City of Tukwila

2005

2005 Water System Plan Update

DECEMBER 2005

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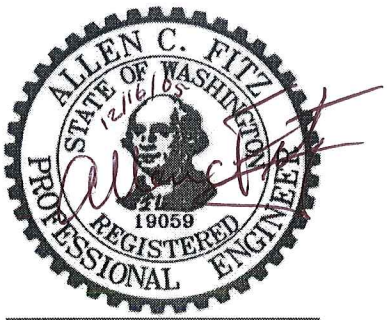
City of Tukwila

2005 Water System Plan Update

CERTIFICATION

This 2005 Water System Plan Update for the City of Tukwila has been prepared under the direction of the following Registered Professional Engineers.



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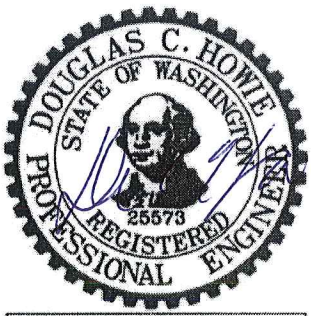

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Section 1
Introduction

The City of Tukwila is required to develop a Water System Plan (WSP), and update it every six years, according to Chapter 246-290-100 Washington Administrative Code (WAC). The plan is approved by the Mayor, adopted by the City Council, and administered by the Public Works Director.

1.1 Objective

The objective of this WSP is to evaluate the existing water system and its operation to:

- Identify present and future needs
- Set forth the means for addressing those needs, and
- Demonstrate that the system has the operational, technical, managerial, and financial capability to achieve and maintain compliance with all relevant local, state and federal plans and regulations.

All anticipated water system projects should be identified in the Capital Improvement Program portion of the WSP. Information contained in the WSP should be referenced when proposing new facilities or modifications to new facilities.

1.2 Scope of Work

The scope of work as requested by the City of Tukwila and required by the Department of Health (DOH) includes the following tasks:

- Collect and update basic planning data related to land use, population, and water demand.
- Perform a system analysis based on existing standards, hydraulic capabilities, and water quality.
- Develop an improvement plan to correct existing and projected system deficiencies, including a schedule and financial program.
- Update and document the City's operations and maintenance program, cross connection control program, water quality monitoring, and regulatory compliance program.
- Document the City's design, and construction standards.
- Provide SEPA checklist, water resource agreements, and other supporting documents.

The 1999 Comprehensive Water Plan was used as a basis for this WSP update. DOH's Plan Content Checklist from its Water System Planning Handbook is included in Appendix A. Similarly, several DOH forms related to its Municipal Water Law Interim Planning Guidance For Water System Plan / Small Water System Management Program Approvals document are found in the appendix. Appendix B is Attachment 2 General Approval Checklist. Appendix C is

the Attachment 5 Consistency Statement Checklist. The completed SEPA checklist and Determination of Non-Significance are in Appendix D. Appendix E contains Tukwila's responses to comments made by DOH and adjacent purveyors on a draft of the Plan.

1.3 Planning Period

A 20-year planning period, beginning in 2005, has been analyzed for the Tukwila water system. Key years in the WSP are as follows:

- 2005 — First year of the WSP planning period.
  First year of the financial analysis planning period (corresponding to the most recent City of Tukwila Rate Study).
- 2010 — Sixth year of the WSP planning period.
- 2024 — End of WSP planning period.

1.4 Overview of Existing System

The City of Tukwila's service area is currently supplied primarily from the City of Seattle's water system through a purveyor contract with Cascade Water Alliance. Nearly all of the water is drawn from the Cedar River Watershed through the 60-inch Cedar River Pipeline No. 4 in the south and the 48-inch West Seattle supply line in the north. Combined, these sources provided approximately 2.24 MGD in 2003. Water is distributed to customers via approximately 45 miles of water pipe varying in size up to 18 inches in diameter. One reservoir and one booster station are available to provide storage and control pressures within the system. A summary of the Tukwila water system is provided in Table 1-1. A map showing the location of Tukwila within the regional supply setting is provided as Exhibit 2-3, within Section 2, System Description. Detailed descriptions, inventories and Exhibits are provided in Section 2.

