,050 mm),

Valves and Hydrants

C500-02: Metal-Seated Gate Valves for Water Supply Service

C501-92: WITHDRAWN -Sluice Gates

C502-05: Dry-Barrel Fire Hydrants

C503-05: Wet-Barrel Fire Hydrants

C504-00: Rubber-Seated Butterfly Valves

C506-78(R83): WITHDRAWN - Backflow Prevention devices

C507-05: Ball Valves, 6 In. Through 48 In. (150 mm Through 1,200 mm)

C508-01: Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In.(600 mm) NPS

C509-01: Resilient-Seated Gate Valves for Water Supply Service

C510-97: Double Check Valve Backflow Prevention Assembly

C511-97: Reduced-Pressure Principle Backflow Prevention Assembly

C512-04: Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service

C513-05: Open-Channel, Fabricated-Metal, Slide Gates and Open-Channel, Fabricated-Metal Weir Gates

C515-01: Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

C540-02: Power-Actuating Devices for Valves and Slide Gates

C550-05: Protective Epoxy Interior Coatings for Valves and Hydrants

C560-00: Cast-Iron Slide Gates

C561-04: Fabricated Stainless Steel Slide Gates

C563-04: Fabricated Composite Slide Gates

Pipe Installation

C600-05: Installation of Ductile-Iron Water Mains and Their Appurtenances

C601-81: WITHDRAWN - Disinfecting Water Mains

C602-00: Cement-Mortar Lining of Water Pipelines in Place—4 In. (100 mm) and Larger

C603-05: Installation of Asbestos Cement Pressure Pipe

C605-05: Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

C606-04: Grooved and Shouldered Joints

Disinfection of Facilities

C651-05: Disinfecting Water Mains

C652-02: Disinfection of Water-Storage Facilities

C653-03: Disinfection of Water Treatment Plants

C654-03: Disinfection of Wells

Meters

C700-02: Cold-Water Meters—Displacement Type, Bronze Main Case

C701-02: Cold-Water Meters—Turbine Type, for Customer Service

C702-01 : Cold-Water Meters—Compound Type

C703-96 (R04): Cold-Water Meters—Fire Service Type

C704-02 : Propeller-Type Meters for Waterworks Applications

C706-96 (R05): Direct-Reading, Remote-Registration Systems for Cold-Water Meters

C707-05: Encoder-Type Remote-Registration Systems for Cold-Water Meters

C708-05: Cold-Water Meters Multijet Type

C710-02: Cold-Water Meters—Displacement Type, Plastic Main Case

C712-02: Cold-Water Meter--Singlejet Type

C713-05: Cold-Water Meters: Fluidic-Oscillator Type

C750-03: Transit-Time Flowmeters in Full Closed Conduits

Service Lines

C800-05: Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials)

Plastic Pipe

C900-97: Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In.-12 In. (100 mm-300 mm), for Water Dist.

C901-02: Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service

C903-05: Polyethylene-Aluminum-Polyethylene Composite Pressure Pipes

C905-97: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In.-48 In. (350 mm-1,200 mm)

C906-99: Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Th. 63 In. (1,575 mm), for Water Dist. and Trans.

C907-04: Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm)

C908-01: PVC Self-Tapping Saddle Tees for Use on PVC Pipe

C909-02: Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In.-24 In. (100 mm-600 mm), for Water Distribut

C950-01: Fiberglass Pressure Pipe

Storage

Custom Manual/Standard Set: Flexible-Membrane Storage

Custom Manual/Standard Set: Steel Tanks

D100-96: Welded Steel Tanks for Water Storage

D101-53(R86): WITHDRAWN - Inspecting and repairing steel water tanks, standpipes, reservoirs, and elevated tanks, for water storage

D102-03: Coating Steel Water-Storage Tanks

D103-97: Factory-Coated Bolted Steel Tanks for Water Storage

D104-04: Automatically Controlled, Impressed-Current Cathodic Protection for the Interior of Steel Water Tanks

D110-04: Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks

D115-95: Circular Prestressed Concrete Water Tanks With Circumferential Tendons

D120-02: Thermosetting Fiberglass-Reinforced Plastic Tanks

D130-02 : Flexible-Membrane Materials for Potable Water Applications

Pumping

E101-88 WITHDRAWN - ANSI Std for Vertical turbine pumps - Line shaft and submersible types

Plant Equipment

F101-02: Contact-Molded, Fiberglass-Reinforced Plastic Wash Water Troughs and Launders

F102-02: Matched-Die-Molded, Fiberglass-Reinforced Plastic Weir Plates, Scum Baffles, and Mounting Brackets

Utility Management

G100-05: Water Treatment Plant Operation and Management

G200-04: Distribution Systems Operation and Management

ATTACHMENT 2

Definition - Standard Watermains

Under the following conditions watermains would be considered standard:

A. Existing Watermains

1. Single family/duplex residential zoning *

Dead end streets/easements less than 400 feet in length - no Fire hydrants required.

4 inch or larger cast iron or
Ductile iron pipe, and 2" copper pipe

Dead end streets/easements with single standard fire hydrant and 1000 GPM fire flow available.

6 inch or larger cast iron or
Ductile iron pipe. (8 inch size or larger cast iron or
Ductile iron pipe if more than one standard fire hydrant.)

Through streets and easements with standard fire hydrant(s) and 1000 GPM fire flow available.

6 inch or larger cast iron or Ductile iron pipe

2. All other zoning *

8 inch or larger cast iron or ductile iron pipe.

* NOTE: All zoning - existing 16" and larger watermains shall all be considered as standard. For 12" and smaller size watermains, all existing watermains constructed before 1984 and constructed of materials other than cast iron, ductile iron pipe, or copper pipe shall be considered substandard.

B. New Watermains

New watermains shall conform to the latest Seattle Public Utilities Distribution Watermain Requirements and Design Standards.

Definition - Standard Fire Hydrant

Standard fire hydrant is a 6" or larger nominal size fire hydrant connected by a 6" or larger pipe to a 6" or larger watermain. New fire hydrants must conform to current Seattle Public Utilities requirements.

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

IV. DISTRIBUTION

APPENDIX C

DISTRIBUTION FACILITIES DESIGN AND CONSTRUCTION STANDARDS

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This appendix to the *2007 Water System Plan Update* (WSP) describes the standards and procedures followed by Seattle Public Utilities (SPU) in the installation of new water mains and the interior coating of water storage facilities. These requirements are intended to meet or exceed the design and construction standards referenced in WAC 246-290. Together with the City of Seattle's Standard Specifications (Seattle, 2000a) and Standard Plans (Seattle, 2000b), this material is intended to meet the requirements of the Department of Health (DOH) submittal exception process for distribution main construction and tank painting. By qualifying for this process and following the approved procedures and standards, SPU is provided a waiver from the requirement of DOH approval of individual projects.

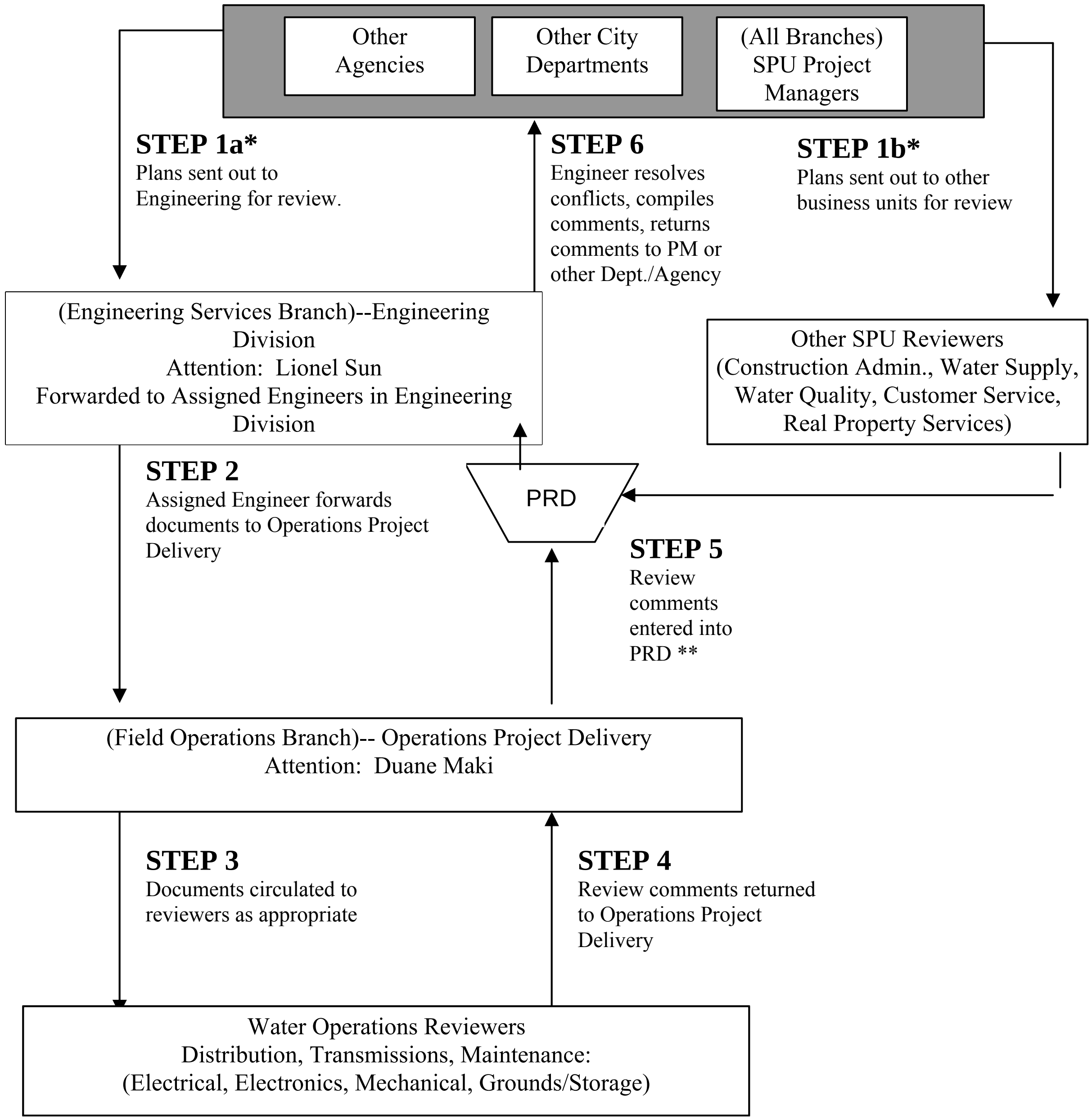
1. Project Review Procedures

All improvements and modifications to the water distribution system follow the Project Document Review Procedure. The distribution system Project Document Review Procedure process is presented as Exhibit 1. The Project Document Review Procedure is triggered at a point in the design phase when preliminary project documents are received from an external source such as a developer or other agency or at the point when internal SPU circulation of preliminary project documents occurs. These project documents are prepared in accordance with SPU Standards, Policies, and conditions set forth in the Water Availability Certificate (see Section 2 of this appendix). This phase of the project is represented in the schematic by the shaded box at the top.

Step 1a and 1b of the Project Document Review Procedure occur concurrently and are designed to initiate project review from Engineering services and other SPU organizational units. Project documents prepared within one unit of the Engineering Division are routed to one of the other units for review (Step 1a) and are also routed to other appropriate non-engineering SPU reviewers (Step 1b). Similar routing for review occurs for projects which include modifications of some sort to the water distribution system. Steps 2, 3, and 4 show the SPU internal document review routing process through the Field Operations Branch. All reviews are compiled at Step 5 when comments are entered into the Plan Review Database. In Step 6, the Engineering Division and Customer Service are responsible for resolution of conflicts, comment compilation including City Standards, and transmittal of materials to the SPU Project Manager and other City Departments, outside agencies, and developers. Once plans are approved, a permission letter, SPU Right-of-Way Permit, or City Street Use Permit is sent as appropriate for the project's location.

The Engineering division provides engineering reviews and acts as the centralized coordinator for all project documents related to the water utility infrastructure. All review comments are recorded in the Plan Review Database (PRD) managed by the Engineering Division.

Exhibit 1
Distribution System Project Document Review Procedures



***Steps 1a and 1b occur concurrently**
**** PRD is the Plan Review Database, used for review comment routing and is currently being upgraded.**

2. Policies and Requirements for Outside Parties

SPU has in place established developer requirements for design and installation of extension or replacement of Seattle's water distribution system. These documents and requirements are accessible through the City of Seattle website at www.seattle.gov/util/engineering/obtain_utility_services/index.asp. The documents available for outside parties include:

Developers and Property Owners

- Application to Change SPU's Distribution System
- Hydrant Testing
- Property Owner Contract
- Standard Charges
- Surety Instrument
- Transfer of Ownership
- Easement Information

Engineers

- General Notes on Plans: 4" – 12" Mains
- Selective Notes on Plans: 4" – 12" Mains
- Information Sheets for Engineers
- Hydrant Test Request Procedure

Contractors

- General Information
- Insurance Requirements
- Hydrant Information
- Water Quality Checklist
- Survey Requirements

Outside parties alter the water distribution system and the ability to deliver water if development requires replacement or extension of existing water mains, pressure zones, etc. These changes to water supply due to development are stated on the Water Availability Certificate that is issued at the time of a building permit or land use change application. Developers must follow established requirements and procedures in both the design and installation of new water infrastructure. SPU reviews and approves the design submitted by the developer and inspects the installation by the developer's contractor. Infrastructure design is based on SPU's engineering design requirements, Policies and City Standard Specifications (Seattle, 2005), as well as other engineering considerations.

Before a developer can begin construction, the developer is required to contract with SPU to change the water distribution system. The developer-SPU contract addresses the standard charges for plan review, easement processing if needed, construction inspection, water quality testing, connection to the existing SPU system, and any other work which SPU performs related to the developer's project. Additionally, the developer must also provide SPU with a surety instrument. All developer plans must be submitted by the developer's engineer for SPU review and approval. Finally, the developer's contractor must conduct a preconstruction meeting with SPU staff to identify and agree upon construction start dates.

3. Design Standards

Performance Standards and Sizing Criteria are addressed in a separate appendix on System Design Standards.

4. Construction Standards

The 2005 City of Seattle Standard Specifications (Seattle, 2005) includes:

- Pipe and Fittings
- Trench Excavation
- Bedding and Backfill
- Pipe Installation
- Valves
- Hydrants
- Service Connections
- Irrigation System (Backflow Prevention)
- Water (for concrete, irrigation and hydrant use)
- Distribution Materials

These specifications include construction materials and methods of construction. Performance standards desired and expected are reflected in the construction standards. All public and private construction within the City of Seattle public right-of-way must comply with the Standard Specifications. The 2005 City of Seattle Standard Plans (Seattle, 2005) supplement the Standard Specifications.

Where applicable, specific standard references to professional and technical society standards (such as AWWA, APWA) have been incorporated. As standards are upgraded, there is a system in place to incorporate these updates and revisions. For the painting of the interior of water tanks, coatings are limited to those that have been certified to meet NSF standard 61.

5. Construction Certification and Follow-up Procedures

5.1 Preconstruction

SPU's construction standards, the 2005 City of Seattle Standard Specifications (Seattle, 2005) and the 2005 Seattle Standard Plans (Seattle, 2005), serve as the basis for all public works project contract documents. These standards are made available to all prospective bidders along with the bid documents for each project at SPU's Engineering Records Vault bid counter. The standards are revised and supplemented in individual water distribution main project plans and specifications.

Prior to the start of a water distribution main construction project, a preconstruction meeting is held with representatives of SPU design, project management, construction, water quality, and operations staff; the contractor and subcontractors; and other involved parties, such as a developer or consulting engineer. At the preconstruction meeting, SPU's procedures for submittals, inspection, water quality control, connection(s) to the existing water system, and installation of meters are discussed.

Submittals are required from the contractor for review by SPU before water distribution main installation is allowed to begin. When contractors perform their own survey, grade sheets are submitted to verify pipeline grade during construction. The contractor's proposed sources of construction materials are submitted and reviewed by SPU's Materials Testing Laboratory. Specific construction materials submittals, including shop drawings, catalog cuts, and technical data are also reviewed, as required.

5.2 Construction Inspection

SPU Construction Engineering personnel perform continuous on-site inspection during installation of water distribution mains to verify conformance with appropriate AWWA, DOH, and City of Seattle Standard Specifications. The procedures listed below are followed during inspection:

Grade and Alignment. Grade and alignment of the new water distribution main are verified by SPU Construction Engineering personnel. Deviations from the plan grade and alignment are noted.

Existing Utilities. Encounters with existing utilities, both marked and unmarked, are noted by SPU Construction Engineering personnel. Proper separation between the new water distribution main and existing utilities is ensured. In the case of encountered sanitary sewers and storm drains where sufficient separation is not available, replacement of the section of sewer/drain pipe crossing over or under the pipe with new ductile iron pipe is required.

Trench Excavation. Trench excavation is observed to verify sufficient depth of cover over water distribution mains (35 inches of cover for 8-inch diameter and smaller mains, 40 inches of cover for 10-inch diameter mains, and 43 inches of cover for 12-inch diameter mains as per Seattle Standard Specifications 7-10.3(5)C and Seattle Standard Plan No. 030). Extra excavation is required if unsuitable material is found at the bottom of the trench.

Pipe Bedding and Backfill. Proper pipe bedding is ensured by SPU Construction Engineering Personnel, in accordance with Seattle Standard Specifications 7-10.3(9). Trench backfill is also observed to conform to Seattle Standard Specifications 7-10.3(10). Unsuitable backfill material is rejected. Proper compaction of the bedding and backfill is ensured and tested by SPU Materials Laboratory personnel, or a private, certified testing firm in accordance with Seattle Standard Specifications 7-10.3(11).

Pipe Installation. Prior to installation of new water distribution mains, SPU Construction Engineering personnel inspect pipe and appurtenances for proper size, material, thickness class, and type of joint. Proper storage and handling of the pipe before it is placed in the trench is ensured. All standing water in the trench is directed to be removed by the contractor before the pipe is laid. Proper cutting of pipe is also observed.

All pipe bell and spigot ends are inspected for cleanliness before jointing. Proper assembly and tightening of mechanical or restrained joint systems is observed. Deflection of joints is observed to not exceed allowable limits of the type of joint.

Thrust Restraint. Thrust restraint measures are observed to conform with the design requirements. Thrust blocking is ensured to cover a sufficient amount of area based on pipe diameter and soil type (Seattle Standard Plans No. 330.1a&b, 331.1a&b) and be of an appropriate mix of concrete. Shackle rods, when used, are observed to be of the proper type, number, and diameter.

Corrosion Protection. When corrosion protection and/or electrolysis monitoring measures are specified, SPU Construction Engineering personnel observe that they are properly installed. Prior to exothermic pipe bonding, the bonding surface is observed to be clean and free of paint, primer, and other coating materials. The soundness of the welds is observed and tested with a glancing blow with a 16 ounce hammer. Joint continuity tests, when specified, are observed to meet minimum levels. Polyethylene wraps are observed to be continuous and free from tears.

Installation of Appurtenances. SPU Construction Engineering personnel verify proper installation of valves, hydrants, blowoffs, and other appurtenances. Proper installation of hydrant tee thrust restraint systems is observed and verified.

5.3 Pressure Testing

SPU Construction Engineering personnel perform hydrostatic pressure tests of all installed water distribution mains according to the requirements of Seattle Standard Specifications 7-11.3(11). Ductile iron water distribution mains 12 inches in diameter or smaller are tested to a pressure of 300 psi. Pipes 16 inches in diameter or larger are tested to 250 psi unless otherwise specified. The test pressure is maintained without pumping for 15 minutes for sections of water distribution main up to 1,500 feet long. A pressure drop of not more than 15 psi, with no visible leaks, during this time is considered acceptable. In-line gate valves will be acceptable if no immediate loss of pressure is registered on gauge when the valve is being checked. Hydrant valves are tested for five minutes. In-line valves are tested on each side and hydrant valves are tested on the water distribution main side only. A pressure drop of not more than 5 psi during this time, with no visible leaks, is considered acceptable. Water distribution mains not passing a pressure test are corrected and retested.

Pressure tests are recorded using a Bristol Babcock portable pressure recorder, using a 0-500 psi chart set at a 96-minute duration. Each test interval is indicated on the chart, along with whether the entire test was considered acceptable. Project information, date of test, and the name of the inspector performing the test are also recorded on the chart. Charts are maintained with project records.

5.4 Disinfection, Flushing, and Water Quality Sampling

SPU Construction Engineering personnel ensure that proper disinfection and flushing are performed and sample ports are provided during water distribution main installation. They coordinate sampling of the main with SPU Customer Service Water Quality Control staff.

Disinfection. SPU Construction Engineering personnel verify that chlorine for pipeline disinfection is applied through one of three allowed methods. In water distribution main installation, dry calcium hypochlorite (65-70 percent chlorine) is applied on a pipe-by-pipe basis in an amount sufficient to provide an initial dosage of at least 25 mg/l free chlorine. In circumstances where this is not feasible, gas chlorine or liquid sodium hypochlorite is applied as the disinfectant. The amount of chlorine required for each method for each diameter of pipe is specified in section 7-11.3(12) of the Seattle Standard Specifications.

Flushing. After a sufficient chlorine residual and contact time has been verified by SPU Water Quality Control personnel, the installed water distribution main is flushed. If dry calcium hypochlorite is the method of disinfection, a flushing velocity of at least 2.5 feet per second is required. Installed water distribution mains are flushed for at least five minutes for every 150 feet of new water distribution main and at least a 30-minute minimum.