The City also receives reclaimed water for irrigation purposes through a contract with King County. The City also has a Green River surface water right currently used for golf course watering, although the City expects to augment this raw water with reclaimed water in the future.

Table 1-1 Tukwila Water System at a Glance (Year 2003[1])	
Sources of Supply	**Cedar River Pipeline No. 4 and West Seattle Pipeline**
Average/Max Day Demand	1,904,363 gpd ADD 3,085,068 gpd MDD (based on 1.72 peaking factor)
Number of Connections	2,154
Demographics Served[1]	1,200 Single Family Households 2,049 Multifamily Households 41,017 Employees
Approximate Miles of Pipe	45 miles
Number of Storage Facilities	1 Reservoir
Number of Booster Pump Stations	1
Number of Pressure Reducing/Pressure Sustaining Valves	8 PRV/ 2 PSV
Number of Pressure Zones	6

[1] Demographics served are estimates for year 2005.

Section 2
Description of Water System

This chapter provides basic information about the physical components of the water system and a brief overview of selected administrative and planning issues related to operations and future expansion. It provides important background information on which the comprehensive program, described by this WSP, is partially based.

2.1 Ownership and Management

The Tukwila water system is owned and operated by the City of Tukwila. The most current Water Facilities Inventory (WFI) report is attached in Appendix F. The WFI contains basic administrative information regarding the water system. The water system is operated and maintained by the Department of Public Works which is managed by the Public Works Director. Several divisions exist within the organization overall and address various facilities and services. There are two divisions associated with the water system and its operation. These divisions are managed by the Maintenance Operations Manager and by the City Engineer, both of whom report directly to the Public Works Director. The Water Superintendent, who reports to the Maintenance Operations Manager, is responsible for the maintenance and operations of the water system, while the Utility Systems Engineer, who reports to the City Engineer, is responsible for implementing capital improvements. Additional detail and management structure is provided in the Operations and Maintenance section of the WSP.

2.2 Service Area Description

The City of Tukwila is bounded by the City of Seatac on the west, the City of Seattle on the north, the City of Renton on the east, and the City of Kent on the south. Tukwila's current and future service area, city boundary, and other adjacent purveyor service areas are shown in Exhibit 2-1. Additional detail about adjacent purveyors is provided later in this chapter. Exhibit 2-2 provides neighborhood names, which are referred to in various sections of this water system plan.

Currently, the City provides water for the majority of the area within the city boundary. Water for the remaining area within the city boundary is provided by King County Water District (KCWD) 125, Highline Water District, the City of Renton, and KCWD 20.

In the future, the City's service area will add five new areas in accordance with the City's Comprehensive Plan which directs the City to provide water service to the entire area within the city boundary. This entails assuming service for areas within the city boundary, but currently serviced by another utility. It also entails assuming service for Potential Annexation Areas (PAAs) which are not currently within the city boundary, but are anticipated to be annexed. The precise timing of adding these new service areas is dependent on a variety of factors and is not

fully known. Timing assumptions have been made for this WSP based on the best available estimates from the City.

The five new areas include:

- **Central City Areas (2):** taken over primarily from KCWD 125; begins in 2010.
- **SW City Corner:** taken over from Highline; begins in 2010.
- **SE City Corner:** taken over from Renton; begins in 2015.
- **South Annex:** taken over primarily from Highline; begins in 2015.
- **West City Area:** taken over primarily from KCWD 125; begins in 2020.

The topography of the service area ranges from lowlands surrounding the Green/Duwamish River valley to plateaus above the river valley walls with slope steepness between 15 and 70 percent. Service area elevation begins at sea level and ranges to over 400 feet, creating the need for many pressure zones within Tukwila's service area.

2.3 Source of Supply

The Tukwila water system was first established in 1929 and constructed a six-inch diameter steel water line to connect Seattle's Beacon Hill to Tukwila's North Hill area. Up to that time, drinking water was supplied by several groundwater wells and the Green River. As the City annexed land in the late 1950's and early 1960's, and later in the late 1980's, the City also began to take over some of the water services for areas within the City limits from other water districts and public utilities. Today, the City is served primarily by the Tukwila water system, and also by KCWD 125, Highline Water District and the City of Renton. A map showing the location of Tukwila within the regional supply setting is provided as Exhibit 2-3.

Primary sources are those that provide water during normal operating conditions. Secondary sources are intended for use in the event of emergencies, high demand, or when primary sources are off-line. As of January 1, 2004 Tukwila's primary and secondary sources of water are supplied mostly by the Cascade Water Alliance (Cascade). Cascade, formed in April 1999, is a group of eight municipal water utilities and districts formed to provide water supply for the current and future demands of the utilities and districts involved. Cascade currently receives most of its water from the City of Seattle under a declining block contract, with the first block of 30.3 mgd extending through December 31, 2023. More details on Tukwila's supply agreement with Cascade, as well as Cascade's contract with Seattle, is described in Section 3.2.1.

Two additional sources of water used by the City for irrigation purposes only are reclaimed water through a contract with King County, and water from the Green River currently used only at the Foster Golf Links golf course.

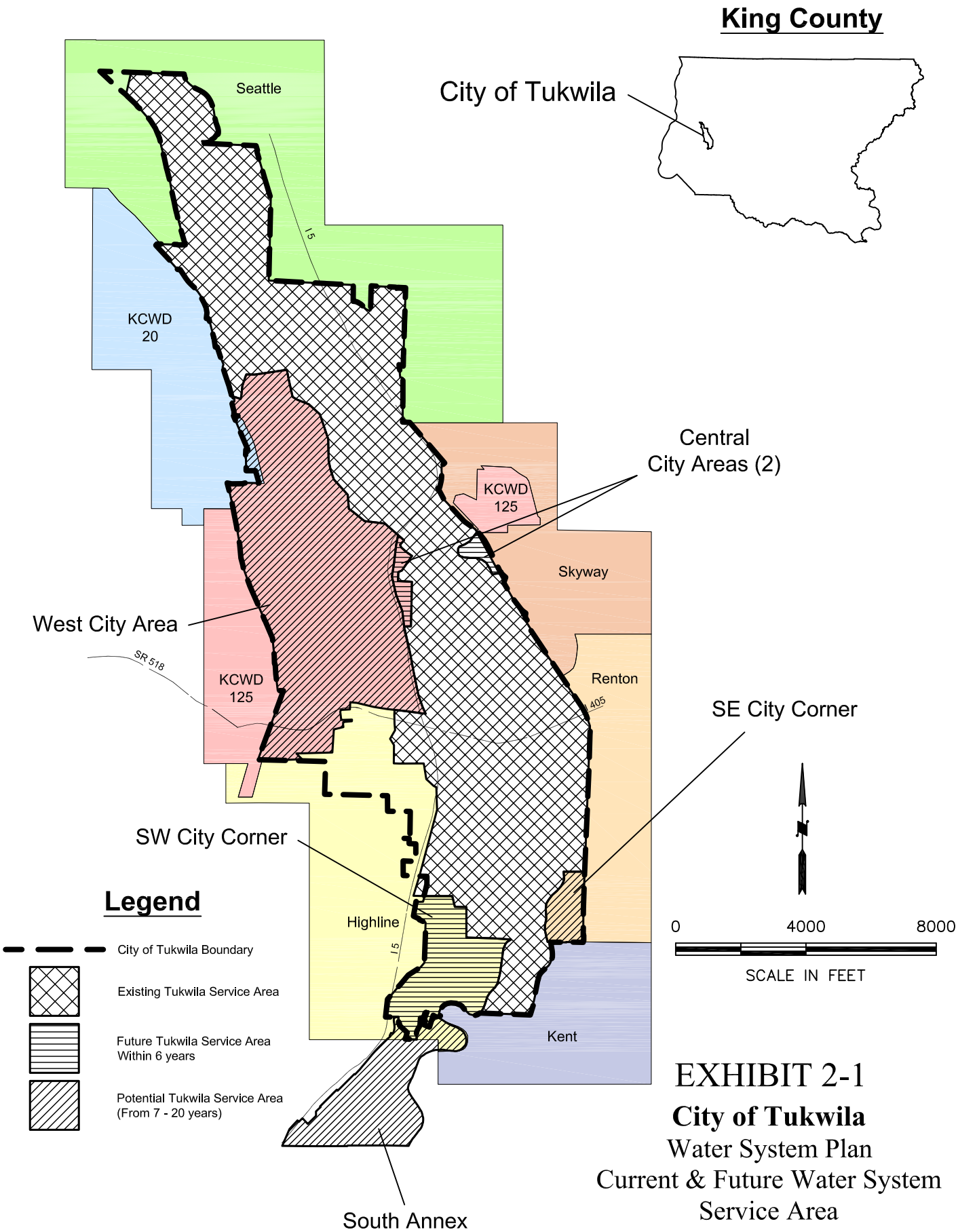

EXHIBIT 2-1

City of Tukwila

Water System Plan

Current & Future Water System Service Area

February 2005

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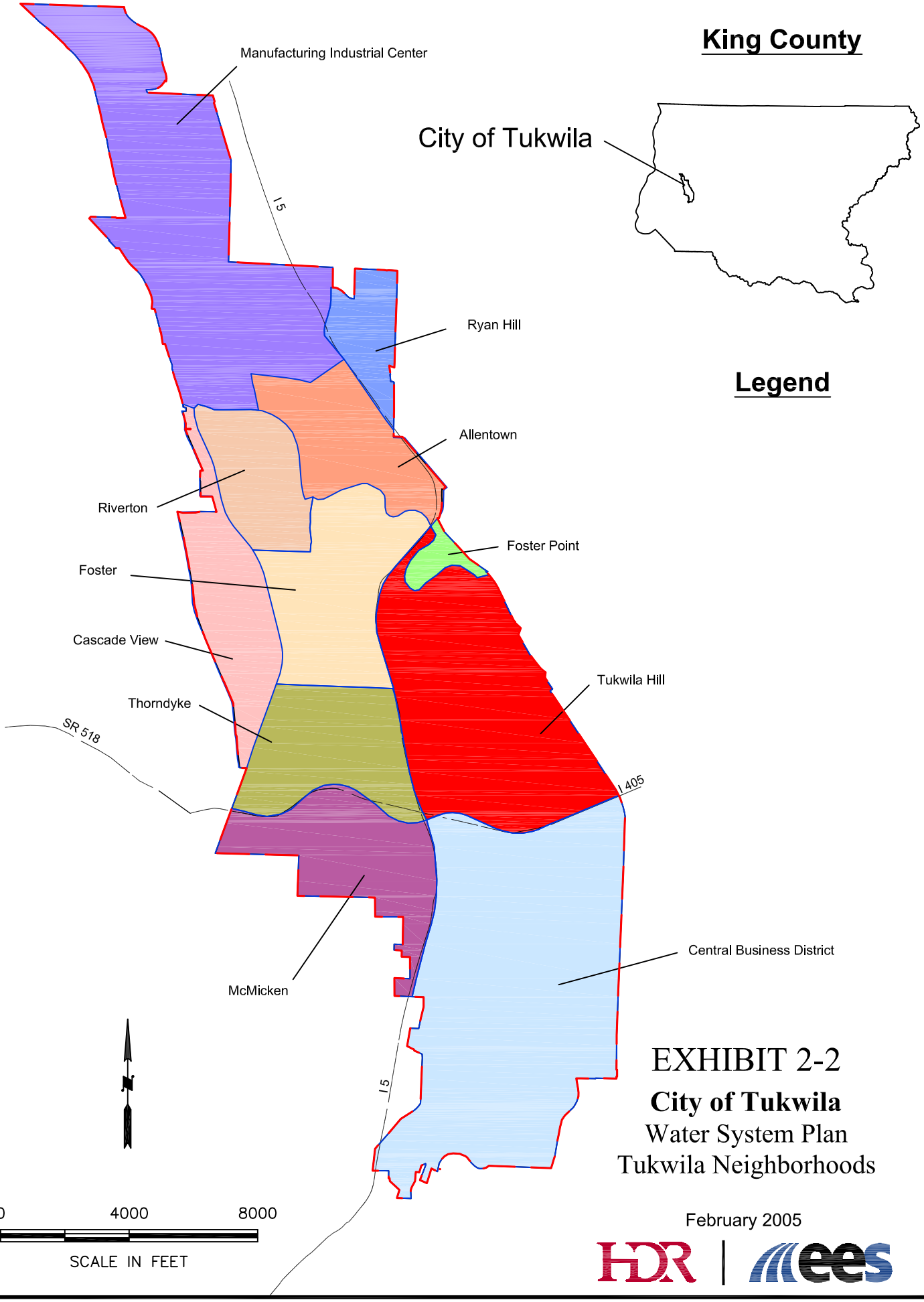