Water Quality Sampling and Testing. Water quality samples are collected by SPU Water Quality Control personnel at intervals of 500 lineal feet or less along a new water distribution main. Samples are analyzed by the SPU Water Quality Laboratory for total coliform. Samples showing a presence of coliform bacteria are considered unsatisfactory and disinfection, flushing, and sampling of the distribution main is repeated (Seattle Standard Specifications 7-11.3(12)M). If samples exceed requirements for any reason other than coliform, the water distribution main is flushed and re-sampled.

Connection to Existing Distribution System. After satisfactory laboratory results are obtained, the installed water distribution main is connected to the existing distribution system. SPU water distribution crews make the physical connection with the aid of the contractor. SPU personnel ensure that, when possible, the total length of pipe required to connect the end of the installed water distribution main to the existing system is less than one standard pipe length of 18 feet. When this is not possible, SPU personnel require the contractor to predisinfect the connection pieces and arrange for water quality sampling of those pieces.

5.5 Procedures for Preparation and Retention of Design and Construction Drawings

Water distribution main design drawings are produced by both SPU Water Design staff and outside engineering staffs. Contract drawings are used to record bid item pay quantities, "as-built" notations and corrections, and all work added or deleted by change order. At the completion of construction, a set of "as-built" drawings is transmitted to SPU Technical Resources Section in the Engineering Support Division of the Engineering Services Branch for transfer to a reproducible medium. A copy is created on a storage medium and given to the SPU Engineering Records Vault, a repository of project information. All projects are assigned a unique vault plan number that is used to catalog the completed construction record drawings. Electronic design drawing files are stored by SPU Technical Resources Section. They are used to create contract drawings that are stamped and signed and then reproduced for advertisement and the use of the contractor and SPU Construction Engineering personnel. Corrected "as-built" record drawings are also transmitted to SPU Geographic Information Systems (GIS) personnel (Data Services, Information and Technology Division, Finance and Administration Branch), who transfer the project information to the City of Seattle GIS database. Within 60 days of completion of all water distribution main projects, a *Construction Report for Public Water System Projects* is submitted to DOH, in accordance with WAC 246-290-040.

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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

V. OPERATIONS AND MAINTENANCE

APPENDIX A
OPERATOR CERTIFICATION

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Operator Certification

April 2006

Introduction

Seattle Public Utilities (SPU) is committed to meeting the requirements of the Water Works Operator Certification Program administered by the Washington State Department of Health (DOH) in conjunction with the Water and Wastewater Operator Certification Board of Examiners under the authority of Chapter 70.119 RCW and the comprehensive program regulations contained in Chapter 246-292 WAC. Under this program, water systems must employ certified operators to carry out various water system functions as part of treatment and distribution systems.

Certification Requirements

SPU is classified as a “Group A” public water system. The Group A classification requires that SPU have certified operators in charge of all active, daily, and technical operations of the water system. In meeting this requirement, SPU maintains certified personnel throughout the utility for a variety of water system operations. This certification includes water treatment plant operators at the Tolt and Cedar Water Treatment Facilities, which are operated and maintained by private entities. Classifications include Water Distribution Manager (WDM) Levels 1 through 4, Water Treatment Plant Operator (WTPO) Levels 3 and 4, Cross Connection Control Specialists (CCS) and Backflow Assembly Tester (BAT) depending on the requirements of specific positions. Table 1 shows the current listing of mandatory water works operator positions for SPU as they relate to the organizational structure of the utility. This list is updated on an annual basis for utility staff and submitted to DOH for their review.

Table 1
Waterworks Personnel Certifications

Branch	Division	Position	Required Certification
Utility Systems Management	Drinking Water	Drinking Water Director	WDM 4
		Water System Operations Manager	WDM 3
		Water System Supervisor	WDM 3
		Senior Water System Operator	WDM 1
		Water System Operator	WDM 1
	Treatment Plant	Water Treatment Plant Facility Manager	WTPO 4
		Water Treatment Plant Operator	WTPO 3
Customer Service	Utility Service Teams	Chief Water Quality Inspector	WDM 3, CCS & BAT
		Senior Water Quality Inspector	WDM 2, CCS & BAT
		Water Quality Inspector	WDM 1
Field Operations	Water Operations	Water Operations Director	WDM 4
		Water Maintenance Supervisor	WDM 3
		Water Transmission Supervisor	WDM 3
		Water Pipe District Supervisor - North End Distribution	WDM 3
		Water Pipe District Supervisor - South End Distribution	WDM 3
		Water Treatment Crew Chief	WDM 2
		Water Treatment Equipment Technician	WDM 2
		Senior Water Treatment Operator	WDM 2
		Water Treatment Operator	WDM 1

Certified operators are either on-site or on call for all critical water system operations. SPU also ensures that certified operators are in charge of all segments of the water system as appropriate. Certified operators staff the Control Center, the two primary water treatment plants, and the Landsburg Diversion 24 hours per day. Also, Water Pipe District Supervisors for the Water Operations Division of the Field Operations Branch maintain Water Distribution Manager Level 3 certification for the "North End," "South End," and "All City" segments of distribution responsibility.

Training

All certified personnel for SPU renew their certificates on an annual basis and enhance their professional growth in the field by accumulating at least three college-related credits or continuing education units (CEUs) every three years. Personnel meet the CEU requirements through a combination of external and internal training opportunities. External opportunities include State-sponsored classes through the Washington Environmental Training Resource Center (WETRC). Examples of classes offered through this program include "Chlorination System Operation and Maintenance" and "Basic Electrical." Internally, SPU takes advantage of a wealth of expertise from a variety of professional staff to offer CEU approved classes. Examples of classes offered through this internal training include:

- National Incident Management System (NIMS)
- Cross Connection Control
- Operations Math
- Corrosion Protection
- Watermain Installation and Print Reading
- Successful Watermain Shutdowns

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VI. BUDGET AND FINANCE

APPENDIX A
CAPITAL FACILITIES PLAN

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Proposed 2007-2030 Capital Facilities Plan - 2006 Dollars (in $1,000's)

Row No.	PROJECT TITLE	Business Area/ Sub-Area	2007	UPDATED FROM 2007-2012 CIP 4/7/06 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	BPA - Aquatic & Riparian Restoration	Watersheds	569	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	BPA - Road Decommissioning/Improvements	Watersheds	15	40	180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	BPA - Security Measures	Watersheds	33	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	BPA - Upland Forest Restoration	Watersheds	211	236	25	25	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Cedar Falls Railroad Hazmat Remediation	Watersheds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Cedar River Watershed HCP (all CIP projects)	Watersheds	11,306	9,619	2,929	2,952	1,979	1,663	1,850	1,850	1,940	1,846	1,846	1,756	1,756	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354	1,354
7	Cedar Watershed Boundary Land Acquisition	Watersheds	101	101	101	101	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
8	Cedar Watershed Bridge Replacement Program	Watersheds	1,580	533	90	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Cedar Watershed Road Improvements Program	Watersheds	780	780	780	780	780	780	780	780	780	780	780	780	780	780	780	780	780	780	780	780	780	780	780	780
10	Chinook Research & Monitoring	Watersheds	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	CRW Cultural Resources Information Management System	Watersheds	300	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	CRW Education Center Exhibits	Watersheds	51	0	0	0	0	0	0	0	0	0	0	600	600	0	0	0	0	0	0	0	0	0	0	0
13	CRW Fish and Wildlife Information Management	Watersheds	300	184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	CRW Materials Inventory Management System	Watersheds	300	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Environmental Stewardship Project Development	Watersheds	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
16	Kerriston Road Study and Improvements	Watersheds	75	200	200	200	200	200	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
17	Lake Youngs Management Plan	Watersheds	150	150	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
18	Limited Use Area Management Plans	Watersheds	100	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	Mobile Safety Assessment & Improvements	Watersheds	400	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	Rock Creek Fish Passage Improvements	Watersheds	1,392	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Proposed 2007-2030 Capital Facilities Plan - 2006 Dollars (in $1,000's)

Row No.	PROJECT TITLE	Business Area/ Sub-Area	2007	UPDATED FROM 2007-2012 CIP 4/7/06 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
21	Snohomish River Basin HPP	Watersheds	1,225	835	70	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Tolt Fisheries Mitigation	Watersheds	35	44	0	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Tolt Watershed Bridge Replacement Program	Watersheds	25	430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Tolt Watershed Management Plan	Watersheds	212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	Tolt Watershed Management Plan Implementation	Watersheds	0	0	0	0	0	0	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
26	Tolt Watershed Road Improvement Program	Watersheds	170	175	120	120	120	120	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
27	Watershed Emergency/Opportunity	Watersheds	200	200	200	200	0	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
28	Watershed Vegetation Management Plans (CRW, Tolt, and Lake Youngs)	Watersheds	100	50	50	50	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	Regional Water Conservation	Water Resources	3,550	3,650	4,000	3,850	2,000	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550
30	Additional Conservation in Seattle (I-63 SO)	Water Resources	1,800	1,965	1,799	1,799	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	Cedar Moraine Monitoring Improvements	Water Resources	725	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	Cedar System Dam Safety Improvements	Water Resources	15	30	30	30	30	30	30	30	30	30	420	365	30	30	30	275	330	2,030	1,530	80	420	365	30	30
33	Landsburg Flood Passage Improvements	Water Resources	1,001	1,518	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	Morse Lake Dead Storage Facilities	Water Resources	2,240	885	9,795	12,355	1,935	0	0	0	25	0	0	0	0	25	0	0	0	0	25	0	0	0	0	3,100
35	Tolt FERC Relicensing Efforts	Water Resources	0	0	0	0	0	0	0	0	0	0	0	25	50	50	100	100	100	100	0	0	0	0	0	0
36	Tolt System Dam Safety Improvements	Water Resources	100	175	55	28	29	400	725	300	475	1,525	175	475	175	325	50	200	475	775	200	25	25	100	50	25

Proposed 2007-2030 Capital Facilities Plan - 2006 Dollars (in $1,000's)

Row No.	PROJECT TITLE	Business Area/ Sub-Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
				UPDATED FROM 2007-2012 CIP 4/7/06																						
37	Water Resources Project Development	Water Resources	100	100	100	100	100	100	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
38	Water System Plan	Water Resources	26	0	44	90	450	395	50	0	44	90	450	395	50	0	44	90	450	395	50	0	44	90	450	395
39	Air Valve Improvements	Transmission	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
40	Augusta Gatehouse Rehabilitation	Transmission	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	Beverly Park Tank Coating and Seismic Upgrade	Transmission	0	0	250	750	1,500	1,300	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	Cathodic Protection Program	Transmission	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
43	Cedar River Pipelines at Ginger Creek	Transmission	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	Control Works Surge Tanks Cover	Transmission	300	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	CRPL 4 Improvements and Betterments	Transmission	127	300	210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	Des Moines Way Pipeline Relocation	Transmission	5	5	5	5	5	5	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	Lake Forest Park Floating Cover Replacement	Transmission	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500	500	6,500	500	0	0
48	Maple Leaf Gatehouse Piping Improvements	Transmission	270	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	Myrtle Tanks Coating	Transmission	694	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	Purveyor Meters Program	Transmission	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
51	Richmond Highlands Tanks Painting	Transmission	829	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Proposed 2007-2030 Capital Facilities Plan - 2006 Dollars (in $1,000's)

UPDATED FROM 2007-2012 CIP 4/7/06

Row No.	PROJECT TITLE	Business Area/ Sub-Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
52	System Dewatering	Transmission	100	200	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
53	Tolt Pipelines Projects in Closeout	Transmission	40	20	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	Transmission Pipelines Rehabilitation	Transmission	600	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
55	430 Pipeline Rehabilitation (old CRPL 2 between Maple Leaf and Volunteer Reservoirs)	Distribution	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	Asset Management Initiatives	Distribution	250	250	250	250	250	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	Bitter Lake Reservoir Cover	Distribution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	500	3,000	200	0	0
58	Chamber Ring and Cover Replacement	Distribution	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
59	Distribution Meter Replacement Program	Distribution	643	643	643	643	643	643	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697	697
60	Distribution System In-Line Gate Valves Replacement	Distribution	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
61	Hydrants Program - New, Replacement, and Relocation	Distribution	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242	242
62	Other Agency - Direct Service Utility Relocations - Small	Distribution	2,052	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
63	Other Agency - Direct Service Utility Relocations - Large	Distribution	2,653	1,672	1,830	1,735	1,735	1,485	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
64	Pump Station Improvements	Distribution	65	70	70	70	70	70	100	100	100	100	100	100	150	150	150	150	150	200	200	200	200	200	250	250
65	Queen Anne Booster Pump Station	Distribution	5,025	700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	Queen Anne Standpipes Replacement	Distribution	3,300	1,250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Proposed 2007-2030 Capital Facilities Plan - 2006 Dollars (in $1,000's)

UPDATED FROM 2007-2012 CIP 4/7/06

Row No.	PROJECT TITLE	Business Area/ Sub-Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
67	Seismic Upgrade: Pipeline Backbone System Analyses	Distribution	750	2,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	Seismic Upgrade: Tanks	Distribution	0	0	0	0	0	500	750	1,500	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	Steel Structures Recoating	Distribution	50	50	50	50	50	50	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
70	Watermain and Feeder Replacement and Rehabilitation Program	Distribution	2,030	600	4,500	4,500	4,500	4,500	2,000	2,000	2,000	2,000	2,000	2,100	2,250	2,400	2,550	2,700	2,900	3,100	3,250	3,450	3,700	3,900	4,100	4,400
71	Distribution System Fireflow and Pressure Improvements	Distribution	675	1,000	1,000	1,000	1,000	1,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	Watermain Extensions Program	Distribution	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
73	Wtr Infrastrc-Service Renewal	Distribution	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	5,500	3,000	2,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
74	Wtr Infrastruc-New Taps	Distribution	5,000	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400
75	Beacon Reservoir Replacement	Water Quality & Treatment	18,490	8,700	1,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	Maple Leaf Reservoir	Water Quality & Treatment	14	0	300	396	17,347	29,341	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	Myrtle Reservoir Replacement	Water Quality & Treatment	6,720	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	Roosevelt Reservoir Retirement	Water Quality & Treatment	0	0	0	0	0	0	0	100	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	Treatment Facility / Water Quality Improvements	Water Quality & Treatment	150	160	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
80	Volunteer Reservoir	Water Quality & Treatment	0	0	0	100	280	1,247	640	5,007	9,353	2,046	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	West Seattle Reservoir	Water Quality & Treatment	730	7,143	14,747	5,823	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	Regional Facility Improvements	Other	1,952	2,097	3,277	2,827	1,680	1,180	750	750	750	1,000	1,000	500	500	750	750	1,000	1,500	2,000	2,000	1,500	1,000	1,000	750	750

Proposed 2007-2030 Capital Facilities Plan - 2006 Dollars (in $1,000's)

UPDATED FROM 2007-2012 CIP 4/7/06

Row No.	PROJECT TITLE	Business Area/ Sub-Area	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
83	Seattle Facility Improvements	Other	1,694	1,746	2,425	770	408	308	1,500	2,000	1,500	1,000	1,000	500	500	1,500	1,500	1,000	1,000	500	500	500	1,500	1,500	1,000	1,000
84	Tank and Standpipes Site Remediation	Other	200	150	10	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	Water Design Standards	Other	250	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	Heavy Equipment Purchase	Other	3,262	1,500	1,500	4,200	4,000	1,000	2,500	2,000	3,400	1,500	1,500	4,500	4,500	1,500	2,500	2,000	3,400	1,800	1,800	4,500	4,300	1,500	2,500	3,400
87	SCADA System	Other	4,055	1,640	1,074	5,251	4,489	25	150	100	50	200	100	50	150	100	50	200	100	50	150	100	50	200	100	50
88	Security Improvements - System-wide	Other	1,925	1,400	1,200	1,200	1,200	1,200	2,000	2,000	2,000	2,000	0	0	0	0	0	0	2,000	2,000	2,000	2,000	0	0	0	0
89	Information Technology	Other	5,582	5,794	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720	5,720
	Total in 2006 $1000's		107,844	76,531	75,963	72,953	67,344	68,826	38,776	43,168	48,098	36,268	30,522	32,297	31,642	29,115	30,009	30,000	34,690	35,235	34,790	35,640	43,024	31,840	31,515	35,685

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VI. BUDGET AND FINANCE

APPENDIX B

STANDARD CONNECTION AND ADMINISTRATIVE CHARGES RULE

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Seattle Public Utilities - Policy & Procedure

Subject: Standard, Connection, and Administrative Charges Rule		Number: SPU-DR-05-06
		Effective: January 1, 2006
		Supersedes: SPU-DR-01-05
Approved:	Date:	Page(s): 16

1.0 PURPOSE

1.1 To set fees for miscellaneous services provided by Seattle Public Utilities.

2.0 REFERENCES

2.1 Seattle Municipal Code 21.04.100, 21.04.105, 21.04.125, 21.04.465, 3.02

3.0 DEFINITIONS

3.1 **Time and Materials** – the cost of a service as calculated by Seattle Public Utilities, including labor, equipment, materials, applicable permit fees, pavement restoration, overhead costs and any similar costs incurred by SPU while performing the service.

3.2 **Normal Hours** – Monday through Friday from 7:30am to 4pm, excluding those holidays observed by the City of Seattle.

3.3 **Extended Hours** – Monday through Friday from 4pm to 9pm from April through October, excluding those holidays observed by the City of Seattle.

3.4 **After Hours** – times other than normal hours or extended hours

4.0 POLICY

4.1 New Service Installation

4.1.1 Standard Charges for installation of new service:

Domestic Services

Size	Fee
3/4"	$2,000
1"	$2,260
1 1/2"	$3,910
2"	$4,090
3" CT	$23,100
4" CT	$23,300
6" CT	$28,730

*Note: If ¾" - 2" new service is being installed with developer water main, see item 4.29.

Combination Fire/Domestic Services

Size	Fee
4" in residential street	$22,400
4" in arterial street	$30,500
6" in residential street	$28,700
6" in arterial street	$36,500
8" Time and Materials, deposit	$50,000

Fire Services

Size	Fee
2" DC	$5,500
4"	$16,250
6"	$17,300
8"	$21,000

Service Conversions

Existing 6” DC to 6” Combo	$28,730
Existing 8” DC to 8” Combo Time and Materials, deposit	$50,000
Existing 4” DC to 4” Combo – Central Business Core	$35,000
Existing 6” DC to 6” Combo – Central Business Core	$36,500
Existing 8” DC to 8” Combo – Central Business Core	Time&Materials, $50,000 deposit

Note – Service Conversions are subject to the connection charge in 4.1.2

Other New Service Installation Standard Charges

- All required City, County, and/or State, and other permits and fees are in addition to the standard charges listed above. Current permit fees are shown below for reference:
  - In unincorporated King County: add $100 permit fee plus $125/hr County inspection fee.
  - In Shoreline: add permit and inspection fee of $127/hr
  - In Lake Forest Park: add $200 permit and inspection fee
  - Within Seattle City Limits: 3" or larger meters - add $165 street use permit fee.

- For 3/4" and 1" services installed in conjunction with new water main construction, if ordered 30 days prior to estimated start of construction: $190 reduction from standard charges.

- For 2" and smaller domestic services installed concurrently with fire services in a common trench: 3/4" or 1" - $300 reduction from standard charge. 1 1/2" or 2" - $500 reduction from standard charge.

- For 10" and larger services (all types) – time and materials.

- All services requiring installation in casings - standard charge plus casing bid price.

- Properties with two abutting mains: service installed at standard charge when main to be tapped is selected by Seattle Public Utilities (SPU). Time and materials if installation is otherwise.

- Time and materials, but not less than the applicable standard charge, for all purveyor services, for all services tapped on transmission mains or for special circumstances as determined by the Director of Seattle Public Utilities (SPU), or designee.

- Contractor Standby Charge – when site/contractor not ready as previously scheduled $ 300 per event

- Isolation valve, if required:
  8" Isolation valve - $ 9,280
  10" Isolation valve - $10,480
  12" Isolation valve - $10,100
  16" or larger - Time and materials, deposit $18,000

- Ring and Cover Casting, if required
  For new or existing ¾", 1" and all fire service: $250 additional
  For new or existing 1½" or 2" domestic services: $80 additional

- Automated Meter Reading equipment, if required by meter installation standards:
  2” or smaller meter: $156 additional
  3” or larger, single register (fire service) $182 additional
  3” or larger, two register (domestic or combo) $307 additional
  3” or larger, 2 register, with fire service in the same chamber $432 additional

4.1.2 **New Service Connection Charge**

The new service connection charge is in addition to the metered service installation charges shown above. The charge is based on the Connection Charge Unit Rate of $673.55. Fire-only services will be charged 40% of the corresponding new service connection charge.

The connection charge rate results in connection costs of:

3/4"	$ 674
1"	$ 1,145
1 1/2"	$ 2,223
2"	$ 3,570
3"	$ 7,409
4"	$ 11,450
6"	$ 22,227
8"	$ 35,698
10"	$ 51,863
12"	$ 70,049
16"	$ 113,156
20"	$ 164,346
24"	$ 222,271

4.2 **Service Size Increase**

- To increase service size of existing 2" and smaller service in the same location (within 30" of existing service) at customer request - applicable new service installation charge will be made (see Item 4.1.1). No charge for meter removal or retirement will be made. Subject to limitations established by Director of SPU, or designee.
  EXCEPTION: To renew and increase 1/2" or 3/4" steel service to 1" copper service in same location (within 30" of existing service) at customer request - $160

- Size increase request at a location exceeding 30" from existing service will be subject to a new service installation charge (Item 4.1.2) and service retirement charges (Item 4.6) for the existing service.