EXHIBIT 2-2

City of Tukwila

Water System Plan

Tukwila Neighborhoods

February 2005

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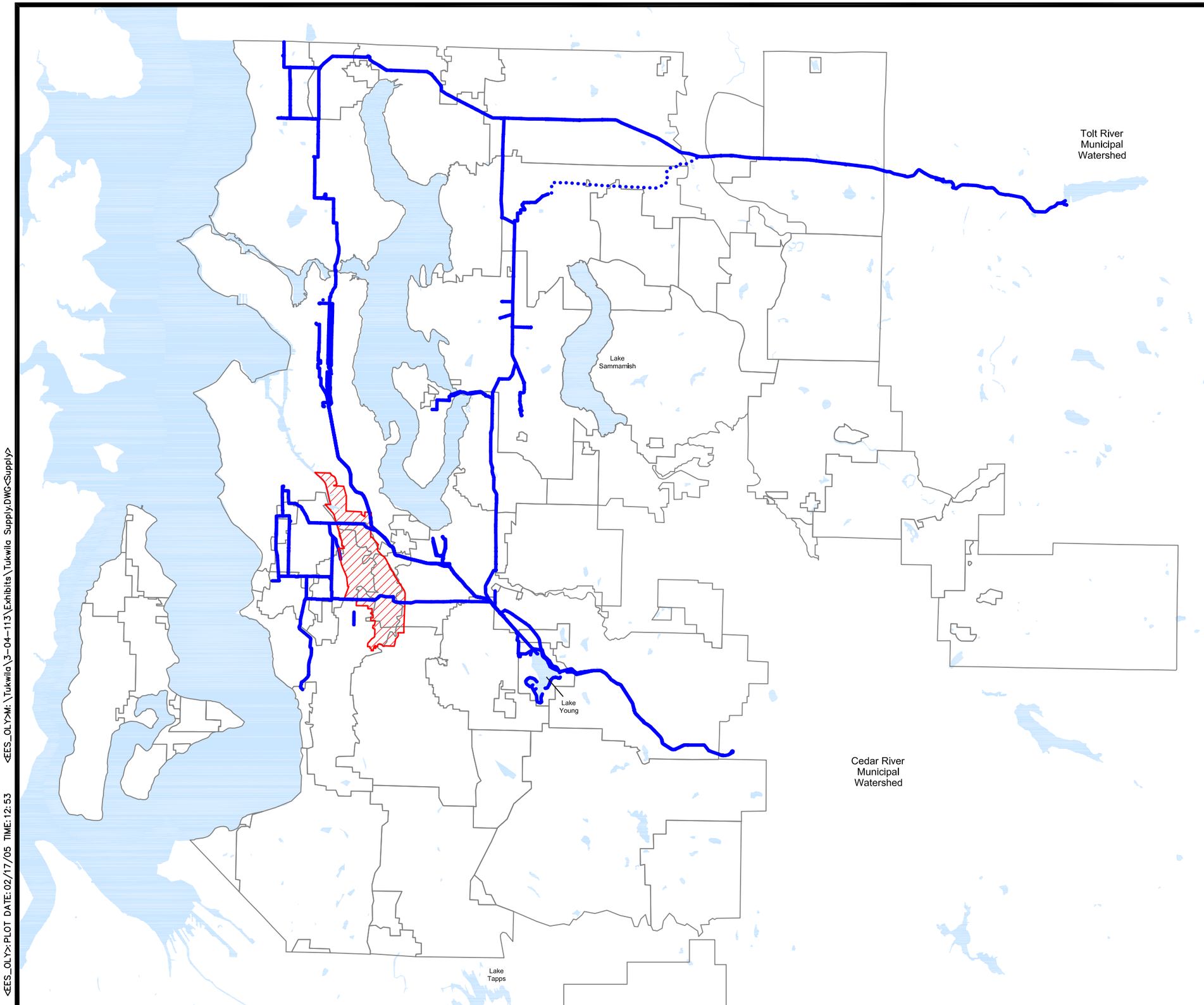
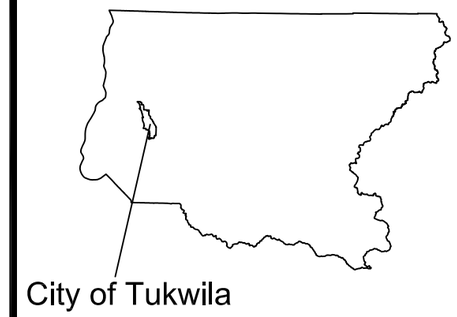