- Service size increases are subject to the Connection Charge.

4.3 **Service Size Reduction (within 30” of existing service).**

- 2” and under - when reduced to smaller size - $180

- All other sizes – time and materials

4.4 **Meter Test (At request of customer)**
Charge will be waived if tested meter is found to be over-registering.

- Tests Conducted at the Meter Shop:

Meter Shop test of 1" or smaller meter:	$105
Meter Shop test of 1 1/2" meter:	$285
Meter Shop test of 2” meter:	$376
Larger than 2" meter: Time and materials - deposit	$500

- Field Testing of 1” or Smaller Meters - $59

- Field Testing Retail Service Meters Outside Seattle Direct Service Area - $424

4.5 **Meter Removal**

3/4" or 1" meter:	$ 54
1 1/2" or 2" meter:	$ 92
3" to 8" meter:	$762
Larger than 8" meter: Time and materials -	deposit $800
Removal of illegal jumper:	$ 54

4.6 **Service Retirement**

Abandonment with or without meter removal. This charge also applies to a customer requested service transfer from one abutting water main to another, not related to new water main construction.

1" and smaller:	$1,100
1 1/2" and 2":	$1,400
3" and larger:	$1,800

4.7 **Meter Reset**

For meter resets following customer-requested removals:

¾" meter	$ 84
1" meter:	$123
1 1/2" meter :	$253
2" meter:	$337
3" or larger meter: Time and materials–deposit	$700
Install Temporary Service Jumper	
2" and smaller:	$ 73
3" and larger: Time and materials – deposit	$700

For meter resets following credit-related removals:

	Normal Hours	All Other Times
¾" or 1" meter:	$ 54	$157
1½" or 2" meter:	$ 92	$157
3" or larger meter:		
Time and materials –	$700 deposit	$700 deposit

Install Temporary Service Jumper	
2" and smaller:	$ 73
3" and larger: Time and materials – deposit	$700

NOTE: If reduction in size occurs at time of reset, then charge reduction fee only.

4.8 **Special Field Trips**

- Meter Shut-Off or Turn-On Charge - Including Fire Services. Charges are for each trip.

	Normal Hours	Extended Hours	After Hours
3/4 - 2" meter -	$ 34	$ 82	$154
3" & larger -	$123	$184	$184

This charge may be suspended in special circumstances as determined by the Director of SPU or designee.

No charge for the first trip for a credit related turn-on during SPU normal business hours. Second and subsequent trips - subject to applicable standard charge above.

- Investigate On-Property Loss of Water

  When loss of water is caused by actions taken on-property - Same charge as for meter turn-ons and shut-offs, above.

  When investigating leaks on-property when the City water service line is intact - Same charge as for meter turn-ons and shut-offs, above.

- Inspection Services: Re-inspection required because the requesting customer is not ready for inspection by deadline or stated date - $51

- Special Meter Read

  For Actual Readings meters of all sizes ordered in connection with property ownership or occupancy changes - $55
  For Obstructed Meter Readings - $62

- Adjust buried, obstructed or low meter boxes or valve boxes caused by customer installed landscaping or resurfacing (¾" to 2" meters) - $303

- Trim customer-installed vegetation obstructing meter boxes or fire hydrants - $65

4.9 Statement of Combined Utility Account

- For request by customer for billing system screen-print statement of account activity for each 12 month period - $5

- For request by customer for formal statement of account activity, for each account number per 12-month period - $34

- For request by another utility for water consumption information to be used for billing the retail services of that utility - $1.51 per account for information covering any period of 12 months or less.

4.10 Process Returned Check or Draft

Includes checks returned for non-sufficient funds or other reasons which prevent processing - $25

4.11 Collection Charges

- Late Payment Charge. Past due balances may be subject to a late payment charge that will include one or both of the following charges:

Collection Notice Charge: $10 for active account Urgent or Shutoff Notice, or closed account Final Notice.

Delinquent Interest Charge: Monthly interest at the legal rate on past due balances.

- Credit field visit in same bill period - $27
- Service shut off charge for non-payment – See Item 4.8

4.12 Duplicate Bill Preparation

For all duplicate bills produced at customer request after original bill was produced - $4

4.13 Delayed Final Customer Billing

For request for final customer bill when notification is received more than 45 days after final bill date - $25

4.14 Acquisition of Hydraulic Flow Data

- Where records are available for fire protection grading purposes - No charge
- SPU measures hydrant flow, flushes main, and prepares flow test report - $906
- Contractor measures hydrant flow with SPU assistance, SPU flushes main and reviews flow test results prepared by contractor - $583
- Performance of hydraulic analysis and report to determine best alternative to meet or exceed fire flow requirements. Time and materials with $2,000 deposit.
- Preparation of Hydraulic Modeling Simulation Report, when a flow test is not feasible, during a declared water emergency, or when a calibrated hydraulic model is available - $200

4.15 Non-Firefighting Hydrant Use Permit

- Permit fee: $21
- Charge for water use:
  If water use is less than 8,000 gallons per day:
  - $29 per day September 16 - May 15
  - $36 per day May 16 - September 15

- For water use above 8,000 gallons per day, a hydrant meter is required and commercial rates are charged.

- During a declared water emergency, any hydrant permit users allowed to continue their permits will be charged at established surcharge commercial rate, if any.

- Billing fee: $49 for billing made by SPU for payment subsequent to hydrant permit use.

- Hydrant valve: $300 deposit for use of SPU supplied valve. Deposit refunded upon return of valve in same-as-issued condition.

- Hydrant meter: $300 deposit for 2" hydrant meter. Deposit refunded after removal of meter by SPU.
  Installation and removal: $60 each

  Water use charged at the commercial rate or surcharge commercial rate if during a declared water emergency.

4.16 **Paint Hydrant**

Paint Hydrant at customer request - $100

4.17 **Hydrant Reset**

Set hydrant back or move closer to water main, where no re-tapping of main is required.

- Inside Seattle City Limits - $3,900 (includes street use permit fee of $165)

- Outside Seattle City Limits - $3,735, plus any of the following additional charges that may be required:
  quick connect adapter - $185
  any city or County permitting, plan review or inspection fees.

4.18 **Hydrant Relocation**

Remove existing hydrant and move to new location, new tap on main required.

- Inside Seattle City Limits - $7,700 (includes street use permit fee of $165)

- Outside Seattle City Limits - $7,535, plus any of the following additional charges that may be required:
  quick connect adapter - $185
  any city or County permitting, plan review or inspection fees.

4.19 **Install New Hydrant on Existing Water Main**

- Inside Seattle City Limits - $8,140 (includes street use permit fee of $165)

- Outside Seattle City Limits - $7,975, plus:
  quick connect adapter - $185
  any city or County permitting, plan review or inspection fees.

- For new hydrants requiring supply lines in excess of 10 feet in length, the charge will be the greater of:
  The applicable standard charge listed under (a) or (b) above; or,
  Time and materials.

4.20 **Install Vertical Extension on Existing Hydrant**

- Inside Seattle City Limits - $800 (includes street use permit fee of $165)

- Outside Seattle City Limits - $630 plus any city or county permitting, plan review or inspection fees.

4.21 **Access Along or Crossing Transmission Right-Of-Way**

- Gate Opening
  Minimum - $100
  Charge may be in excess of the minimum depending upon the circumstances of opening.

- Pipeline Crossing – Time and materials for employees and equipment stationed to protect the pipeline during crossing

4.22 **Additional Services Which Are Billed As Time and Materials**

- Relocation of Meter and Box - Limited to a lateral move of 30" - deposit amount to be determined upon order.

- Service Damage - For repair of damaged curb stop or meter setter, tailrun, etc. – time and materials, $150 minimum.

- Water main Cut and Cap - For cut, cap and block of existing water main - deposit amount to be determined upon order.

- Design and/or Install Pressure Reducer

  SPU Design: Time and materials - $8,200 deposit

  Installation (by SPU)**:** Time and materials.

4" PR (2" Bypass)	$31,000 deposit
6" PR (2" Bypass)	$33,000 deposit
8" PR (4" Bypass)	$41,000 deposit

  The deposit amounts listed above are the expected project costs, and do not include the cost of street repair. Street repair costs will be borne by the developer.

- Work Outside Normal Business Hours - All work performed outside of SPU normal business hours due to customer request, or due to customer water supply concerns, will be charged at an overtime rate.

- State DOT Right-Of-Way - When any work is to be performed in a SDOT right-of-way which necessitates a Letter of Justification - $600 deposit required for application to SDOT by SPU.

- Installation Plans - Water meter and fire hydrant installation plans may be prepared by SPU at the developer's expense. The cost to prepare the plans depends primarily on the availability of as-built information and the number and complexity of the existing utilities. An advance deposit of $360 is required from the customer before design work begins.

DEVELOPER PROJECTS

NOTE: Charges paid more than 12 months in advance of work performed will be recharged at current years rate.

4.23 **Water Main Connection**

For cut-in tee connection to charged water mains, SPU furnishes sleeve(s) to connect new tee into existing main. For wet tap connection, SPU furnishes tapping sleeve and tapping valve. Contractor furnishes all other materials, tees, valves, valve boxes and lids, fittings, sleeves, excavation, backfill, compaction and restoration. SPU performs shutdown and draining of existing mains, connection of new main, and restoration of service - $3,775 per connection.

4.24 **Water Quality Inspection, Sample Collection and Bacteriological Testing**

- $479 for first 500 feet;
- $351 for each additional 500 feet thereafter.

4.25 **Design Review, Plan Approval, Administration and Acceptance of Main**

- $1,245 per water main project.
- CD-ROM containing GIS data of water system infrastructure associated with the water main project. - $165

4.26 **Easements**

- Easement Acquired, not part of a Street Vacation Application - $2,438

- Easement Granted, not part of a Street Vacation Application:
  Minimum $10,000 deposit deposit towards time-and-material for coordination, review, issuance of easement and authorizing legislation

Plus compensation for value of easement to be based on either an appraisal chosen by SPU, or a negotiated value. Compensation may be reduced based on off-setting benefits to SPU, e.g., utility being installed for SPU's benefit

- Easement Granted or Acquired, as part of a Street Vacation Application – Minimum $10,000 deposit towards time-and-material for coordination, review and issuance of easement

4.27 **Construction Inspection**

Rate includes travel to and from job site

0 – 350 lineal feet -	$4,941
351 – 700 lineal feet -	$6,094
701 - 1,050 lineal feet -	$8,894

Over 1,050 lineal feet requires Special Estimate (time & materials, $82/hr)

Time and materials will be charged for re-inspection caused by contractor.

4.28 **Compaction Tests –**

Required when contractor uses native or imported backfill instead of control density fill (includes In-place density per ASTM D 2922 & Maximum dry density per ASTM D 698) - $432

4.29 **New Service Installation (Developer) –**

Standard Charges will be reduced for new service installation (3/4"- 2" domestic) in conjunction with developer installed watermains. None of the discounts for non-developer service installations listed in Section 1 apply to the developer fees listed below.

- The following conditions must be met:
    - Property is within the direct service area of Seattle's water utility; and,
    - Developer is installing a water main to serve the property; and,
    - The Developer will open trench and backfill, and complete all street/sidewalk paving restoration

NOTE: If above conditions are not satisfactorily met, Developer will pay SPU on a time and materials basis for completion of work.

- Charges for new service installations meeting the conditions in (a) are:

3/4" Domestic	$ 980
1" Domestic	$~~1,750~~1,075
1 ½" Domestic	$2,524
2" Domestic	$2,750
2" Fire Service	$3,165

4.30 **CROSS-CONNECTION CONTROL PROGRAM**

Charge for mailing reminder letters to customers who do not provide acceptable proof of satisfactory performance test of their backflow preventers within 30 days of receiving original notification, or to customers who have not installed backflow preventers as required - $26 for each backflow preventer.

- Hanging shut-off notices - $49

- Shut-off & turn-on – Applicable standard charge for Special Field Trip as specified in Section 8a.

LABORATORY ANALYSIS

All laboratory analyses will be conducted at the discretion of the Water Quality Laboratory Manager and on the basis of time availability. Prices reflect the cost for routine analyses with standard reporting and turnaround times. The price for analyses not included in this list will be based on the cost for labor, equipment, material and overhead, as determined by the Water Quality Laboratory Manager. If available and mutually agreeable, analyses may be available on a call out basis at double the charges listed.

4.31	**Bacteriological Analysis**	**Per Analysis**
4.31.1	Total Coliform (MF)	$21
4.31.2	Total Coliform (MPN)	$18
4.31.3	Total Coliform/E. Coli (MMO/MUG; P/A)	$14
4.31.4	Coliform verification; including Fecal Coliform/E. Coli (EC/MUG)*	$21
4.31.5	Fecal Coliform (MF)	$21
4.31.6	Fecal Strep (MF)	$17
4.31.7	Enteric culture identification (API)	$71
4.31.8	Heterotropic plate count	$21
4.31.9	Pseudomnonas (MF)	$21
4.31.10	Biolog	$105
4.31.11	Sample prep for non-drinking water (filter/dilutions)	$12

*This test is performed on drinking water samples that test positive for Total Coliform by the membrane filtration method. It is used to verify the presence of Total Coliform and simultaneously test for Fecal Coliform and E. Coli.

4.32	**Chemical Analysis**	**Per Analysis**
4.32.1	Metals/Inorganics	
4.32.1.1	Metals by Flame AA and Flame Emission	
	Screen	$11 per element
	Batch of 8 to 19	$28 per element
	Batch of 20 or more	$16 per element
4.32.1.2	Metals by Graphite Furnace AA	
	Batch of 1 to 19~	$38 per element
	Batch of 20 or more	$20 per element
4.32.1.3	Digestion for non-drinking water samples	$19 per sample
4.32.1.4	ICPMS 21 element screen⌖	$189 per sample
4.32.1.5	ICPMS (less than 20 samples, 3 to 7 elements/sample)	

$18 per element

4.32.1.6 ICPMS (20 or more samples for 3 to 7 elements or 10 or more samples for 8 or more elements) $12 per element

4.32.1.7 Metals Filtration $17 per sample

~ If 2 or more metals can be analyzed simultaneously, then 10 samples of 2 metals qualify for volume discount.

⌖ICPMS screen includes: Al, Ag, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Hg, K, Mn, Na, Ni, Pb, Sb, Se, Sn, Tl, Zn

4.32.2 Titrations

4.32.2.1	Total Alkalinity	$15
	Batch of 10 or more	$11 per sample
4.32.2.2	Calcium or Hardness, edta	$16
	Batch of 10 or more	$12 per sample

4.32.3 Organics

4.32.3.1	Total Trihalomethanes (TTHMs)	$85
4.32.3.2	Total Organic Carbon (TOC)	$25
4.32.3.3	Haloacetic Acids (HAAs)	$120
4.32.3.4	Dissolved Organic Carbon (DOC)	$33
4.32.3.5	DBP Formation/Simulate Distribution System (Prep only)	$43

~ If 2 or more metals can be analyzed simultaneously, then 10 samples of 2 metals qualifies for volume discount.

4.32.4 Nutrients

4.32.4.1	Total Nitrogen	$21
4.32.4.2	Total Phosphorus	$21
4.32.4.3	Nitrate-Nitrite	$20
4.32.4.4	Soluble Reactive Phosphorus	$20

4.32.5 Other Procedures

4.32.5.1	Color	$7
4.32.5.2	Copper (comparitor, colorimetric)	$9
4.32.5.3	Fluoride (potentiemetric)	$11
4.32.5.4	Iron (colorimetric comparitor)	$9
4.32.5.5	pH, potentimetric	$11
4.32.5.6	Specific conductance	$8
4.32.5.7	Turbidity	$7
4.32.5.8	Chlorine Residual, colorimetric	$8
4.32.5.9	Chlorine Demand	
	Single contact time at the requested temperature, pH, and Cl_2 dosage	$72
	For each additional contact time, temperature, pH or Cl_2 dosage on the same water source.	$23
4.32.5.10	Seepage (minimum - or sum of parameters tested)	$36
4.32.5.11	UVA (254-545)	$11
4.32.5.12	SOC-VOC Screen	$126
4.32.5.13	VOC Screen	$101
4.32.5.14	Nitrate-Nitrite Screen and UVA	$19

4.32.5.15 Solids, Total Suspended $24
4.32.5.16 Solids, Total Dissolved $24

4.33 **Limnological Analysis** **Per Sample**
4.33.1 Algal biovolume and identification to genus $46
4.33.2 Algal Toxins $46
4.33.3 Flavor Profile Analysis (FPA) and Flavor Rating Assessment (FRA) $56

REAL PROPERTY CROSSING AND USE PERMITS

4.34 **Real Property Crossing Permits**
New permit required for each new owner as permit does not run with the land.

4.34.1 Permit for utility crossings within SPU fee-owned property over or under SPU water transmission pipelines

- Initial review or Issuance and Recording permit estimated to require up to 16 hours of SPU time for review or issuance - $1,300
- Minimum $3,000 deposit towards time-and-material for permit estimated to require over 16 hours of SPU time for review, issuance, recording
- $320 administrative fee due whenever property ownership (permittee) changes with no change in use, and every 3rd year after the first year of permit issuance for continued use

4.34.2 Permit for road or driveway crossings to SPU fee-owned property.

- Initial review or Issuance and Recording permit estimated to require up to 16 hours of SPU time for review or issuance - $1,300
- Minimum $3,000 deposit towards time-and-material for permit estimated to require over 16 hours of SPU time for review, issuance, recording
- $320 administrative fee due whenever property ownership (permittee) changes with no change in use, and every 3rd year after the first year of permit issuance for continued use

4.34.3 Permit for road or driveway crossings of SPU pipeline through property not fee-owned by SPU

Recording fee of $ 32

4.35 **Real Property Use Permits**

For use of SPU's fee-owned property, excluding utility crossing of SPU's transmission lines covered in Crossing Permit. New permit is required for each new owner as permit does not run with the land.

4.35.1 Utility uses (in non-tunnel location)

- Initial review or Issuance and Recording permit estimated to require up to 16 hours of SPU time for review or issuance - $1,300

- Minimum $3,000 deposit towards time-and-material for permit estimated to require over 16 hours of SPU time for review, issuance, recording

- Annual Use fee (may be reduced based on off-setting benefits to SPU, e.g., decrease in City's maintenance costs)

  For linear use: $250.00, plus 25 cents per linear foot over 1,000 feet, or

  For surface use: either appraised fair market value, or 10% of 50% of the assessed value of the adjoining property

- Change of Permittee- $405 to issue new permit when ownership (Permittee) changes with no change in use

4.35.2 Utility uses (in SPU tunnel)

- Initial review or Issuance and Recording permit estimated to require up to 16 hours of SPU time for review or issuance - $1,300

- Minimum $3,000 deposit towards time-and-material for permit estimated to require over 16 hours of SPU time for review, issuance, recording

- Annual Use fee (may be reduced based on off-setting benefits to SPU, e.g. conduit installed for City use)

  $767 for each conduit or interduct under 2-inches diameter
  $1534 for each conduit 2-3-inches diameter
  $2300 for each conduit (which can contain interduct) 3-inches diameter, up to 48 square inches in cross sectional area of the cable or conduit.

- Change of Permittee- $405 to issue new permit when ownership (Permittee) changes with no change in use

4.35.3 Temporary Construction Use
For staging for up to 6 months (If use is expected to be over 12 months, then apply the standard charge for Surface Use, see 3.34.1)

- Initial review or Issuance and Recording permit estimated to require up to 16 hours of SPU time for review or issuance - $1,300

- Minimum $3,000 deposit towards time-and-material for permit estimated to require over 16 hours of SPU time for review, issuance, recording

- One renewal of permit: $1,800 for each 6-month period up to 12 months total

4.35.4 Recreation trails and park uses
Note - Only governmental entities may apply, may be superseded by Memorandum of Agreement

- Initial review or Issuance and Recording permit estimated to require up to 16 hours of SPU time for review or issuance - $1,300

- Minimum $3,000 deposit towards time-and-material for permit estimated to require over 16 hours of SPU time for review, issuance, recording

- Annual Use fee $250.00, plus 25 cents per linear foot over 1,000 feet (may be reduced based on off-setting benefits to SPU, e.g., decrease in City's maintenance costs)

4.35.5 Special Short-term Use of SPU real property (land only, not buildings)

- $ 50 per calendar day to park vehicles, or similar use for community or charity events, and

- $100 gate-opening fee for one opening and one closing

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VII. MISCELLANEOUS

APPENDIX A
WATER FACILITIES INVENTORY

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

WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

Quarter: 1
Updated: 11/30/2005
Printed: 12/14/2005
WFI Printed For: On-Demand
Submission Reason: Non-Periodic update

RETURN TO: Northwest Regional Office, 20435 72nd Ave S STE 200, Kent, WA, 98032

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
77050 Y	SEATTLE PUBLIC UTILITIES	KING	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS — 8. Owner Number 005246
WYLIE HARPER [WQ LAB ENGINEER] 800 S STACY ST SEATTLE, WA 98134	SEATTLE, CITY OF DAVE HILMOE — TITLE: DIRECTOR 800 S STACY ST SEATTLE, WA 98134
STREET ADDRESS IF DIFFERENT FROM ABOVE	**STREET ADDRESS IF DIFFERENT FROM ABOVE**
ATTN	ATTN
ADDRESS	ADDRESS
CITY STATE ZIP	CITY STATE ZIP

9. 24 HOUR PRIMARY CONTACT INFORMATION		10. OWNER CONTACT INFORMATION	
Primary Contact Daytime Phone:	(206) 684-7880	**Owner Daytime Phone:**	(206) 684-7414
Primary Contact Mobile/Cell Phone:	(206) 559-8517	**Owner Mobile/Cell Phone:**	
Primary Contact Evening Phone:	(206) 684-7880	**Owner Evening Phone:**	
Fax:	**E-mail:** wylie.harper@seattle.gov	**Fax:**	**E-mail:** dave.hilmoe@seattle.gov

WAC 246-290-420(9) requires that water systems provide 24-hour contact information for emergencies.