King County



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City of Tukwila

Existing Pipeline

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EXHIBIT 2-3

City of Tukwila

Water System Plan

Regional Supply Setting

February 2005

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2.3.1 Cedar River and West Seattle Pipelines

The source of Tukwila's primary and secondary water is the Cedar River. Raw water is diverted from the Cedar River at Landsburg, where it is screened, chlorinated, and fluoridated before being sent to Lake Youngs. At the Lake Youngs regulating basin, located east of Renton, water is disinfected via ozonation and UV, treated with lime to adjust pH levels for corrosion control, and chlorinated for further disinfection prior to customer delivery. The water is then transmitted to the Puget Sound area via four high pressured transmission mains, known as the Cedar River Pipelines.

2.3.2 Reclaimed Water

Tukwila receives reclaimed water from King County's Renton wastewater treatment plant. Reclaimed water is defined by RCW 90.46 as "effluent derived in any part from sewage from a wastewater treatment system that has been adequately and reliably treated, so that as a result of that treatment, it is suitable for a beneficial use or a controlled use that would not otherwise occur and is no longer considered wastewater". This reclaimed water is currently used to irrigate ball fields and streetscapes. Tukwila is planning to use reclaimed water to irrigate Foster Golf Links, its public golf course, in the future.

2.3.3 Green River

Tukwila has a surface water right on the Green River. This untreated water is currently used to irrigate Foster Golf Links; however, the City is planning to use reclaimed water to augment this irrigation in the future.

2.4 Pressure Zones

The service area is divided into six pressure zones. The zones are labeled according to the elevation, relative to mean sea level, of the static pressure head in each zone. The zone boundaries are located to provide a service pressure range of 60 to 155 psi under maximum and average day demand conditions. Zone boundaries are shown in Exhibit 2-4 and include the following:

- 360 Zone – City Zone
- 320 Zone – North Boeing Field Zone
- 380 Zone – Crystal Springs Zone
- 400 Zone – North Hill Zone
- 465 Zone – Upper Ryan Hill Zone
- 340 Zone – Lower Ryan Hill Zone

The 360 City Zone is the largest pressure zone in the City that extends from the southern City limit to the South Norfolk Road at the south end of Boeing Field/King County International Airport, and includes the City's Central Business District. This zone is supplied through five supply stations where the water flow from the source point is metered, and the water pressure

reduced through pressure reducing valves (PRVs). Supply stations SS10 and SS11 are located in the north and tap from the West Seattle Pipeline, while supply stations SS13, SS14 and SS15 are located in the south and tap from the Cedar River Pipeline No. 4.

The 320 North Boeing Field Zone is located at the north end of the City, from north of South Norfolk Road to the northern City limit. This zone is supplied by the 360 City Zone through a PRV.

The 380 Crystal Springs Zone is located in a small area directly south-west of the I-5 and Highway 518/I-405 junction. This zone is supplied through a PRV from supply station SS16 that taps from the Cedar River Pipeline No. 4. This zone is isolated from the main 360 Zone with a one-way check valve.

The 400 North Hill Zone is located north-east of the 380 Crystal Springs Zone, directly north-east of the I-5 and Highway 518/I-405 junction. This zone is supplied by the North Hill Pump Station, which pumps from the North Hill Reservoir.

The 465 Upper Ryan Hill Zone is located on the north-east section of the City and is approximately bounded by 49th Avenue South to the west, the City limit to the north, 51st Avenue South to the east, and I-5 to the south. This zone is supplied directly from supply station SS169, and feeds the 340 Lower Ryan Hill Zone. The 340 Lower Ryan Hill Zone is located directly west of the 465 Upper Ryan Hill Zone and is approximately bounded by I-5 to the west, the City limit to the north, 49th Avenue South to the east, and I-5 to the south.

2.5 Major Facilities

The Tukwila water system consists of eight primary supply stations, two secondary supply interties, one storage reservoir, one booster-pump station, about 45 miles of transmission and distribution pipelines, and many valves and other appurtenances. Exhibit 2-4 shows the location of the major facilities discussed below.

2.5.1 Supply Stations

Tukwila's water supply system is served entirely through eight supply taps on Seattle's transmission mains through PRVs to decrease pressures from the mains. Four of the supply taps are off the Cedar River Pipeline No. 4 (CRPL 4), which runs through the southern portion of the City. Three supply taps are off the West Seattle Pipeline that branches off from CRPL 3 just east of Tukwila and runs through the northern portion of the City. The remaining supply tap is off the CRPL 3. Tukwila also has two emergency interties with the City of Seattle. One is on East Marginal Way South at the northern boundary of the City and the other is at 47th Ave South and Victor Street. The supply stations and locations are shown in Table 2-1.

Table 2-1 Supply Stations, Source, and Locations		
Supply Station	**Source**	**Location**
SS 169	CRPL 3	Beacon Ave. S. & S. Leo St.
SS 10	WSPL	E. Marginal Way & S. 112th St.
SS 11	WSPL	44th Ave. S. & S. 115th St.
Oxbow	WSPL	10190 W. Marginal Way
SS 13	CRPL 4	Southcenter Parkway & Tukwila Parkway
SS 14	CRPL 4	West Valley Highway & S. 158th St.
SS 15	CRPL 4	Christensen Rd. & Black Dr.
SS 16	CRPL 4	S. 158th St. & 53rd Ave. S.
Emergency	Seattle Intertie	E. Marginal Way at north City limit
Emergency	Seattle Intertie	47th Ave S. and Victor St

2.5.2 Storage Facility

The Tukwila water system currently operates 2 million gallons (MG) of storage at the North Hill Reservoir. The reservoir is the sole storage facility for the City. The North Hill Reservoir is a concrete reservoir constructed in 1991 that operates at the nominal water surface elevation of 250 feet mean sea level (MSL). The reservoir is supplied primarily by Supply Station 13, which taps off of CRPL 4.

2.5.3 Pump Stations

Tukwila operates a single booster pump station with two sets of pumps configured to pump to two separate pressure zones and a high capacity fire flow pump. The two High pumps are regulated by 30 hp electric motors with variable frequency drives (VFD) and deliver up to 480 gpm each to the North Hill 400 Zone. The two Low pumps are driven by 50 hp electric motors and deliver 1050 gpm each to the main 360 Zone during high demand periods only. The fire flow pump is driven by a 250 hp motor and designed to pump 4,000 gpm into either zone if the fire demands exceed the capacity of either zone.