11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)

- [x] Not applicable (Skip to #12)
- [ ] Owned and Managed
- [ ] Managed Only
- [ ] Owned Only

SMA NAME: ____________ SMA Number: ______

12. WATER SYSTEM CHARACTERISTICS (mark ALL that apply)

- [ ] Agricultural
- [x] Commercial / Business
- [x] Day Care
- [x] Food Service/Food Permit
- [ ] 1,000 or more person event for 2 or more days per year
- [x] Hospital/Clinic
- [x] Industrial
- [x] Licensed Residential Facility
- [x] Lodging
- [x] Recreational / RV Park
- [x] Residential
- [x] School
- [ ] Temporary Farm Worker
- [ ] Other (church, fire station, etc.): ____________

13. WATER SYSTEM OWNERSHIP (mark only one)

- [ ] Association
- [x] City / Town
- [ ] County
- [ ] Federal
- [ ] Investor
- [ ] Private
- [ ] Special District
- [ ] State

14. STORAGE CAPACITY (gallons)

411,570,000

--- SEE NEXT PAGE FOR A COMPLETE LIST OF SOURCES ---

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
77050 Y	SEATTLE PUBLIC UTILITIES	KING	A	Comm

15	16 SOURCE NAME	17 INTERTIE	18 SOURCE CATEGORY										19 USE			20	21 TREATMENT						22 DEPTH	23	24 SOURCE LOCATION			
Source Number	LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456 IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	INTERTIE SYSTEM ID NUMBER	WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	PERMANENT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN INTERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	CEDAR RIVER									X			X			Y		X		X	X	X		125000	SW SE	19	22N	07E
S02	TOLT RIVER									X			X			Y		X	X	X		X		83280	NW SW	32	26N	09E
S03	RIVERTON HTS #1				X									X		Y		X		X		X	359	3200	NE NW	21	23N	04E
S04	BOULEVARD		X											X		Y		X		X		X	293	2000	NW NW	16	23N	04E
S05	RIVERTON HTS #2				X									X		Y		X		X		X	270	1800	NE NW	21	23N	04E
S06	RIVERTON HTS WF			X										X		Y		X		X		X	270	5000	NE NW	21	23N	04E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
77050 Y	SEATTLE PUBLIC UTILITIES	KING	A	Comm

Lines 25, 29, 35 and 36 are required to be completed (other lines are optional).	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)	0	164803	Unspecified
A. Full Time Single Family Residences (Occupied 180 days or *more* per year)	150981		
B. Part Time Single Family Residences (Occupied *less than* 180 days per year)	0		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	0		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied *more than* 180 days/year	13822		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied *less than* 180 days/year	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services (Campsites, RV Sites, Spigots, etc.)	0	0	
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	13321	13321	
28. TOTAL SERVICE CONNECTIONS		178124	

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or *more* days per year? 628000

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?												
B. How many days per month are they present?												

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?												
B. How many days per month is water accessible to the public?												

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students daycare children and/or employees are present each month?												
B. How many days per month are they present?												

33. ROUTINE COLIFORM SCHEDULE * Requirement is exception from WAC 246-290	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	240	240	240	240	240	240	240	240	240	240	240	240

35. Reason for Submitting WFI:

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other ____

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: David Hilmoe DATE: 4/17/2006

PRINT NAME: David J. Hilmoe TITLE: Drinking Water Director

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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VII. MISCELLANEOUS

APPENDIX B
WATER SYSTEM MANAGEMENT AND PERSONNEL

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Water System Management and Personnel

April 2006

Seattle Public Utilities 2005 Reorganization

Seattle Public Utilities (SPU) reorganized at the end of 2005. The reorganization is designed to help SPU be more effective in delivering core services to customers, both internal and external, and help the department achieve our strategic objectives. The process began with a realignment of staff to meet the following goals:

- Create a clear point of accountability for each SPU line of business (i.e., drinking water, sewer, drainage, and solid waste).
- Group employees in branches and divisions to provide further clarity regarding roles and responsibilities.
- Streamline decision-making processes between management and staff.
- Continue to improve and refine the delivery of essential services and programs by soliciting input from our customers.

An organizational chart for SPU, which shows the new departmental structure, is provided as Exhibit 1. A brief explanation of the role of the Director's Office and each SPU branch is provided below.

Director's Office

The Director's Office includes the Director of Seattle Public Utilities and the offices of Corporate Policy and Performance, Communications, and the Community Relations Development.

The Director is responsible for making sure the utility carries out the mission adopted for SPU. The Director has responsibilities typical of a water superintendent, such as developing budgetary requirements, assuring effective performance of the water system, and implementing City ordinances and utility policies regarding water service. Functions of the offices within the Director's Office are provided below:

- **Communications**
  Communications Office and communication professionals located in SPU branches provide Department-wide communication services, assure communications standards are set and followed, and manage communication responses to emergent situations and events.

- **Corporate Policy and Performance**
  The Office of Corporate Policy and Performance assists the SPU Director to design and execute policy, strategy, analyses, assessments and plans in order to maintain and improve service delivery and asset management. The work of the office especially focuses on issues involving multiple disciplines, branches, departments, governments and public constituencies.

- **Community Relations Development**
  Community Relations Development creates deliberate and positive relationships between SPU and professional communities, influential leaders and other community stakeholders that represent customer interests in a manner that supports and is tied to the department's Strategic Business Plan.

Utility Systems Management Branch

Utility Systems Management (USM) provides a clear point of accountability for the overall management of each SPU utility system, including SPU's drinking water, sewer, drainage, solid waste programs and associated assets. USM also includes the following functions: 1) Security & Emergency Management, 2) SCADA Development, 3) Major Inter-agency Projects, 4) Strategic Asset Management, and 5) Technology Systems. To fulfill this mission USM serves as Specifiers[1] and system managers; and exercises delegated responsibilities and authorities to assure:

- These systems and assets are properly planned, developed, funded, designed, constructed, maintained, operated, protected, replaced and monitored.
- Asset management principles and practices are applied to achieve established customer and environmental service levels at the lowest life-cycle cost.

The Drinking Water Division Director serves as the point of contact for all drinking water system-related issues. The Business Area Managers who report to the Division Director serve as the Specifier for each of the business areas in the Drinking Water Line of Business. For Drinking Water, these business areas are: Water Resources, Water Quality and Treatment, Transmission and Distribution, and Major Watersheds. The Division also includes the Water System Operational Planning and System Control business area responsible for running day-to-day operations from the Control Center and includes certified water system operators.

Field Operations & Maintenance Branch

Field Operations and Maintenance strives daily to provide outstanding customer service by professionally operating, maintaining and improving SPU's drinking water, sewer, drainage, solid waste programs, and infrastructure investments which protect public safety, public health and the environment. Water operations staff are certified as required by regulations.

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[1] Specifiers plan, specify, and are accountable for the delivery of utility and corporate services. Specifiers are responsible for making sure SPU establishes and meets customer and environmental service levels, consistent with financial constraints and life cycle principles. In addition, Specifiers are responsible for ensuring the application of our asset management principles in recommending or making resource allocation decisions.

Engineering Services Branch

The Engineering Services Branch (ESB) provides a variety of engineering and engineering support services to clients within and outside of SPU. ESB provides project management, engineering, design, survey, drafting, basemapping, construction specification and contract preparation, project cost estimating, geotechnical, materials testing, construction inspection, and contract payment services. Registered professional engineers and land surveyors reside in this Branch, as well as elsewhere in SPU. ESB executes SPU capital projects from start to completion, and provides specific services as appropriate on projects developed by other City departments, other agencies, and developers. ESB applies asset management principles and practices to achieve the triple bottom line goals of customer satisfaction, environmental protection/enhancement and cost efficiency.

Science, Sustainability & Watersheds Branch

The Science, Sustainability & Watersheds Branch helps ensure that SPU's investments, operations, services, and programs are scientifically sound, promote environmental sustainability, and provide stewardship of watersheds and aquatic resources. The Branch also provides a place to research, develop, and test science and sustainability-based ideas and approaches that will contribute to the achievement of SPU's economic, social, and environmental (triple bottom-line) goals. This Branch is responsible for drinking water quality monitoring, except the monitoring that occurs at SPU's two primary water treatment plants, which is conducted by our contracted facility operators. SPU's certified water quality testing laboratory resides in this Branch.

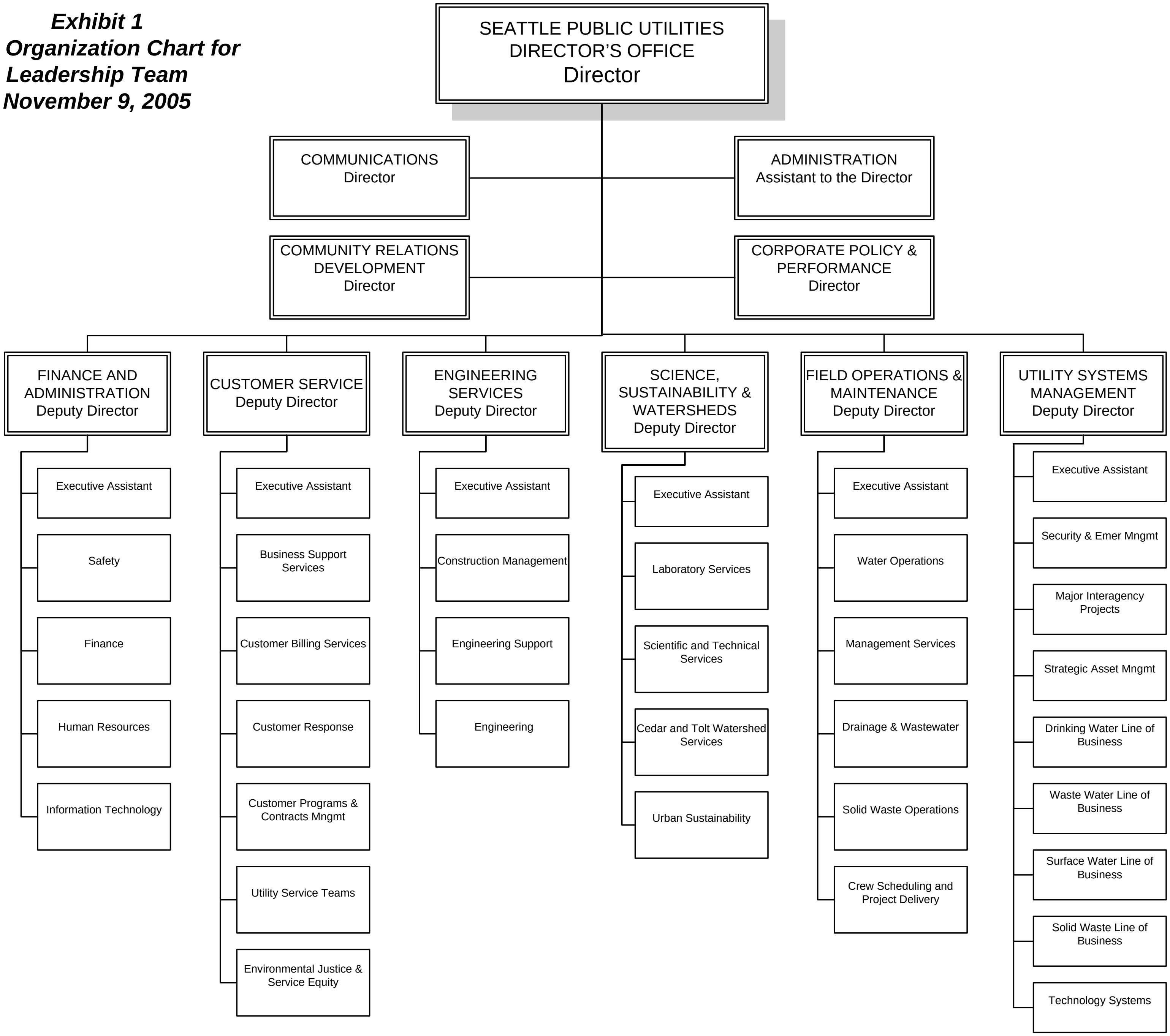
Customer Service Branch

The Customer Service Branch is responsible for providing support and assistance to all residential, commercial and key SPU customers receiving water, sewer, drainage and solid waste services. The services this branch provides include: 1) Customer Contact, Response & Outreach; 2) Customer Billing water; Water Meter Reading; 3) Resource Conservation (includes water conservation), 4) Wholesale Water Contracts Management, 5) Water Service Inspections (for new taps/lines, repairs, leaks, backflow assembly testing, cross connection control and water quality complaints); and 6) Environmental Justice & Service Equity. This branch includes several water quality inspector positions which have Backflow Assembly Tester (BAT), and Cross Connection Control Specialist (CCS) certification requirements.

Finance and Administration Branch

The Finance and Administration Branch provides financial, human resource and information technology services to all sections and employees of Seattle Public Utilities.

Exhibit 1
SPU Organization Chart for Leadership Team
November 9, 2005



SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VII. MISCELLANEOUS

APPENDIX C

WATER SERVICE WITHIN THE DIRECT SERVICE AREA AND CONNECTION CHARGE POLICY AND PROCEDURES

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Seattle Public Utilities - Policy & Procedure

Subject: Water Service within the Direct Service Area		Number: SPU-CS-102
		Effective: October 17, 2003
		Supersedes: SPU-CS-010 (12/30/83) 400P-23-05 (9/01/82)
Approved:	Department: Seattle Public Utilities	Page(s):

1.0 PURPOSE

To establish policies and procedures for Seattle Public Utilities for granting water service connections to its water distribution system within its direct service area.

2.0 ORGANIZATIONS AFFECTED

2.1 City of Seattle, Seattle Public Utilities (SPU)
2.2 City of Shoreline
2.3 King County
2.4 Customers residing near and within SPU's direct water service area

3.0 AUTHORITY FOR RULE

3.1 Revised Code of Washington 35.91; 35.92; 80.28.080
3.2 Seattle Municipal Code 21.04
3.3 Most current SPU Water System Plan

4.0 GENERAL POLICIES

4.1 Standards and Requirements for New Services

4.1.1. All new SPU water service connections will be connected to a standard water main designed to serve that property. (see also Policy SPU-CS-101, Water Availability Certificates)

4.1.2 All water service connections to SPU's water distribution system will be metered and either monthly or bi-monthly bills will be sent to the property owner or owner's designee,

4.1.2.1 The only exception to the above metering and billing policy will be for the fire services on Interstate Highways 5 and 90.

4.1.3 Application for water service by the property owner will be approved when SPU has issued a current, approved Water Availability Certificate, and when SPU has been provided with the following:

4.1.3.1 SPU's application for water service form completed and signed by the property owner, and

4.1.3.2 the common street address and legal description of the parcel to be served, and

4.1.3.3 utility plans showing all existing and proposed utilities

4.1.3.4 all recorded easements needed for private service lines, when applicable.

4.1.3.5 payment of the current standard or estimated deposit fees for installation, and

4.1.3.6 payment of the street use permit if applicable, and

4.1.3.7 payment of the Connection Charge in full (see Policy _______, Connection Charge), or entering into SPU's finance contract for its payment over a 10-year period

4.1.4 Each legal parcel will be served by one domestic water service, except

4.1.4.1 When SPU has allowed or required parcels not abutting a water main to be served by either a privately owned water main or long service lines, a covenant or homeowner bylaws will be filed with those parcels to run with the land and prohibit the property owners of those parcels from requesting individual service directly from SPU's distribution system.

4.1.4.2 Certain parcels may be served by more than one domestic service due to the use of the property, i.e., hospitals, nursing homes and similar facilities, to assure continuous uninterrupted water service. Each service will be from separate water mains abutting the parcel when possible.

4.1.4.3 A community containing more than one legal parcel and either more than 350 feet of private road, or a gated private road of any length, will be served with one domestic meter at the perimeter of that community of legal parcels.

It may be possible that a second SPU domestic service be available to this community's private system from a second SPU-owned water main if needed to provide reliability via a "looped" private water system, i.e., a system having two separate sources of water from the SPU distribution system. Both domestic services would be located at the perimeter of the community of legal parcels. (see also Sec. 4.4.5 of Policy SPU-CS-101, WACs)

4.1.4.4 One very large parcel of land which contains a privately owned water distribution system may be served by more than one domestic service to provide reliability via a "looped" private water system (e.g., the University of Washington campus).

4.1.4.5 One property may not serve another with water service, unless explicitly approved by both SPU and the affected property owners for a temporary, specified time period.

4.1.4.6 Each legal parcel will be eligible for separate water service for irrigation in addition to other domestic service.

4.1.4.7 Each legal parcel will be eligible for separate fire-only service.

4.1.5 Fire-only water services will consist of a detector check valve and a bypass meter assembly.

4.1.5.1. Water may be used at no charge for testing of the on-property fire suppression system monthly as follows:

- 100 cubic feet for fire services 1-to-2inches
- 500 cubic feet for fire services 3-to-5 inches
- 1,000 cubic feet for fire services larger than 5 inches

4.1.5.2. The detector check valve will be changed by SPU, at the property owner's expense, to a fully metered fire service if water used at the property regularly exceeds the above limits set for system testing

4.1.6. If a property's water service will be used solely or in part for an internal fire suppression system (e.g. sprinkler heads), the property shall not be served by a water service less than one inch (1") in size.

4.1.7 Water service to direct service area customers will be from SPU's distribution water main system and not from its supply or transmission pipelines.

4.1.8 Water services up to two inches (2") in size will be charged a reduced installation rate when

4.1.8.1 a new water main to serve the property and to be owned by SPU is installed by a property owner, and

4.1.8.2 the property owner's contractor will trench for SPU's service line and backfill the trench.

4.1.9 Water service to customers within SPU's direct service area may be obtained from a water purveyor whose distribution system abuts the property within SPU's direct service area and SPU requests this purveyor in writing to provide temporary service to a particular property until SPU is ready to serve from its own distribution system.

4.1.10 SPU will consider an application for water service to a property not located within its direct service area only when

4.1.10.1 SPU's water service pipe and meter will be within SPU's direct service area, and

4.1.10.2 the water utility whose direct service area includes this property has requested SPU in writing to serve this property until such time as that utility is prepared to serve it directly, and all other applicable requirements in SPU's policies have been fulfilled.

4.1.11 Temporary water service from the distribution system for less than six months may be authorized via a hydrant use permit or hydrant use meter issued by SPU Customer Services if no other source of water is available. No administrative or water usage charges for hydrant permit holders will be made for water main installation projects sponsored by SPU and for which SPU will pay all project costs.

4.1.11.1 Hydrant use without a hydrant permit or hydrant meter, or use of a restricted hydrant, will result in monetary penalties in addition to all other hydrant use charges:
$ 300 penalty for the first occurrence
$ 500 penalty for the second occurrence
$1,000 penalty for the third and subsequent occurrence

4.1.11.2 Permits may be issued if water use will be for less than 8,000 gallons per day

4.1.11.3 Permit holder will pay a permit fee as well as a daily charge for the water used. Payment may be made either in advance of service, or subsequent to service following a billing by SPU. A billing fee will be charged for payments made subsequent to service.

4.1.11.4 Permit holder will use an SPU supplied (or approved) hydrant valve.

4.1.11.5 Permit holder will pay SPU for any hydrant repairs necessitated by the improper operation of the hydrant at a time and material basis.

4.1.11.6 Hydrant meters will be required either

4.1.11.6.1 at the discretion of SPU Customer Services, or

4.1.11.6.2 under the following circumstances:

- water use will exceed 8,000 gallons per day, and
- use will be longer than 30 days, and
- no other acceptable or practical method of measuring or estimating actual water used is practical, and
- one hydrant only will be used, and
- projected weather conditions will permit the meter to be used without danger of freezing its parts.

4.1.12 Metered service will be required when temporary water is needed from one location for longer than six months.

4.2 Standards and Requirements for Changes to Existing Services

4.2.1. Existing substandard water service will be brought to standard water service whenever possible.

4.2.1.1 When a distribution main is installed which extends the distribution system to abut properties not formerly served by an abutting main, or to serve properties not formerly served by a main designed to serve that property, each property will abandon the service line to the nonabutting main and receive service from the main designed to serve or abutting the property.

4.2.1.1.1 Property owner will not be responsible for the cost either for SPU to retire the existing water service if it is two inches (2") in size or smaller, or for SPU to relocate an existing two-inch (2") or smaller water service. (see also Policy________ Connection Charge)

4.2.1.1.2 Property owner will be responsible for the SPU costs for retirement and relocation of the existing water service if it is larger than two inches (2"). (see alsoPolicy __________ Connection Charge)

4.2.2. When a water main is replaced, existing water services from that segment of water main will be transferred to the new main, the property owner will not be responsible for either retirement or new installation charges.

4.2.3. When the City or SPU changes the street or other infrastructure abutting a property with substandard water service, that water service will be changed to conform to standard practices in preparation for other changes to or in the street.

4.2.4. Property owners may request changes in the size of their water service, the location of their meter along the frontage of their property, and the type of use of their existing water service.

4.2.4.1. When increasing a service size, SPU will both retire an existing service and tap for a new service and property owner will pay SPU standard or time-and-material charges.
(see also Policy __________ for Connection Charge.)

4.2.4.2. When decreasing a two-inch (2") or smaller service, SPU will reduce the size of the existing meter and property owner will pay on a time-and-material basis. Any subsequent changes to water service size at this property will require a service retirement and new tap.

4.2.4.3. When decreasing a service larger than two inches (2"), SPU will both retire the existing service and tap for a new service and property owner will pay SPU standard or time-and-material charges.

4.2.4.4. Property owner may request a relocation of an existing service to a site along the property's frontage, the new location may not be in a driveway or within five feet (5') of a tree. SPU will both retire the existing service and tap for a new service if the lateral distance between the old and new locations is 31 inches or greater. Property owner will pay SPU standard or time-and-material charges in keeping with the current SPU Standard, Connection and Administrative Charges.

4.2.5. An existing domestic, irrigation or fire service may be changed to another use at the request of the property owner if no change in size or location is needed. (see Connection Charge Policy ______)

4.2.5.1. The property owner will pay for any SPU services required to change a fire-only service to a combination fire and domestic service

4.2.5.2. Any other changes to meter type will be at SPU's discretion at no additional cost to the property owner when no change in water service location or size is requested by the property owner.

4.2.6. Property owner will be charged for SPU repair of damage to the curb stop, meter, meter setter, meter box or lid, or tailrun.

4.2.7. Termination of existing water service

4.2.7.1. Domestic (including irrigation) water service may be shut off by SPU due to either nonpayment of utility charges (see Policy 400P-23-02 Credit and Collection), at the request of the property owner, or to effect maintenance, repair or changes to the water system.

4.2.7.1.1. SPU may remove the meter at owner's expense following shut off of service

4.2.7.1.2. Property owner may request SPU, at owner's expense

- to remove the water meter to stop water and sewer services and charges during an extended vacancy at the property. The eventual reset of the water meter also will be charged to the property owner. Removal of the meter does not stop solid waste services or charges.

- to shut off the water meter to prevent damage to the property from leakage or unauthorized water use

- to retire the domestic or irrigation service to the property.

4.2.7.2. Fire service (either fire-only or combination domestic and fire) will not be terminated by SPU without written request by the property owner and written acknowledgement and concurrence by the local fire department or district.

4.2.8. SPU may retire a domestic water service after 15 years of nonuse and charge the property owner for the cost of the retirement.

4.2.9. If a jumper, not authorized by SPU, is installed to pilfer water, SPU may retire the service and charge the property for the retirement, as well as charge for estimated water and other utility services provided during the time period the jumper was in use, as determined by SPU.

5.0 PROGRAM REVIEW

Periodic review of this policy shall be performed by the SPU Customer Services Branch as changes or conditions warrant in order to ensure that it remains current and effective in guiding SPU employees. Any recommended changes will be submitted to the SPU Director for consideration.

6.0 RESPONSIBILITIES

6.1 Property owner is responsible for

- the installation, replacement or repair of the privately owned service line from the City's union to the building(s) served, including changing a private service line when the service location to the property changes in accord with this Policy

- calling SPU Customer Services for inspection of all private underground water service line installations, repairs or replacements prior to covering

- marking the desired location of a new water service before SPU installs the service

- identifying and correcting water leakage or unauthorized water usage and notifying SPU of corrections allowing SPU to inspect any repairs or corrected water use problems

- notifying SPU of changes in property ownership or owner's designee for receiving the utility billings

6.2 SPU is responsible for

- the installation, replacement or repair of the publicly owned service from the City's water main, including the tap into the main, to the City's union

- timely inspection and other customer services

- responsiveness to customer needs

- offering all customers in like circumstances the same requirements, services, contracts or agreements, or privileges

- notifying property owner of any water usage excesses through fire services to allow owner to correct any problems prior to SPU's changing the fire service from a detector check to a meter.

7.0 DEFINITIONS

7.1 Abutting water main is a main which crosses some amount of the property; it may not be a standard main designed to serve if either the abutting main does not cross the full frontage of the property and there is a developable parcel beyond the property, or if the abutting main is not standard in size or material.

7.2 Direct water service area is the retail service area served by SPU's water distribution system as defined by the most current SPU Water System Plan.

7.3 Domestic service is a type of water service serving all potable water used at a property except fire-only water service.

7.4 Fire-only water service is available to provide stand-by water service for the sole purpose of supporting fire suppression devices on property (sprinklers, private hydrants, etc.) via a detector check meter assembly. A combination fire and domestic service is a domestic water service and is not a fire-only water service.

7.5 Irrigation service is a type of domestic water service designed to provide irrigation-only water at a property; sewer charges are not made on the water used through irrigation-only water services.

7.6 Jumper is a pipe installed to allow domestic or irrigation water to freely flow from the publicly owned service line to the user without being measured or billed by a meter, usually located in the meter box when a meter has been removed or not yet installed.

7.7 Master meter is a metered water service from a SPU-owned water main serving more than one legal parcel due to and in accordance with established SPU policy and procedure.

7.8 Private water service consists of the underground pipe leading from SPU's union to the building(s) being served, including any valves, stopcock, private submeters, backflow devices, etc.

7.9 Retirement of water service occurs when SPU has removed the connection to its distribution system by removing the tap to the water main and all other related water service equipment

7.10 Standard water service exists when a property receives metered water service from a standard water main designed to serve that property

7.11 Substandard water service exists either when a property's water service comes from a water main not designed to serve that property (i.e., it could be an abutting or non-abutting substandard water main or a non-abutting standard main), or when a property's water service comes from a neighboring property's water service.

7.12 Tail run is a short length of pipe installed by SPU from the meter box to SPU's union.

7.13 Termination of water service may include shut off of water at the meter, removal of the water meter, or retirement of SPU's tap and service line to the property

7.14 Transmission or supply pipelines are used to move water from the source to the treatment plant and from the plant to the distribution system.

7.15 Union is a coupling at the end of SPU's water service connecting the public water service to the privately owned water service.

7.16 Water main designed to serve a property is a main either abutting the property or located as close to the property as possible considering barriers such as slope, soil or other conditions which make it unsafe or impractical to bring the water distribution system closer to the property. (see also Standard and Substandard Water Service)

7.17 Water service provides water from the distribution system to residential, industrial and commercial users within the direct service area. It includes a tap into a SPU water main and a SPU service line. (An active water service also includes a meter, tail run and union which connects to the property's private service line; an inactive water service has had the meter removed or not yet installed.)

7.17.1 Domestic water service is available to provide any potable water to a property, excluding fire-only water service.

7.17.2 Fire-only water service is available to provide stand-by water service for the sole purpose of supporting fire suppression devices on property (sprinklers, private hydrants, etc.) via a detector check meter assembly. A combination fire and domestic service is a domestic water service and is not a fire-only water service.

Seattle Public Utilities - Policy & Procedure

Subject:		Number:
Connection Charge		SPU-DR-02-03
		Effective: May 20, 2004
		Supersedes: SPU-CS-010 (12/30/83)
Approved: Chuck Clarke 4/23/04	**Department:** Seattle Public Utilities	**Page(s):** 5

1.0 PURPOSE

To establish policies and procedures for Seattle Public Utilities (SPU) for charging property owners in SPU's direct service area seeking to connect to and receive water from the water system a reasonable and equitable share of the cost of the water system.

2.0 ORGANIZATIONS AFFECTED

Property owners within SPU-Water's direct service area.

3.0 AUTHORITY FOR RULE

3.1 Revised Code of Washington 35.91.020, 35.92.025, 80.28.080
3.2 Seattle Municipal Code 21.04.105, 21.04.115, 21.04.465

4.0 GENERAL POLICIES

At the time of ordering a new or changed water service from SPU's water system, the property owner shall contribute to the water system by either

- Paying the current Connection Charge in full, or
- Signing a finance contract with SPU for payment of the Connection Charge and interest over a 10-year time period, or
- Designing and installing a water main for SPU ownership from which the property will receive its water service in accordance with Policy SPU-CS-100, 101 and 102, or
- Having contributed an equitable share to the water main costs designed to serve the property and installed by another property owner(s) as evidenced by written documentation to SPU by the property owner who installed the water main at the time of design and construction, or
- Contributing to a current Local Improvement District for installation of the water main.

4.1 New Water Service

4.1.1 If the property owner requests domestic, fire, irrigation, or combination water service for a property, including newly created legal parcels, currently not having a water service from SPU, then SPU will charge the Connection Charge at the time of receiving one or more applications for domestic, irrigation, fire, or combination water service for a property or group of properties in accordance with Policy SPU-CS-102, Water Service in the Direct Service Area, Sections 4.1.4.3 and 4.1.4.4.

4.1.2 If SPU requires the property owner to design and install the water main for SPU's ownership and operation in order to serve the property owner's proposed use on the property, then SPU will not charge the Connection Charge on water services for the properties owned by that owner, or owners, which will be served by the segment of water main so designed and installed. See Policy and Procedures SPU-CS-100 and SPU-CS-101.

4.2 Existing Water Service

4.2.1 SPU will compute and charge a Connection Charge when

4.2.1.1 Owner seeks an increase in the size of the existing SPU domestic, irrigation, fire, or combination service for a property, or

4.2.1.2 Owner seeks to add a separate service to the property for a use (domestic, fire, irrigation) which is not separately provided to the property currently, or

4.2.1.3 Owner either seeks, or is required by SPU to order, a separate water service to a property currently being served by a water service serving another property.

4.2.1.4 Owner seeks to change an existing fire-only water service to a domestic water service.

4.2.2 SPU will not charge a Connection Charge to a property currently receiving water service when

4.2.2.1 Either SPU or a property owner replaces the existing water main with a new one, and no change in the size or use of water service is being sought, and the transfer of service occurs at the time of the replacement of the water main.

4.2.2.2 Either SPU or a property owner extends the water main distribution system so that a water main is designed to serve a property which has an existing water service, and if the existing service is transferred to the main at the time of its installation and no change in water service size is sought by the property owner.

4.3 Payment of Connection Charge

Before completion of the water service order, the owner will pay any applicable Connection Charge either

4.3.1 in full, or

4.3.2 by signing a 10-year Finance Contract with SPU in accordance with Seattle Municipal Code 21.04.115.

4.4 Calculation of Connection Charge

4.4.1 The current Connection Charge will consist of the product of Connection Charge Units (CCU) and the current Connection Charge Unit Rate (CCUR).

4.4.2 The CCUR is expressed as the equity value of the water system per customer equivalent. The equity value is the portion of the utility plant left after subtracting accumulated depreciation and the value of revenue bonds outstanding.

4.4.3 The CCU will be based on the Customer Equivalents (CE) of the water services to a property. The number of CEs is the sum of retail connections serving one property * weighted by their hydraulic capacities, as follows:

Service Size	CE
3/4"	1.0
1"	1.7
1.5"	3.3
2"	5.3
3"	11.0
4"	17.0
6"	33.0
8"	53.0
10"	77.0
12"	104.0

16"	168.0
20"	244.0
24"	330.0

*See also Section 4.1.1 and Policy and Procedure SPU-CS-102 Sections 4.1.4.3 and 4.1.4.4

4.4.4 The CCU per property will be calculated using the following steps:

1. Total the CE of the property's domestic water services
2. Total the CE of the property's fire-only water services and multiply the sum by 0.4
3. Choose the larger number derived from Steps 1. and 2.
4. Total the CE of the domestic water services which will remain available to the property plus the CE of any additional domestic water services ordered for the property.
5. Total the CE of the fire-only water services which will remain available to the property plus the CE of any additional fire-only water services ordered for the property, and multiply the sum by 0.4
6. Choose the larger number derived from Steps 4. and 5.
7. If the number derived in Step 3. is larger than the number derived in Step 6, then there will be no Connection Charge made.
8. The difference between the numbers obtained in Steps 3. and 6. is the CCU if the number derived in Step 6. is larger than the number derived in Step 3.

4.4.5 The Connection Charge due per property will be the product of multiplying the CCU derived in Section 4.4.4 by the current CCUR, as found in SPU's current Standard, Connection and Administrative Charges document. (In 2004, the CCUR will be $661.00.)

5.0 PROGRAM REVIEW

Periodic review of this policy shall be performed by the SPU Customer Services Branch as changes or conditions warrant in order to ensure that it remains current and effective in guiding SPU employees. Any recommended changes will be submitted to the SPU Director for consideration.

6.0 RESPONSIBILITIES

SPU is responsible for offering all customers in like circumstances the same requirements, services, contracts or agreements, or privileges.

7.0 DEFINITIONS

7.1 Connection to the water system includes a tap into an SPU water main in SPU's direct service area and a SPU service line; see also water service

7.2 Irrigation water service is a type of domestic water service designed to provide irrigation-only water at a property; sewer charges are not made on the water used through irrigation-only water services.

7.3 Property is synonymous with the term legal parcel, as recorded with King County, and may be created via lot boundary adjustments, shortplats, subdivisions.

7.4 Water main designed to serve a property is a main either abutting the property or located as close to the property as possible considering barriers such as slope, soil or other conditions which make it unsafe or impractical to bring the water distribution system closer to the property.

7.5 Water service provides water from the distribution system to residential, industrial, and commercial users within the direct service area. It includes a tap into a SPU water main and a SPU service line. (An active water service also includes a meter, tail run and union which connects to the property's private service line; an inactive water service has had the meter removed or not yet installed.)

7.5.1 Domestic water service is a type of water service serving all potable water to a property, excluding fire-only water service.

7.5.2 Fire-only water service is a type of water service to provide stand-by water service for the sole purpose of supporting fire suppression devices on property (sprinklers, private hydrants, etc.) via a detector check meter assembly. A combination fire and domestic service is a domestic water service and is not a fire-only water service.

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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VII. MISCELLANEOUS

APPENDIX D
SAFETY PROCEDURES

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Safety Procedures

May 2006

Seattle Public Utilities (SPU) continues to make worker safety a top priority and the utility is committed to meeting all OSHA and WISHA regulations, including meeting all safety training requirements. The mission of SPU's Safety Program is to promote safe and healthy workplaces and to empower employees to take personal responsibility for job safety. There have been no substantial changes to the safety program since the 2001 Water System Plan Update.

The Tolt and Cedar Water Treatment Facilities are operated and maintained by private entities. Staff at these facilities are required, through their Service Agreement contracts with SPU, to maintain a level of safety consistent with applicable laws and regulations, insurance requirements, best industry practice, and the requirements of each facility's operation and maintenance manual.

Potential workplace hazards for the water system are identified in the Job Safety Analysis, and include safe driving, the handling and storage of chlorine and other water treatment chemicals, lockout/tagout, confined space entry, and use of heavy equipment. In addition, Material Safety Data Sheets (MSDS) are located at each SPU facility that houses hazardous chemicals. This inventory can be requested at any time. MSDSs are also available on the internal SPU Safety website.

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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VII. MISCELLANEOUS

APPENDIX E
RECORDKEEPING AND REPORTING PROCEDURES

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Recordkeeping and Reporting For Water Quality and Supply
April 2006

This appendix prepared for the *2007 Water System Plan* summarizes the procedures and tools used by Seattle Public Utilities (SPU) to record and report on data about water quantities and quality in the system. Some of this effort provides regulatory compliance data to the Washington State Department of Health (DOH), while other data is gathered to aid and document decisions about operations, planning and design.

The attached Public Records Retention Schedule & Destruction Authorization tables, most recently updated in 2004, describe the records produced by sections within SPU to support their functions and states the length of time the records must be maintained. The City of Seattle Records Management Program develops records retention schedules to meet legal, fiscal and historical requirements and assists with identifying the method of disposal for records past their approved retention via shredding, recycling or transfer to the Municipal Archives.

In recent years, SPU has taken steps to increase the use of computerized databases for recording and reporting data. In addition to the efficiencies and capabilities inherent in a database, the electronic storage makes it practical to archive historical data indefinitely while having it easily accessible for analysis. SPU has traditionally retained data well beyond the minimum time periods specified in WAC 246-290-480, and the computerized systems will facilitate this.

The first implementation of a comprehensive quality and supply database was the Integrated Water Resource Management System (IWRMS), which came into use in 1995. This PC-based system replaced separate main-frame databases for supply and quality information. The new database included weather information from the watershed areas, water quantity information (e.g., reservoir levels and intake flows), and water quality data related to microbiology standards. The data generally represented daily values, such as totalized flow over 24 hours or the instantaneous value of a parameter at a certain time each day. The system also had the capability to generate many of the monthly reports required by DOH for compliance with the Total Coliform Rule (TCR) and Surface Water Treatment Rule (SWTR). These monthly reports were then transferred to the Laboratory Information Management System (LIMS) in 1998. Some of the less voluminous data, such as results of chemical monitoring, were not included in the database, but were maintained in separate spreadsheets. Some operational information, for example hourly values of distribution storage levels, was not included because of the effort that would be needed to input the data manually. This data continued to be recorded on paper by system operators or by chart recorders.

In 1996, SPU began using SCADA-style hardware and software to automatically log system operations data received at the Operations Control Center at 15-second intervals. This greatly reduced the reliance on paper records for logging system data. However, IWRMS was not intended to handle this volume of information, and the data is currently archived on CD-ROMs. In early 2006, SPU achieved the switchover from the “big board” – a largely analog display of system information – to a new PC-based SCADA system. The current SCADA system includes a data warehouse, with data that is updated in time frames that range from seconds to days.

The LIMS installed in 1998 provided improved tools for management of laboratory operations, such as tracking samples, and reporting results. The system could not be easily linked to IWRMS, and has been used for storage and reporting of water quality data. In 2006 the Water Quality Laboratory began implementing a new LIMS that will better facilitate handling of all lab data that the old LIMS could not. The new LIMS will also advance our ability to implement the data warehouse.

SPU is beginning the implementation of a data warehouse to provide the long-term storage of all operational data in one location along with the capabilities for trend analysis. This new Information Management System (IMS) is intended to facilitate the warehousing and distribution of SCADA and LIMS data, as well as other data of interest to many user groups. It is anticipated that IWRMS will be retired when IMS is implemented, but all historic IWRMS data will be retained and transferred.

Sections within the Drinking Water Division have responsibility for reporting and managing operational data. The Laboratory Services Division has the responsibility for water quality data and the submission of reports to DOH. The Water System Planning & System Control section has primary responsibility for most supply-related data, with assistance from the Water Resources Management and SCADA sections.

	STATE OF WASHINGTON OFFICE OF THE SECRETARY OF STATE DIVISION OF ARCHIVES & RECORDS MANAGEMENT LOCAL RECORDS COMMITTEE PER RCW 40.14	**PUBLIC RECORDS RETENTION SCHEDULE & DESTRUCTION AUTHORIZATION**	*OSOSF-002 (Formerly SSA-24)*

1. AGENCY TITLE City of Seattle	**2. DEPARTMENT/DIVISION TITLE** Seattle Public Utilities: Field Operations: Water Quality & Supply	**3. OFFICE/SECTION TITLE** 18.03.06	**4. DATE SUBMITTED** December 23, 2004

5. ADDRESS (PO Box or Street, City, and Zip Code) City of Seattle 600 Fourth Ave. PO Box 94728 Seattle, Wa. 98124-4728	**6a. RECORDS MANAGER NAME (TYPE OR PRINT)** Jennifer Winkler	
	6b. RECORDS MANAGER TELEPHONE (206) 684-8154	**6c. RECORDS MANAGER E-MAIL** jennifer.winkler@seattle.gov

7. RECORDS MANAGER SIGNATURE (Required)
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8. LIST OF RECORDS SERIES

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	DIVISION DIRECTOR'S OFFICE							
1.	**Closed Storage Inspection Program Policy & Procedures** Records document the Utility's policies and procedures for operating storage facilities to meet regulatory requirements and Department water quality standards. Includes procedures for monitoring, prevention of water quality degradation, security, reservoir maintenance, treatment and emergency response. May also include drafts documenting substantive changes, correspondence, meeting notes, etc.	OF M			When Updated, Revised, or Superceded	6 Years	GS50-01-01	Potentially Archival
2.	**Facility Inspection Reports – Secondary Treatment** Records document fire inspections performed by the Seattle Fire Department at the Utility's secondary treatment facilities to determine compliance with fire codes. May include copies of inspection reports, violation notices, recommendations and documentation of corrective action taken.	OF M			Upon Completion of Inspection and Applicable Corrective Action	6 Years	GS53-04-05	

AGENCY MANAGER SIGNATURE: | **AGENCY ARCHIVIST SIGNATURE:**

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3.	**Maps / Drawings of Water Distribution System – Secondary** Working copies of maps and drawings showing construction details of water tanks, distribution reservoirs, secondary treatment facilities, etc. Used for system maintenance purposes.	OFM	SPU Engineering Vault		When Revised or Superceded	0 Years	GS55-06A-18(S)	
4.	**Open Reservoir Annual Report** Report is a summary of the Utility's open reservoir protection program activities that is compiled and submitted to WDOH annually. Includes a summary of significant actions undertaken at each reservoir (outlet disinfection, reservoir security, contamination prevention, etc…), action taken to maintain/improve open reservoir water quality and treatment, plan of operation, water treatment summary, water quality monitoring information, etc.	OPR			Report Completed	10 Years	GS55-06A-21	2 copies to Municipal Archives
5.	**Open Reservoir Chart Recordings** Circular and strip charts are used to monitor chlorine residual and reservoir water flow periodically throughout the week. May include hard copy or electronic charts. Charts are organized by geographic location then date.	OFM			End of Calendar Year	3 Years	GS55-06A-17	

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6.	**Open Reservoir Daily Patrol Inspections** Records document daily security inspection of the Utility's open reservoirs. Information includes inspector name, date and time of visit to the reservoir, vehicle information, etc. May also include inspector's observation notes and a description of any follow-up actions. Information is summarized in annual reports submitted to WDOH.	OFM			End of Calendar Year	10 Years	GS50-06B-16	
7.	**Open Reservoir Daily Treatment Logs** Records are daily logs documenting secondary drinking water treatment applications and water flow in and out of the open water distribution reservoirs. Records include time information logged, water meter reading, chemical feed, chemical dosage residual, operator remarks and initials. Logs are submitted to WDOH monthly.	OPR			End of Calendar Year	10 Years	GS55-06A-21	
8.	**Open Reservoir Database - Secondary** Database is used to electronically track the daily activities and findings documented in the Open Reservoir Daily Patrol Inspections. Information includes date and time of visit, name, description of reservoir condition and any actions taken.	OFM			End of Calendar Year	2 Years	GS50-06B-16(S)	

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9.	**Open Reservoir Material Recovery Records** Records are reports documenting type and quantity of materials or debris recovered during annual washing of reservoirs. Information includes date and time washing occurred, name of reservoir, description of material recovered, etc. Individual reservoir reports are summarized and submitted to WDOH annually.	OPR			End of Calendar Year	10 Years	GS55-06A-21	
10.	**Open Reservoir Protection Program Policy and Procedures** Records document the Utility's policies and procedures for operating its open distribution reservoirs to meet regulatory requirements and department water quality standards. Includes procedures for monitoring, prevention of water quality degradation, security, reservoir maintenance, treatment and emergency response. May also include drafts documenting substantive changes, correspondence, meeting notes, and additional supporting documentation.	OFM			When Updated, Revised, or Superceded	6 Years	GS50-01-01	Potentially Archival

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11.	**Open Reservoir Security Breach Reports** Reports document security violations occurring in or around open reservoir areas such as vandalism, break-ins, trespass, theft, suspicious behavior, etc. Reports may include description of the incident, day and time the incident occurred and information on follow-up actions taken.	OFM			Incident Resolved	10 Years	GS50-06B-11	
12.	**Open Reservoir Weekly Treatment Reports** Internal report summarizing weekly treatment activities at each reservoir (average chlorine residual, comments regarding unusual occurrences, etc.). Used for program reporting purposes.	OFM			Report Completed	3 Years	GS55-06A-17	
13.	**Sanitary Survey Compliance Files** Records document the Utility's response to findings documented in sanitary surveys conducted by WDOH. May include list of findings or deficiencies submitted by the State, documentation of corrective action taken or explanations of why repairs cannot be made, out of service orders, spreadsheets used to track completion of repairs, and additional supporting documentation.	OPR			Completion of Survey and Applicable Corrective Action	10 Years		WAC 246-290-480 c

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14.	**Sanitary Survey Inspection Log** Spreadsheet used to schedule internal sanitary survey inspections conducted throughout the year.	OFM			End of Calendar Year	0 Years	GS50-01-02	
15.	**Sanitary Survey Internal Inspection Reports** Records document quarterly ground level and annual rooftop inspections performed by the Utility to monitor components of the water distribution system for needed maintenance and repairs. Includes inspection reports, photos, and related supporting documentation.	OPR			Completion of Survey and Applicable Corrective Action	10 Years	GS55-06A-21	WAC 246-290-480 c
	REGULATORY COMPLIANCE SECTION							
16.	**Agreed Order Compliance Files** Agreement between the City of Seattle and WDOH to bring the Cedar River Water Source into compliance with the Surface Water Treatment Rule. Records are used to document City compliance with agreement. May include copy of agreed order, modifications and amendments, work plans, project/compliance timelines, and additional supporting documentation.	OPR			Termination of Agreement	6 Years	GS50-01-11	

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17.	**Algae Count Reports** Periodic reports used to monitor seasonal Lake Youngs algae blooms and make operational adjustments to filtration system. Information includes sample site identification, date and time of sampling intervals, volume and algae type.	OFM			End of the Calendar Year	10 Years	GS50-01-32	
18.	**Aquatic Microorganism Photographs** Records are photographs of microorganisms taken from samples in the City water system. Used for species identification and water quality monitoring purposes.	OFM			Reference Purpose Served	0 Years	GS50-06F-06	Potentially Archival
19.	**Bilateral Compliance Agreement** Agreement between the City of Seattle and WDOH documenting steps and timeline for bringing the City into compliance with the lead and copper rule. May include copy of agreement, modifications and amendments, monitoring requirements and results, progress reports, corrosion control studies, etc.	OPR			Termination of Agreement	6 Years	GS50-01-11	

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20.	**Building Inspection Reports** Records document fire inspections performed by the Seattle Fire Department at the Water Quality Lab to determine compliance with fire codes. May include copies of inspection report, violation notices, recommendations and documentation of corrective action taken.	OFM			Upon Completion of Inspection and Applicable Corrective Action	6 Years	GS53-04-05	
21.	**Chemical Analysis Reports – Not for Regulatory Compliance** Reports are compilations of finished data generated from LIMS or other database systems, which are not used for regulatory reporting purposes. Examples include Purveyor Reports that are provided to purveyors per contract along with invoice for service, internal reports that are generated in response to Utility staff requests for specific information on certain data points, and other data summary reports used for internal water quality monitoring purposes.	OFM			End of Calendar Year	6 Years	GS55-06A-17 GS50-01-32	

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	STATE OF WASHINGTON OFFICE OF THE SECRETARY OF STATE DIVISION OF ARCHIVES & RECORDS MANAGEMENT LOCAL RECORDS COMMITTEE PER RCW 40.14	**PUBLIC RECORDS RETENTION SCHEDULE & DESTRUCTION AUTHORIZATION**	*OSOSF-002 (Formerly SSA-24)*

1. AGENCY TITLE City of Seattle	**2. DEPARTMENT/DIVISION TITLE** Seattle Public Utilities: Field Operations: Water Quality & Supply	**3. OFFICE/SECTION TITLE** 18.03.06	**4. DATE SUBMITTED** December 23, 2004

5. ADDRESS (PO Box or Street, City, and Zip Code) City of Seattle 600 Fourth Ave. PO Box 94728 Seattle, Wa. 98124-4728	**6a. RECORDS MANAGER NAME (TYPE OR PRINT)** Jennifer Winkler **6b. RECORDS MANAGER TELEPHONE** (206) 684-8154	**6c. RECORDS MANAGER E-MAIL** jennifer.winkler@seattle.gov

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8. LIST OF RECORDS SERIES

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22.	**Chemical Analysis Reports – Regulatory Compliance** Records are compilations of finished data used to document compliance with State and Federal water quality regulations. Includes, but is not limited to, annual inorganic reports, quarterly disinfection analysis, run reports and additional data summaries used to document compliance with State water quality regulations.	OPR			Life of the Water System	0 Years		Potentially Archival 40 CFR 141.33 WAC 246-290-480(a)
23.	**Chemical Raw Data Records – Non-Regulatory Compliance** Records document chemical testing results of water samples taken from various locations throughout the water system and supply sources. These samples are not required to be reported to WDOH but, are taken to demonstrate good laboratory practices. Examples include seepage tests, customer call samples (i.e. tap tests), purveyor or other contracted service test results, etc. May include lab worksheets, sample run data, calibration test results, lab notebooks, bench sheets, etc.	OFM			End of Calendar Year	6 Years		

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24.	**Chemical Raw Data Records – Regulatory Compliance** Records document chemical testing results of water samples taken from various locations throughout the water system and supply sources. Used to document compliance with State drinking water regulations. May include lab worksheets, sample run data, calibration test results, lab notebooks, bench sheets, etc.	OPR			Life of the Water System	0 Years		40 CFR 141.33 WAC 246-290-480(a)
25.	**Consumer Confidence Reports** Records are drinking water quality reports provided annually to utility customers. May include information about water source, identification of any contaminates found in the water, contamination levels, possible contamination source, contact information, etc. Used to document compliance with State drinking water regulations.	OPR			Report Completed	6 years	GS55-06A-21	WAC 246-290-72011(6)
26.	**Fire Extinguisher Inspection Tags** Prepared by fire departments or private firms.	OFM			Destroy when Obsolete or Superseded	0 Years	GS50-06B-03	

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27.	**Fire Incident Reports – Secondary** Includes basic information collected to document each fire incident.	OFM	Seattle Fire Department		Closure of Investigation	3 Years	GS53-04-14(S)	
28.	**FPA Database** Database contains flavor profile analysis results that document taste and order characteristics of the City's drinking water. Data is used to monitor drinking water for customer satisfaction purposes.	OFM			End of the Calendar Year	6 Years	GS50-01-02	
29.	**Laboratory Accreditation Records** Documentation of the Washington Department of Ecology's accreditation of the utility's water quality laboratory. May include annual accreditation application, copy of the quality assurance manual, performance evaluation (PE) samples analysis report, results of WDOE on-site audit and additional supporting information.	OPR			Upon Renewal of Accreditation	6 Years		Potentially Archival

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30.	**Laboratory Information Management Systems (LIMS)** Database system tracks drinking water quality sampling activities and results. May include sample identification numbers and descriptions, collection date and location, name of person collecting sample, type of test performed, analytical results, etc. System is used for project management and to support regulatory reporting functions.	OFM			Life of the Water System	0 Years		
31.	**Lead and Copper Compliance Records** Records used to document compliance with State and Federal drinking water regulations related to lead and copper monitoring. May include sampling data and analyses, reports, surveys, letters, evaluations, schedules, etc.	OPR			End of Calendar Year	12 Years		40 CFR 141.91
32.	**Limited Alternative Filtration Application** Records document the City's application to WDOH and Environmental Protection Agency for Limited Alternative Filtration status. May include treatment plan report, water quality data, public meetings response to comments, questions, etc.	OPR			Termination of LAF Status	6 Years		

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33.	**Limnology Field Data Books** Logbooks used to record field data collected monthly at various locations in the water system. Documents depth of water and temperature, oxygen and saturation data.	OFM			End of Calendar Year	10 Years		
34.	**Limnology Monitoring Plan** Monitoring plan documenting the Utility's annual limnological sampling schedule. Includes name of water source and information on sampling parameters, number of sample stations, and frequency of sampling event (weekly, monthly quarterly, yearly, etc.). Also includes revisions and updates made to the original monitoring plan.	OFM			End of Calendar Year`	10 Years	GS50-01-38	Potentially Archival
35.	**Limnology Reports** Reports summarize long-term data used to evaluate changes in reservoir water quality and ecology. Includes biological, chemical and physical data related to the water body in addition to conclusions and recommendations for improved water quality.	OPR			Life of the Water System	0 Years		

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36.	**Macrophytes Map** Map documents the aquatic plant habitat of various water sources. Map is produced annually and depicts plant type, quantity and distribution. Used to track long-term ecological trends and support environmental management projects and practices.	OFM			Life of the Water System	0 Years	GS50-18-38	Archival
37.	**Microbiology Bench Sheets** Daily compilation of water sampling results. Information includes LIMS number, site code, description of sampling location, sample type, collection time, temperature, and analysis results. Used to document compliance with State drinking water regulations and to demonstrate good laboratory practices.	OPR			End of Calendar Year	6 Years	GS55-06A-21	
38.	**Microbiology Field Sheets** Also know as chain-of-custody forms. Sheets document when and where water samples were taken from the distribution system, person taking sample, sample code, water temperature, chloride residual, LIMS number, etc. Used to document compliance with State drinking water regulations and to demonstrate good laboratory practices.	OPR			End of Calendar Year	6 Years	GS55-06A-21	

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39.	**Microbiology Quality Assurance / Quality Check Records** Records are logbooks that document results of daily, monthly and annual QA/QC tests of laboratory's microbiology equipment and materials (equipment calibration, sterility, temperature, etc.). Used to support the laboratory accreditation process and demonstrate validity of sampling results.	OPR			End of Calendar Year	6 Years	GS55-06A-17	
40.	**Operating Permits** Permits for operational functions: elevator, sprinklers, fire systems, boilers, extinguishers etc. Used to ensure permit is valid or current for building.	OFM			Expiration of Permit	0 Years	GS50-06B-10	
41.	**Quality Assurance Plan/Manual** Plan documents standard operating procedures of the Utility's Water Quality Lab and is used to support the laboratory accreditation process.	OPR			When Revised, Updated or Superceded	Permanent	GS50-01-24	

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42.	**Surface Water Treatment Rule Reporting Files** Records document results of annual inspection of watershed treatment areas as required by WDOH under the Surface Water Treatment Rule. May include annual reports, correction letters from WDOH, and additional supporting documentation.	OPR			Upon Completion of Report and Applicable Corrective Action	6 Years	GS55-06A-21	
43.	**Taste and Odor Reports** Records document results of weekly drinking water taste tests. Information includes name of water source, flavor rating assessment (FRA) results, summary of issues/events affecting water taste (algal blooms, dredging, etc.), and graphs. Records are used to document the laboratory's voluntary monitoring of secondary drinking water regulations.	OFM			End of Calendar Year	3 Years	GS55-06A-17	
44.	**Water Facilities Inventory (WFI) Form** Inventory of the City's water system updated and reported to WDOH annually. Information includes identification of water sources, number of connections, population served, type of treatment used, type of system, contact information, etc.	OPR			End of Calendar Year	6 Years		

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45.	**Water Quality Monitoring Waivers** Records are requests from the Utility to WDOH requesting exceptions to the water quality monitoring requirements. May include waiver application, approval/denial from State, correspondence, etc.	OPR			Upon Revocation, Expiration or Denial of Waiver	6 Years		40 CFR 141.33(d)
46.	**Water Quality Special Studies – Project Files** Records are supporting documentation related to the development of special studies, projects and surveys related to water quality issues. Examples include studies on water distribution improvements, corrosion treatment optimization, etc. May include drafts documenting significant changes, meeting notes, correspondence, completed surveys, background research, and additional supporting documentation.	OPR			Project Completed	6 Years	GS50-01-39	Potentially Archival
47.	**Water Quality Studies – Final Reports** Final reports resulting from water quality related projects, special studies, surveys, etc.	OFM			Report Completed	6 Years	GS50-01-32	Potentially Archival

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48.	**Water Quality Violation Notices** Records are notices to consumers informing them when water supply is out of compliance with drinking water regulations. Information includes description of violation, violation date, populations affected, actions consumers can take, summary of corrective action, etc. Also includes documentation of notice distribution (media, web, mail, etc.).	OPR			Upon Issuance of Notice	6 Years		Potentially Archival WAC 246-290-480(f)
49.	**Weather Station Data** Periodic data reports documenting various climatological conditions throughout the water supply area. It includes station location, dates and times of temperature and precipitation checks, daily air temperature, type and amounts of precipitation, listing of other weather occurrences such as fog, sleet, hail or damaging wind, etc. Used to track weather impacts on water source ecosystems.	OFM			Life of the Water System	0 Years	GS50-01-32	
50.	**Zoophyto Database** System consists of zoo and phyto plankton related data parameters extracted from the LIMS database. Used for environmental monitoring and trend tracking purposes.	OFM			End of the Calendar Year	10 Years	GS50-01-02	

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1. AGENCY TITLE	2. DEPARTMENT/DIVISION TITLE	3. OFFICE/SECTION TITLE	4. DATE SUBMITTED
City of Seattle	Seattle Public Utilities: Field Operations: Water Quality & Supply	18.03.06	December 23, 2004

5. ADDRESS (PO Box or Street, City, and Zip Code)	6a. RECORDS MANAGER NAME (TYPE OR PRINT)	
City of Seattle 600 Fourth Ave. PO Box 94728 Seattle, Wa. 98124-4728	Jennifer Winkler	
	6b. RECORDS MANAGER TELEPHONE (206) 684-8154	6c. RECORDS MANAGER E-MAIL jennifer.winkler@seattle.gov

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	SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SECTION							
51.	**SCADA Bid and Proposal Files – SI – (Successful Bids and Proposals Only)** Case histories of requests for bids and proposals to develop the Utility's SCADA system.	OPR			Contract Close-Out	6 Years	GS50-08A-01	
52.	**SCADA Bid & Proposal Development Files** Files documenting the process of developing the SCADA request for proposal (RFP) for contractor bid. May include user surveys / questionnaires, brochures, needs assessment records, meeting notes, and additional supporting documentation.	OPR			RFP Completed	6 Years	GS50-01-39	Potentially Archival
53.	**SCADA Contract and Amendments – Awarded** Files containing documentation of the administration, receipt, inspection and payment of contract, amendments and warranties. Records may include requests for proposals (RFPs), contractor proposals, presentation booklets, the contract, billing information, progress reports, correspondence, SI SCADA meeting minutes, closeout documentation, etc.	OPR			Contract Closed-Out	6 Years	GS50-01-11	

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54.	**SCADA Strategic Planning Files** Records documenting the development of the SCADA strategic plan. Plan is used to guide the development and implementation of the SCADA system. May include draft plans, notes, comments, correspondence, meeting and committee materials and supporting records generated during the development of the plan.	OPR			**Project File:** Plan Completed	6 Years	GS50-01-39	Potentially Archival
					Final Plan: Upon Update or Revision	6 Years	GS50-01-32	Potentially Archival
55.	**SCADA System Development Project Files** Files documenting the SCADA system development process and used for internal project planning, tracking and implementation purposes. May include problem identification reports, system objective studies, cost benefit analysis, project sign-offs, testing data, correspondence, SCADA implementation team meeting minutes and additional project administration documentation.	OPR			Project Completed	6 Years*	GS50-01-39	* If records are needed to document compliance with contract requirements, retain per "Contracts and Amendments – Awarded" schedule

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56.	**<u>SCADA System Documentation</u>** Documentation of the SCADA system including data elements developed in house or by the system development contractor. May include operator manuals, general description of design, system definition, design detail, file layout, establishment of programs, listing of reports and data dictionary.	OFM			Data Successfully Transferred to New or Upgraded System	1 Year	GS50-06A-07	
					System No Longer in Operation	10 Years		
57.	**<u>SCADA System Records</u>** Computer system monitors and controls pressures, flows, water levels, water quality, valve positions, pump activity, and operating and security alarms for the water distribution system. Used to control the water system remotely according to set parameters.	OPR			End of the Calendar year	10 Years	GS55-06A-17	* Online data is transferred to oracle every two minutes

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	WATER MANAGEMENT SECTION							
58.	**Modeling System Data** Systems are used to develop a broad range of models related to the City's water system. Examples include hydraulic network models and yield models. Data is used to determine the affects certain conditions and changes will have on the distribution and water supply system.	OFM			When superseded or no longer needed	0 Years	GS50-01-32	
59.	**Modeling System Documentation** May include data and file specifications, codebooks, record layout information, calibration/validation reports, user guides and similar records related to documentation of modeling systems.	OFM			After code revision, retirement of system or until all records existing in system have passed their retention period, whichever is longer	0 Years	GS50-06A-07	

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City of Seattle 600 Fourth Ave. PO Box 94728 Seattle, Wa. 98124-4728	Jennifer Winkler	
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60.	**Precipitation Tower Measurements** Records are monthly precipitation depth readings from the watershed's rain tower. Data is no longer being collected due to safety hazards. The Cedar River Watershed previously reported this data to the Water Management Section for precipitation monitoring purposes.	OFM			End of Calendar Year	3 Years	GS55-06A-17	
61.	**Snow Pack Measurements** Measurements are collected by the Cedar River Watershed twice a year and reported to the Water Management Section and Department of Agriculture for watershed monitoring and water forecasting purposes. Information includes date, location and depth readings.	OFM			End of Calendar Year	3 Years	GS55-06A-17	
62.	**Turbidity Measurement Records** Records document daily cloudiness readings in watershed river bodies. Readings are reported to the Water Management Division for inclusion in the Water System Operating Guidelines. Information includes date, time and location of reading in addition to turbidity measurements.	OFM			End of Calendar Year	3 Years	GS55-06A-17	WAC 246-290-480(1)(e)

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63.	**Water Management Interagency Agreements** Files document the development and administration of agreements with other government agencies such as the Landsburg Mitigation Agreement and Instream Flow Agreement. May include agreement, agreement oversight documentation, correspondence, closeout records, etc.	OPR			Termination of Agreement	6 years	GS50-01-11	Potentially Archival
64.	**Water Management Reports / Studies – Final** Final technical reports or studies prepared by or for the Water Management Section. Study examples include: accretion flow, switching criteria, stream gage, fish monitoring, long-term weather impacts, and biological studies related to stream flow and habitat relationships.	OFM			Report Completed	6 Years	GS50-01-32	Potentially Archival
65.	**Water Management Reports /Studies – Development Documentation** Files relating to the development of special studies and reports produced in-house or by Water Management sponsored committees or task forces.	OPR			Project Completed	6 Years	GS50-01-39	Potentially Archival

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66.	**Water Supply Condition Reports** Weekly briefing reports posted on the web site to keep public informed of water supply conditions and are summaries of operating guidelines. May include data on precipitation, fish habitat, SPU construction projects, and related news on supply conditions.	OFM			Administrative Purpose Served	0 Years	GS50-01-32	Potentially Archival
67.	**Water Supply Graphs /Tables** Various daily/weekly/monthly graphs and tables used to monitor and report water supply conditions and trends for the Cedar and Tolt River Watersheds. Specific data may include precipitation, water surface elevations, consumption, inflow, snow pack telemetry (SNOTEL), synopsis graphs, etc.	OFM			End of Calendar Year	3 Years	GS50-01-32	Potentially Archival
68.	**Water System Operating Guidelines** Summaries of daily/weekly water flow, instream resource conditions and system operating guidelines issued to meet instream flow requirements. May include recorded precipitation, fish condition reports, target flow range, status reports on distribution reservoirs, demand forecast projections, climate outlooks, reservoir /river operation summaries, etc.	OPR			End of Calendar Year	6 Years	GS55-06A-17	Potentially Archival

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City of Seattle	Seattle Public Utilities: Field Operations: Water Quality & Supply	18.03.06	March 17, 2005

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69.	**Weather Data Records** Periodic data reports documenting various climatological conditions throughout the water supply area. Data may include date, location of station, month, times of temperature and precipitation checks, maximum and minimum daily air temperature, type and amount of precipitation, weather conditions (fog, sleet, hail, damaging wind, etc.), and staff gauge reads. Used to track weather impacts on water source ecosystems and for long-term water supply forecasting purposes.	OFM			Life of the Water System	0 Years	GS50-01-32	
70.	**Well Monitoring Readings** Records document results of periodic piezometer readings. Data is reported to the Water Management Section from the Cedar River Watershed for groundwater monitoring purposes. Information includes date and time of data reading, well identification number and depth to water data.	OFM			End of Calendar Year	3 Years	GS55-06A-17	

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	WATER SUPPLY & TREATMENT / OPERATIONS TRANSITIONS							
71.	**Distribution System Monitoring Charts** Circular and strip charts that record daily conditions of the water distribution system. Data parameters may include flow, pressure, temperature, etc. Records are primarily used to monitor and detect problems in system operations but may also be used to support studies related to future water consumption and system design improvements. Charts are organized by geographic location then date.	OFM			End of the Calendar Year	10 Years	GS55-06A-17	
72.	**Distribution System Significant Incident Reports** Reports document conditions of the distribution system during significant geological events such as earthquakes, volcanic eruptions, etc. Includes description of event and copies of system monitoring charts documenting changes in system flow, pressure and temperature. Used to support engineering studies and projects related to natural disaster mitigation.	OFM			End of the Calendar Year	10 Years	GS50-01-32	

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STATE OF WASHINGTON
OFFICE OF THE SECRETARY OF STATE
DIVISION OF ARCHIVES & RECORDS MANAGEMENT
LOCAL RECORDS COMMITTEE
PER RCW 40.14

PUBLIC RECORDS RETENTION SCHEDULE & DESTRUCTION AUTHORIZATION

1. AGENCY TITLE City of Seattle

2. DEPARTMENT/DIVISION TITLE Seattle Public Utilities: Field Operations: Water Quality & Supply

3. OFFICE/SECTION TITLE 18.03.06

4. DATE SUBMITTED December 23, 2004

5. ADDRESS (PO Box or Street, City, and Zip Code)
City of Seattle
600 Fourth Ave. PO Box 94728
Seattle, Wa. 98124-4728

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73.	**Flow Summary Reports** Monthly summary reports compiled from the daily system monitoring chart data. Information includes reporting period, water levels, pressure readings, and critical flow.	OFM			Report Completed	10 Years	GS55-06A-06	
74.	**Maps and Drawings – Water Distribution System (Secondary)** Records are copies of drawings and maps that contain construction details of pipelines, conduits, mains, water tanks, reservoirs, groundwater wells, pumps and pump stations, facilities, etc.	OFM	SPU Engineering Vault		When Revised or Superceded	0 Years	GS55-06A-18(S)	
75.	**System Transition Project Files** Project management files used to document transition of large capital improvement projects (Cedar Water Treatment Facility, Landsburg Fish Passage, etc.) from the construction phase to operation. May include project manager updates, meeting notes, agendas, transition schedules, correspondence and copies of operation and maintenance manuals, copies of as-built drawings, change orders and additional supporting documentation.	OPR			Project Complete	10 Years	GS50-01-39	

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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VII. MISCELLANEOUS

APPENDIX F

POTENTIAL NEW INTERTIES BETWEEN SPU AND ITS WHOLESALE CUSTOMERS

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Potential New Interties Between SPU and Its Wholesale Customers
June 2006

DOH regulations (WAC 246-290) define an intertie as “an interconnection between public water systems permitting the exchange or delivery of water between those systems.” Each SPU service connection with a wholesale customer fits this definition. The regulations require DOH approval prior to the construction or use of any new intertie, and as a prerequisite of approval the intertie must be addressed in an approved Water System Plan (WSP), Coordinated WSP, WSP amendment, or Small Water System Management Program. The regulations also outline the intertie elements to be covered in a WSP, and DOH planning guidelines call for these elements to be addressed in the WSPs of all affected systems, in this case the wholesale customer and SPU.

The wholesale customer’s WSP would cover more aspects of and in greater detail the proposal for the new service connection. The customer would have the lead responsibility for obtaining DOH approval of the connection, including the required DOH approval of the design of the intertie. From SPU’s perspective, the affect of any new wholesale connection on its system would be essentially the same regardless of location on the transmission lines, as described below.

Details that would need to be included in the customer’s WSP include:

- The exact location of intertie.
- Date intertie connection is proposed to be utilized.
- The purpose, physical capacity, service area, and proposed usage of the intertie.
- A copy of the wholesale contract that covers the connection.
- Description of how the intertie:
  (A) Improves overall system reliability;
  (B) Enhances the manageability of the system;
  (C) Provides opportunities for conjunctive use; or
  (D) Delays or avoids the need to develop new water sources.
- Discussion of any water quality and treatment issues. If the customer has its own source, any blending issues would need to be investigated by the customer and discussed in their WSP.
- Alternatives to the intertie, both initially and at the expiration of the intertie agreement if it is not in perpetuity.

- If alternatives are of poorer quality or from a less reliable source, the connection would have health and safety benefits to the wholesale customer and would be noted as such.

Only certain aspects of a new wholesale service connection would be relevant to SPU and under its control, and are discussed below to satisfy the requirement that this WSP address potential new interties.

Date connection is to be utilized. Other than in an emergency, SPU would not activate the connection until the customer obtained DOH approval of the intertie connection and any water right issues were resolved.

The purpose, physical capacity, service area, and proposed usage of the intertie
Providing service to new wholesale customers would need to be consistent with SPU's Service Area Policy. Providing additional service connections to existing wholesale customers would occur according to the provisions of our wholesale customer contracts.

Identification of any potential public health or safety concerns. No potential impacts to SPU's system are expected.

Demonstration of the source capacity and hydraulic capacity of the supplying and receiving systems at the designed flow rate through the intertie. As described in this WSP, the existing source capacity, expressed as firm yield, is projected to meet forecasted demand until beyond 2060, including the increased demand from existing and potential new wholesale customers. SPU has large diameter transmission mains with excess capacity near all existing or possible new wholesale customers. Any proposed intertie would be along one of these mains, and the WSP describes the adequacy of the hydraulic capacity of the transmission lines. SPU has a well calibrated hydraulic model of its regional transmission system, and can advise the customer on the minimum pressure and flow that will be available for a new connection. These parameters are included in wholesale contracts.

Water right assessment. As demonstrated in the water rights evaluation part of this WSP, SPU has sufficient rights to cover projected growth in water demands, including those of potential new wholesale customers. If a new connection would result in providing water outside the existing place of use for the water right of the source that would feed the connection, SPU would not agree to supply service to this connection unless the department was able to change the place of use for that source.

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VII. MISCELLANEOUS

APPENDIX G
EMERGENCY RESPONSE PROGRAM

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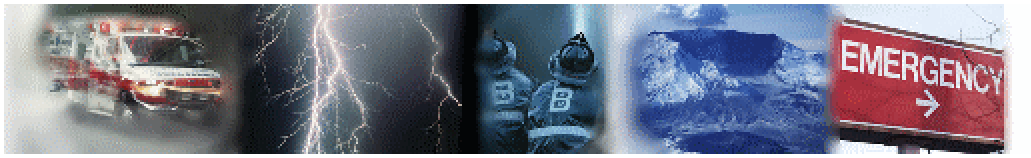

Seattle Public Utilities Emergency Response Program

October 2006

Note: This document is an extract from the **Seattle Public Utilities Disaster Readiness and Response Plan** (DRRP), updated July 2004, that has been modified for security purposes for inclusion in the *2007 Water System Plan.* The terms of the plan, appendices, and annexes referred to in the DRRP are not provided within this extract.

PURPOSE: The purpose of this plan is to describe how Seattle Public Utilities (SPU) will engage its collective resources to administer a **comprehensive emergency management program** in the event of a major emergency or disaster. Specifically, it describes SPU's roles and responsibilities within the City of Seattle Incident Command System. The principal aims of this program are:

- To serve as a member of the City of Seattle's coordinated response and recovery effort and to minimize the adversity a **major emergency** or **disaster** could inflict on citizens, the environment and public and private property.
- To reconstitute, as speedily as possible, the sewer, drainage, solid waste, and water systems and infrastructure investments that may become impaired from the effects of a **major emergency** or **disaster.**
- To promote mitigation strategies that will improve the survivability of critical infrastructure and reduce the public's exposure to recurrent hazards.
- To develop an increased level of emergency preparedness within the utility.
- To support a regular training and exercise program designed to train all personnel and assist in the preparation of realistic plans.
- To effectively use technological advances in day to day activities in order to better prepare for **major emergency** and **disaster** situations.
- To incorporate the principals of the **Incident Command System** in daily operations throughout the organization.
- To ensure that employees <u>always</u> conduct operations in accordance with approved safety practices, regardless of the situation.

I. SITUATION, HAZARD IDENTIFICATION, VULNERABILITY ANALYSIS AND ASSUMPTIONS

A. <u>Situation.</u> The City of Seattle is a major metropolitan area that is susceptible to a wide variety of hazards.

B. <u>Hazard Identification and Vulnerability Analysis</u>. A thorough analysis conducted by the City of Seattle's Office of Emergency Management produced a hazard ranking by incidence of risk for 17 types of hazards (e.g., earthquakes, floods). See Attachment 1 for a summary.

C. Assumptions.

1. A **major emergency** or **disaster** could happen at any time.

2. The time of year, day of the week, time of day, and weather conditions are key variables that can have an impact on the seriousness of an incident and on SPU's ability to respond.

3. SPU and the other operational departments are prepared and have adequate resources, or access to adequate resources, to adequately handle a **major emergency**.

4. A **disaster** would severely stress normal municipal systems, and would likely require outside assistance from the State and Federal governments.

5. In a **disaster** it is likely that local government response may be delayed, and that the general public should be prepared to take care of their basic survival needs for at least 72 hours.

II. MISSION: The emergency preparedness mission of Seattle Public Utilities is to: prepare for; plan; respond; and mitigate; the effects of major emergencies and disaster in order to protect the people, property and environment of the City of Seattle.

III. CONCEPT OF OPERATIONS:

A. General. The roles played by the City of Seattle, State and Federal agencies change with the onset of a major emergency or disaster. A description of these roles has been clarified in a companion document.

B. **Integrated Emergency Management** and the **Incident Command System**. The four key components of **Integrated Emergency Management** and the **Incident Command System** are: Incident Command, Lead Agency Responsibilities, Control Centers, and City of Seattle Emergency Operations Center (EOC).

1. Incident Command. Incident Command is the nationally recognized and mandated standard for emergency management mandated by Seattle Municipal Code (SMC), WAC and Federal requirements. It is the standard by which public safety, public health and public works organizations operate together. Some of the key components are:

a) Common Terminology
b) Clearly Defined Command Structure
c) Manageable Span of Control
d) Defined Duties and Tasks.

2. Lead Agency Responsibilities. Lead agency responsibilities in incidents are mandated by Seattle City Charter, SMC and WAC. In situations where there is more than one hazard present during the Incident, the agency or department with

the largest component of the Incident normally has responsibility for the overall incident. As an incident evolves and the situation changes, Lead agency status can also change. If, during a declared emergency, there is disagreement or uncertainty by field supervisors over which department is responsible for serving as “lead agent”, it will be resolved by immediate referral to the EOC director. While not a complete listing, SPU is mandated or can assume to have Lead Agency Responsibility for the following hazards:

HAZARD	***LEGAL AUTHORITY***
Slide/ Subsidence	SMC 10.06.010
Volcanic Eruption	SMC 3.12.030C
Dam Break (Cedar River/Tolt River Dams)	WAC 173-175-530
Flood (affecting Watershed)	WAC 173-175-790

C. Relationship between Emergency and Normal Functions. While emergency operations can make heavy demands on available personnel and logistical resources and create an array of urgent needs and actions, the City's initial ability to respond would depend on the use of existing departmental assets. SPU is accustomed to dealing with emergencies on an everyday basis and already has organizational systems in place to manage their first response obligations. The difference between these everyday occurrences and **a major emergency** or **disaster** is that the latter are characterized by the necessity to mobilize and direct and control a more substantial effort, one requiring the participation of multiple agencies or individuals that do not habitually work together.

D. Emergency Organization. The emergency organization for SPU is set up so that it can be rapidly expanded to match the level of emergency conditions and needs that exist in the field. The National Incident Management System (NIMS) and the standardized Incident Command System (ICS) are the organizational model used by SPU. Pivotal in this process is the **Incident Commander**. It is this person, who is responsible for directing the tactical size-ups that are used to ascertain the situation's status and parameters. This person is also the principal authority for making field decisions regarding:

1. What resources are needed,
2. What their composition must be,
3. When they are needed on scene, and
4. When and how they will be employed.

In a simple emergency, the **Incident Commander** draws upon the resources available and calls back to one of the **Control Centers** for any additional support needed to stabilize the situation.

If there is more than one Incident or the Incident crosses several departmental lines, the next step is to activate the **Operations Control Center** in accordance with (IAW) an **Emergency Action Plan (EAP)** relating to that incident. Under those circumstances, expertise and assistance is collected at the Operations Control Center to support the **Incident Commander**. Functions at the **Operations Control Center** are generally broken down into the designated **Incident Command** functions of Operations, Planning, Logistics, and Finance/ Administration. Each EAP designates the appropriate staffing for the hazard encountered.

IV. COMMUNICATIONS: SPU has developed a detailed communications plan to follow during emergency events.

V. PLAN DEVELOPMENT AND MAINTENANCE

A. Development and Maintenance. The development and maintenance of the SPU's Basic Plan is a cooperative effort among all sections of SPU. Accordingly, the following specific responsibilities are assigned:

1. SPU's Emergency Preparedness Officer will administer the coordinating steps involved in the development, maintenance, promulgation, review and approval, and publication of the entire plan. Initial staffing will be conducted through the Safety Lateral Team.

2. Appendices to this plan. Appendices and annexes are of a nature that have a broad use by SPU. Because these relate to specialized functions that individual departments and/or support organizations deliver or provide for, it is clear that those with the day-to-day technical expertise and experience would know the function best. With this rationale in mind, assignments for developing, writing, and maintaining specific functional annexes, both in lead and associate capacities, are rooted in applicability to normal missions.

3. Emergency Action Plans (EAPs). EAPs are normally mandated by Federal, State or City code or regulation and are normally/site and event dependant. Seattle has created EAPs for potential disasters. They are designed to give clear guidance in the necessary steps to prevent loss of life, property or degradation of the environment under specific circumstances.

B. Review.

1. In order for this plan to offer reliable guidance for administering the City's comprehensive emergency management program on a day-to-day basis and during times of crises, it is essential that it be kept current. Therefore, each branch is responsible for ensuring that those portions of this plan that are assigned to them are reviewed annually and updated at least every four years from the date of the last revision.

2. Revisions will be submitted, upon completion, to Emergency Preparedness Officer for coordination, executive and legislative review and approval, printing, and distribution. The Emergency Preparedness Officer will ensure that two copies of all locally approved revisions, together with a completed plan review checklist, are furnished to the Seattle Office of Emergency Management, no latter than 90 calendar days after publication.

Seattle Public Utilities

Hazard Identification and Vulnerability Assessment Summary

July 2006

City's Hazard Identification and Vulnerability Assessment

Vulnerability analyses are contained within several assessments. At the highest level is the City of Seattle's Hazard Identification and Vulnerability Assessment (HIVA), updated in 2004, which is available at http://www.cityofseattle.net/emergency_mgt/pdf/shiva.pdf.

This assessment lays out the natural and man-made hazards that the city plans for. Within the HIVA, and other assessments, Seattle Public Utilities (SPU) considers a number of hazards and the associated risks. These include:

Natural
- Weather
- Seismic
- Landslide

Man-made/Technological
- Non-intentional
  - Chemical release
  - Communications disruption
  - Utility disruption/outages
  - SCADA or IT failure
- Intentional
  - Terrorism
  - Vandalism
  - Cyber attack

SPU's Vulnerability Assessment

SPU takes into account the above hazards in specific ways within our internal policies and plans. In 2002, SPU used the Sandia National Labs' Risk Assessment Methodology for Water (RAM-Water) and for Dams (RAM-D) assessment tools to examine the security threats to the SPU regional water system. SPU and Sandia developed this information into a comprehensive analysis and fault-tree. This provided the basis for mitigation and response plans.

Other sources of hazard data which SPU uses in planning and policy making comes from the US Geological Survey (USGS) landslide (2000, 2003, 2005) and seismic (1999 & 2003) modeling for King County and Seattle.

SPU has prioritized our water supply and delivery functions/purposes against the risks. The priorities SPU uses for providing water during emergencies includes the following:

1. Public safety (e.g., any threat to large sectors of population, such as dam failure or major contamination to the water system)
2. Fire flow
3. Water for critical customers (may be non-potable)
4. Water to the largest number of people possible (may be non-potable)
5. Potable water for the largest number of people possible

At SPU's source impoundment reservoirs, South Fork Tolt Reservoir and Chester Morse Lake, the vulnerabilities include the risk of water contamination from:

- Unauthorized public access,
- Road and land maintenance,
- Vehicular and equipment leaks (fuel, lubricating and hydraulic oils, antifreeze),
- Wildfire mitigation and control (including chemical retardants).

Security risks to the dams and critical infrastructure are included in vulnerabilities that are assessed; both for impact to the water system and for public safety.

For the transmission and distribution system, seismic and landslide risks are assessed. All exposed pipelines and critical control points are being examined for contamination and security risks. At points of chemical water treatment, chemical release risks, both accidental and intentional, are considered. SPU is eliminating gaseous chlorine treatment at in-town treatment sites. Conversion to brine or sodium hypochlorite is almost complete.

Seismic assessments are also included for the 15 dams for which SPU maintains emergency action plans. In addition, seismic risks are driving upgrades or replacements of several above-ground water storage facilities.

System operation plans include manual processes to account for SCADA or utility failures (i.e., power and telecommunications).

Planning and operations of the water system takes vulnerability analyses into account regularly. The need for capital investments to address these vulnerabilities is being evaluated, balancing risk, cost and benefit.

SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VII. MISCELLANEOUS

APPENDIX H
PLAN CONTENT CHECKLISTS

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Washington State Department of Health
Water System Planning Handbook
Plan Content Checklist
Seattle Public Utilities (SPU) *2007 Water System Plan,* November 2006

Water System Planning Handbook Chapter	**Seattle Public Utilities 2007 Water System Plan**		
	Part	**Section**	**Comments**
Chapter 1 - Description of Water System			
Ownership and Management			
System Name	I	1.1	
Type of Ownership	I	1.1	
Management Structure	Appendix	VII.B	
Water Facilities Inventory Report Form	Appendix	VII.A	
System Background			
History of Water System Development and Growth	I	1.1	
Geography	I	1.1	
Neighboring/Adjacent Purveyors	I	2.3	
Ordinances/By Laws	I II	1.2 2.1 3.1 4.1 5.1 2.1	
Inventory of Existing Facilities			
Description of Facilities and Major Components	I Appendix	2.3 3.3 4.3 5.3 II.A III.A IV.A	
Number of Service Connections (Existing and Approved)	I	2.3	
Existing Interties	I	2.3	
Related Plans			
List of Related Plans	I	2.4	
Comments From Agencies and Adjacent Purveyors			*To be added as appropriate*
Responses to Comments			*To be added as appropriate*
Existing Service Area and Characteristics			
Existing Service Area Map	I	1.1 2.3	
Zoning and Land Use	Appendix	VII.I	
Future Service Area			
Future Service Area Map	I	2.3	
Zoning and Land Use	Appendix	VII.I	
Service Area Agreements	I	2.3	
Service Area Policies	I	2.1	
Satellite Management			Not applicable

Water System Planning Handbook Chapter	Seattle Public Utilities 2007 Water System Plan		
	Part	Section	Comments
Condition of Service Policies	I Appendix	2.1 III.B VI.B VII.C VII.F	
Complaints			
Policy	I	5.4	
Recordkeeping	I Appendix	5.4 VII.E	
Chapter 2 - Basic Planning, Data and Water Demand Forecasting			
Current Population, Service Connections, Water Use, and Equivalent Residential Units			
Current Population	I	2.3	
Total Service Connections	I	2.3	
Water Use Data Collection	I Appendix	2.3 I.A – I.C	
Equivalent Residential Units			Not applicable
Projected Land Use, Future Population, and Water Demand			
Projected Land Use	I Appendix	2.4 I.A	
Projected Population	I Appendix	2.4 I.A	
Projected Non-Residential Water Needs	I Appendix	2.4 I.A	
Projected Non-Revenue Water	I Appendix	2.3 2.4 5.2 – 5.4 I.A	
Water Rates and Rate Impacts on Water Demand	I Appendix	2.4 I.A – I.B	
Water Demand Forecasting	I Appendix	1.4 2.4 I.A – I.B	
Chapter 3 – System Analysis			
System Design Standards	Appendix	IV.B IV.C	
Water Quality Analysis			
Historical Review of Trends	I	3.2 – 3.3	
Future Requirements	I	3.4 - 3.5	
System Description and Analysis			
Source	I	2.3 – 2. 4	
Water Treatment	I Appendix	3.3 – 3.4 II.A	

Water System Planning Handbook Chapter	Seattle Public Utilities 2007 Water System Plan		
	Part	Section	Comments
Storage	I Appendix	4.3 5.3 – 5.4 III.A IV.A IV.B	
Distribution System/Hydraulic Analysis	I Appendix	2.3 4.3 – 4.4 5.3 – 5.4 III.A IV.A IV.B	
Identification of System Improvements Assessment of Alternatives Prioritizing Improvements Selection of Alternatives	I	1.2 – 1.3 2.4 – 2.5 3.3 – 3.5 4.4 – 4.5 5.4 – 5.5	
Chapter 4 - Conservation Program, Water Right Analysis, System Reliability and Interties			
Conservation Program Development and Implementation			
Required Measures For All Systems Other Measures and Level of Implementation Conservation Program Outline Regional Conservation Programs	I Appendix	1.1 1.4 2.1 – 2.5 I.B	
Source of Supply Analysis			
Enhanced Conservation Measures	I Appendix	1.1 1.4 2.1 – 2.5 I.B	
Water Right Changes	I Appendix	1.4 2.3 - 2.4 I.C	
Interties			SPU has no plans to use interties for normal supply purposes
Artificial Recharge	I	2.3	
Use of Reclaimed Water, Reuse, and other Non-potable Sources	I Appendix	2.1 2.4 – 2.5 I.E	
Treatment	I Appendix	3.3 – 3.4 II.A	
Water Right Evaluation			
Permits, Certificates, Claims and Applications – Narrative Existing Water Right(s) Status Forecasted Water Right(s) Status Water Rights, Current Water Usage and Projected Needs Assessment of Need for Additional Water Rights	I Appendix	2.3 2.4 I.B I.C	

Water System Planning Handbook Chapter	Seattle Public Utilities 2007 Water System Plan		
	Part	Section	Comments
Water Reservations			Not applicable
Water Supply Reliability Analysis			
Summary of System Reliability Efforts	I	1.2 1.4 2.1 2.3 - 2.5 3.1 4.1 – 4.4 5.1 5.3	
Water Shortage Response Planning	I Appendix	1.1.1 I.D	
Monitoring Well Levels	Appendix	I.F	
Interties			
Existing Interties	I	2.1 2.3 – 2.4 3.3 4.1 - 4.2	
New Intertie Proposals	Appendix	III.B VII.F	
Intertie Agreements	I	2.3	
Identification of System Improvements Assessment of Alternatives Prioritizing Improvements Selection of Alternatives	I Appendix	2.3 – 2.4 I.C	
Chapter 5 - Source Water Protection			
Wellhead Protection Program	I	3.3	See also Seattle Public Utilities, *Highline Wellfield Wellhead Protection Program*, 2000. Unchanged since approval with 2001 WSP, except for potential contaminant inventory updated in 2003 and 2005.
Watershed Control Program	I	1.1 3.1 3.3 - 3.4	See also Seattle Public Utilities, *Watershed Protection Plan*, February 2004, covering Cedar River Municipal Watershed, South Fork Tolt Municipal Watershed, Lake Youngs Reservation.
Identification of System Improvements Assessment of Alternatives Prioritizing Improvements Selection of Alternatives	I	3.4	Refer also to Wellhead Protection and Watershed Protection Plans, above.
Chapter 6 - Operation and Maintenance Program			
Water System Management and Personnel	Appendix	VII.B	
Operator Certification	Appendix	V.A	
System Operations and Control			See Seattle Public Utilities, *System Operations and Control*, March 2006.

Water System Planning Handbook Chapter	Seattle Public Utilities 2007 Water System Plan		
	Part	**Section**	**Comments**
Identification of Major System Components	I Appendix	2.3 3.3 4.3 5.3 II.A III.A IV.A	
Routine System Operation			See Seattle Public Utilities, *System Operations and Control*, March 2006.
Preventative Maintenance Program	I	1.2 – 1.3 2.3 – 2.4 3.3 – 3.4 4.3 – 4.5 5.2 – 5.4	
Equipment, Supplies and Chemical Listing	Appendix	II.D	
Comprehensive Monitoring (Regulatory Compliance) Plan	Appendix	II.C	
Emergency Response Program Water System Personnel Emergency Call-Up List Notification Procedures Vulnerability Analysis Contingency Operational Plan	I Appendix	1.2 3.3 – 3.5 4.4 5.2 VII.G	See also Seattle Public Utilities, *System Operations and Control*, March 2006.
Safety Procedures	Appendix	VII.D	
Cross-Connection Control Program	Appendix	II.B	
Customer Complaint Response Program	I Appendix	5.4 - 5.5 VII.E	
Recordkeeping and Reporting	I Appendix	5.3 5.4 VII.E	
O & M Improvements Identification of System Improvements Assessment of Alternatives Prioritizing Improvements Selection of Alternatives	I	2.4 – 2.5 3.3 – 3.5 4.4 – 4.5 5.3 – 5.5	
Chapter 7 - Distribution Facilities Design and Construction Standards			
Project Review Procedures	I Appendix	5.4 IV.C	
Policies and Requirements for Outside Parties	I Appendix	5.4 IV.C	
Design Standards (Performance Standards and Sizing Criteria)	I Appendix	5.4 - 5.5 IV.B	
Construction Standards (Materials and Methods)	I Appendix	5.4 - 5.5 IV.B IV.C	See also the *2005 City of Seattle Standard Specifications* and *2005 Seattle Standard Plans*.
Construction Certification and Follow-up Procedures	I Appendix	5.4 IV.C	

Water System Planning Handbook Chapter	Seattle Public Utilities 2007 Water System Plan		
	Part	**Section**	**Comments**
Identification of System Improvements Assessment of Alternatives Prioritizing Improvements Selection of Alternatives	I	5.4 – 5.5	
Chapter 8 - Improvement Program			
Improvement Schedule	II Appendix	1.2 1.3 VI.A	
Chapter 9 - Financial Program			
Water Systems with 1,000 or More Connections (Not Regulated by UTC)			
Past and Present Financial Status	II	2.2	
Available Revenue Sources	II	2.2 2.3	
Allocation of Revenue Sources	II	2.4	
Program Justification	II	2.4 2.5	
Assessment of Rates	II	2.3	
Chapter 10 - Miscellaneous Documents			
Supportive Documents			
State Environmental Policy Act			Separately bound
Other Documents			*None at this time*
Agreements			Not applicable
Comments on WSP from County			*To be added as appropriate*
Comments on WSP from Adjacent Utilities			*To be added as appropriate*

Municipal Water Law Water System Plan General Approval Checklist

Item	Element	Addressed in plan on pages indicated	Comments
Water rights and system capacity			
1	The water rights self-assessment you have included in your WSP and SWSMP must be complete and must adequately reflect your water right status. Please review your self-assessment for completeness, accuracy and consistency with your water rights. If there are factors (i.e. supplemental, seasonal, etc.) to your water right that are not addressed in the self-assessment format, provide additional statements on how those factors affect your self-assessment.	Appendix I.C	
2	The system capacity analysis must incorporate the water right quantity parameters (QaQi) found in your water rights self-assessment. Identify the number of connections, population served, and/or Equivalent Residential Units (ERUs) that you are currently serving and identify your current instantaneous and annual water usage. Water use demand should not exceed existing water right QaQi.	Appendix I.C	
3	The system capacity analysis must incorporate the water right quantity parameters (QaQi) found in your water rights self-assessment. For a 6-year planning horizon, evaluate the number of connections, population served, and/or Equivalent Residential Units (ERUs) that you are planning on serving, utilizing historical water usage and future population projections. Water use demand projections should not exceed existing water right QaQi.	Part I, p. 2-25; Appendix I.C	
Service Area Delineation			
4	Provide a map and description of the water system service area. The map must delineate your retail service area (existing and future) as well any other service area (existing and future) you wish to include in your water right place of use. Provide clear differentiation between the two boundaries.	Part I, p. 2-10	
5	Provide a copy of the land use map(s) for jurisdictions served by your system.	Appendix VII.I	
Conservation			
6	New language has been added to RCW 70.119A, which states, "…municipal water suppliers shall continue to meet the existing conservation requirements of the department and shall continue to implement their current water conservation programs." Describe what, if any, previous efforts will be discontinued. For discontinued efforts, identify why continuation of these efforts would be ineffective or provide documentation that the discontinued program had a prescribed end date or savings level.	Part I, p. 2-26 and 2-27; Appendix I.B	No plans to discontinue efforts.
7	Must meet current conservation requirements. Please review the requirements (attached) and provide identification of where in your current WSP each of the elements is included.	Part I, Chapter 2; Appendix I.A; Appendix I.B ; etc.	See attached listing for details.

Item	Element	Addressed in plan on pages indicated	Comments
8	Provide a completed Water Conservation Program (Element 14 of the SWSMP).	N/A	For SWSMPs only
9	Describe the projects, technologies, and other cost-effective measures that comprise your water conservation program.	Appendix I.B, Water Conservation Plan 2007-2012, p. 4-5; Part I, p. 2-17	
10	Describe the improvements in the efficiency of water system use resulting from implementation of your water conservation program over the last six years.	Part I, p. 2-17 and 2-18	
11	Provide a demand forecast for the next 6-years based on the water savings expected from the planned conservation measures.	Part I., p. 2-25 and 2-26	
12	Provide a demand forecast for the next 6-years based on the water savings expected if implementing additional conservation measures that were considered cost-effective, including those that were not chosen to be implemented at this time.	Appendix I.B, Water Conservation Plan 2007-2012, page 1.	No conservation measures are considered to be cost-effective.
Reclaimed Water			
13	Exploring opportunities for water reclamation is an element of the Municipal Water Law that must be addressed in this plan Systems > 1000 Connections must complete Attachment 9: Water Reclamation Checklist for Systems with 1,000 or more Connections or provide comparable documentation.	Appendix I.E	
Duty to Serve			
14	Describe how your system responds to requests for new water service by providing: 1. The process for service requests, including timeframes 2. How you determine that your system's capacity is adequate to provide new water service (including sufficient water rights) 3. Conditions of a non-technical nature that may affect your ability to provide new water service (annexation procedures, water rights issues, local ordinances, etc.) 4. Your system's procedures for granting or requesting extensions of time during a water service related project, and describe your procedure for handling disputes and appeals when water service requests are denied	Appendix VII.C, Policy and Procedure, Water Service within the Direct Service Area.	

Item	Element	Addressed in plan on pages indicated	Comments
Local Government Consistency			
15	*Consistency with applicable adopted local plans, regulations and policies must be determined prior to plan submittal. For each appropriate planning agency provide a completed "Consistency Statement Checklist" or analogous documentation.*	Consistency documents for Seattle, Shoreline and King County will be attached prior to submittal to DOH.	
Watershed Coordination			
16	If your system is located in an area developing a watershed plan per RCW 90.82, describe your efforts to coordinate with the local planning unit. We have attached a list of Water Resource Inventory Areas (WRIA) where watershed plans are currently in development along with contact names for each area.	Part I, p.2-48; Watershed Plans.	

Current Conservation Planning Requirements for Water System Plans (WSPs)

Water Use Reporting

Item	Comment	Authority	Location in SPU's WSP
1	Provide a summary of historical average and peak water usage.	– WAC 246-290-221(1) – WAC 246-290-480 (2)(e)(v)	Part I., p. 2-15; Appendix I.A, page 10
2	Source meters are required. If the water system's sources are lacking a source meter, provide a schedule for installing a source meter within the next six years.	– WAC 246-290-415(3) & (5) – WAC 246-290-480 (1)(e)(v) – WAC 173-173-040 – WAC 246-290-130(4)(g)	N/A
3	Provide a breakdown of the system's unaccounted for water. The breakdown should identify the difference between the total unaccounted for water and the non-revenue water that can be identified (or estimated).	– RCW 90.44.110 – RCW 90.03.005 – WAC 246-290-480(2)(e)(v)	Part I., p. 2-15 and 2-16
4	If unaccounted for water is 20% or greater, provide a plan to decrease it.	– RCW 90.03.005 – RCW 90.03.400 – RCW 90.44.110 – WAC 246-290-415(3) & (5)	N/A
5	Systems that do not collect water use data must provide a schedule as to when acceptable data collection will occur during the next six years.	– WAC 246-290-100(4)(d)(iii) – WAC 246-290-480(1)(e)(v), (2)(d),& (2)(e)(v)	N/A

Demand Forecasting

Item	Comment	Authority	Location in SPU's WSP
1	Consecutive 6-year and 20-year water demand forecasts (for both Average Day Demand (ADD) and Maximum Day Demand (MDD)) must be provided.	– WAC 246-290-100(4)(b)(ii) & (4)(d)(ii) – WAC 246-290-221(1)	Part I., p. 2-25 and 2-26; Appendix I.A, page 10

Conservation Program

Item	Comment	Authority	Location in SPU's WSP
1	Include an evaluation that identifies the cost-effectiveness of conservation measures (as determined by the utility) and determine which conservation measures will be implemented. Provide details of analysis.	– RCW 90.03.005 – WAC 246-290-100(4)(d)(i)	Appendix I.B, Water Conservation Plan 2007-2012, page 1. No conservation measures are considered to be cost-effective.
2	For each conservation program element chosen, describe how and when the element will be implemented. Measures must be in the Capital Improvement Program and financial program (if substantive).	– WAC 246-290-100(4)(d)(i) & (g)	Appendix I.B., Water Conservation Plan 2007-2012, p.6, Exhibit 3

3	Provide a copy of the system's rate structure. Provide an evaluation of the rate structure that looks at (1) the feasibility of adopting and implementing a rate structure that promotes water conservation, and (2) the affordability of water rates.	– WAC 246-290-100(4)(d)(i), & (4)(h)(iv)	Part II, p. 2-5 through 2-7

Municipal Water Supply—Efficiency Additional Requirements:

Item	Comment	Location in SPU's WSP
1	Describe what, if any, previous efforts will be discontinued. For discontinued efforts, identify why continuation of these efforts would be ineffective or provide documentation that the discontinued program had a prescribed end date or savings level.	Part I, p. 2-17. No discontinued efforts.
2 > 1,000 conn.	Describe the projects, technologies, and other cost-effective measures that comprise the water conservation program.	Appendix I.B, Water Conservation Plan 2007-2012, p. 4-5; Part I, p. 2-17
3 > 1,000 conn.	Describe the improvements in the efficiency of water system use resulting from implementation of your water conservation program over the last six years.	Part I, p. 2-17 and 2-18
4 > 1,000 conn. Inchoate Water	Provide a demand forecast for the next six years based on the water savings you expect from the planned conservation measures.	Part I, p. 2-25 and 2-26
5 >1,000 conn. Inchoate Water	Provide a demand forecast for the next six years based on the water savings expected if implementing additional conservation measures that were considered cost-effective, but not chosen to be implemented.	See Appendix I.B, Water Conservation Plan 2007-2012, page 1. No conservation measures are considered to be cost-effective.

Recommended WSP Comments:

Item	Comment	Location in SPU's WSP
1	The WSP checklists from the MOU for Water Use Data Collection, Demand Forecasting, and Water Conservation Planning Requirements should be completed and included in the plan.	Appendix I.B., p.7.
2	A 6-year and 20-year water demand forecast (for both ADD and MDD) should be provided which includes the changes in demand due to conservation savings.	Part I, p. 2-25 and 2-26 Appendix I.A, page 10
3	Conservation program promotion should be implemented on an annual basis. **Note:** Will be required if part of their past program unless considered ineffective or prescribed to end.	Part I, p. 2-26 and 2-27, Appendix I.B.
4	Please evaluate all of the recommended conservation measures (in the Conservation Planning Requirements) for your size system. If pursuing additional water rights in the next 20 years, as part of your source of supply analysis, evaluate all recommended measures from the next larger system size category.	Appendix I.B. –Conservation Potential Assessment, p. 8 through 9 Table 3; Ten Year Program Plan p. 8 through 13; and Appendix I.E, Reclaimed Water Opportunities

Water Reclamation Checklist for Systems with 1,000 or more Connections

The Municipal Water Supply - Efficiency Requirements Act, Chapter 5, Laws of 2003 (Municipal Water Law), amended Chapter 90.46 of the Revised Code of Washington (RCW) to require public water systems serving 1000 or more connections to evaluate opportunities for reclaimed water when completing their water system plans (WSP). This checklist may be used to ensure that your WSP includes sufficient information about opportunities for reclaimed water and your system's efforts to develop those opportunities.

Water System Name: Seattle Public Utilities Date: September 2006

PWS ID: 77050Y

SPU's 2007 Water System Plan, Appendix I.E, Reclaimed Water Opportunities, contains the following elements as applicable to the evaluation of reclaimed water opportunities in SPU's retail service area.

1. An evaluation of water reclamation opportunities is found in the WSP on pages: At a minimum, include the following in your evaluation of reclamation opportunities: • An inventory of large water users. • Identification of potential reclaimed water users. • Estimates of how much water could be saved by development of reclaimed water projects • Identification of opportunities that your system intends to pursue within the next six years • A brief analysis of the financial and operation feasibility of identified opportunities The form on the opposite side of this page is provided to assist you in conducting an inventory of potential users and estimate savings. Use of this form is optional.
2. Provide the results of that evaluation. If new or additional reclaimed water opportunities are available, include a brief description of activities you are considering undertaking or those activities you will undertake to pursue development of those opportunities. If reclaimed water opportunities are not available, include a brief description of the interaction with the local wastewater facility (or other entity within the area you serve that may be a generator of reclaimed water) to evaluate opportunities to develop reclaimed water.
3. If evaluation of water reclamation is not included because such an evaluation has been completed by the wastewater facility, or other entity, please include a copy of that evaluation.
4. If water reclamation is mandated for this water system through local government agreement, contract, local regulations, ordinances, or other mechanism, please provide a copy of the governing mechanism.
5. If reclaimed is available within the service area of your water system please include the following information: • Name of Facility • Class of Water Received (A, B, C or D) • Reclamation Permit Number • Amount of Reclaimed Water received • A brief description of how this water is used, including information on cross connection control • Date when your utility began receiving reclaimed water

Reclaimed Water Potential Use Checklist	✓	Est. Annual Use	Est. Annual Savings
Crop Irrigation			
Trees	☐	________	________
Sod	☐	________	________
Nursery	☐	________	________
Pasture	☐	________	________
Irrigation of Food Crops	☐	________	________
Landscape Irrigation			
Cemeteries	☐	________	________
Freeway Landscapes	☐	________	________
Other Restricted Landscape Areas	☐	________	________
Golf Courses	☐	________	________
Parks	☐	________	________
Playgrounds	☐	________	________
Schoolyards	☐	________	________
Other Open Access Areas	☐	________	________
Residential Landscapes	☐	________	________
Ponds			
Landscape Impoundments	☐	________	________
Recreational Impoundments	☐	________	________
Water Trucks			
Street Sweeping	☐	________	________
Fire fighting & protection	☐	________	________
Washing of Corporation Yards, Lots, and Sidewalks	☐	________	________
Dust Control (Dampening Unpaved Roads, Other	☐	________	________
Dampening Soil for Compaction (Construction Sites, Landfills, Pipelines, etc.)	☐	________	________
Other			
Toilet and Urinal Flushing	☐	________	________
Lift Stations	☐	________	________
Ship Ballast	☐	________	________
Fish Hatchery Basins	☐	________	________
Washing Aggregate and Making Concrete	☐	________	________
Flushing of Sanitary Sewers	☐	________	________
Industrial Boiler Feed	☐	________	________
Industrial Cooling	☐	________	________
Industrial Process	☐	________	________
Environmental Uses			
Streamflow Augmentation	☐	________	________
Aquifer recharge	☐	________	________
Wetland Mitigation	☐	________	________
Other	☐	________	________
***Other uses not listed above:**			
______________________________	☐	________	________
______________________________	☐	________	________
______________________________	☐	________	________
______________________________	☐	________	________
______________________________	☐	________	________
______________________________	☐	________	________

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SEATTLE PUBLIC UTILITIES
2007 WATER SYSTEM PLAN

VII. MISCELLANEOUS

APPENDIX I
SEATTLE ZONING MAP
(PROVIDED IN LIMITED COPIES)

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Appendix for Seattle Zoning Maps for North and South Seattle

This is a placeholder for the hard copies of the Seattle Zoning Maps – North and South, which will only be provided in copies submitted to WDOH and maintained in SPU's files.

Note: Customers can look up zoning information at the following city web site:

http://www.seattle.gov/dpd/Research/Zoning_Maps/default.asp

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