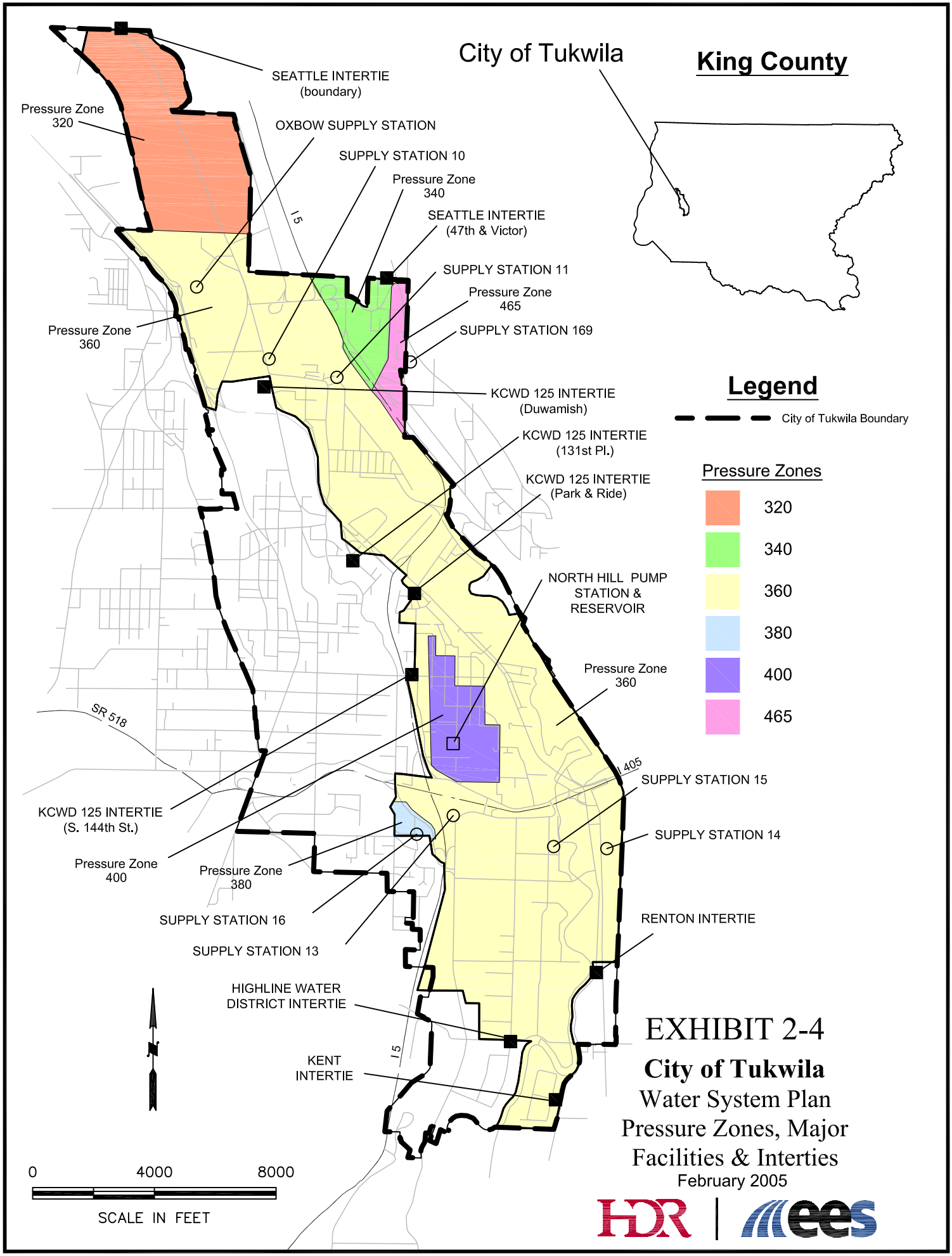

EXHIBIT 2-4

City of Tukwila

Water System Plan
Pressure Zones, Major
Facilities & Interties

February 2005

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2.5.4 Transmission and Distribution Mains

Transmission mains convey the water from the sources to the distribution system and storage. In Tukwila, transmission mains are generally 8-inch to 12-inch mains in residential zones and 10-inch to 18-inch in non-residential zones. Many of the system transmission mains are restricted by control valves at the pressure zone boundaries.

Distribution mains are typically 8-inch and smaller. The current City standard minimum distribution main size is 8-inch in residential zones and 12-inch in non-residential zones. Smaller pipes exist in the system from previous standards and from areas where mains were taken over from other districts, in particular the Allentown area which was formerly KCWD 25.

Tukwila's transmission and distribution systems consist of approximately 238,584 feet or 45 miles of pipes. The majority of the mains are comprised of ductile iron and cast iron pipe. Tables 2-2 and 2-3 summarize the system's piping according to main size, materials and total length.

Table 2-2
Summary of Main Sizes and Approximate Lengths

Main Size	Approx. Length (ft)
2"	5,133
4"	1,722
6"	33,412
8"	80,089
10"	42,297
12"	56,668
16"	5,272
18"	14,291
Total	**238,884**

Table 2-3
Summary of Pipe Materials and Approximate Lengths

Pipe Material	Approx. Length (ft)
PVC Main	5,255
Steel Main	2,062
Cast Iron	134,491
Ductile Iron	96,776
Asbestos Cement	300
Total	**238,884**

2.6 PRVs and Critical Valving

The City of Tukwila uses pressure reducing valves (PRVs) and check valves to maintain adequate system pressures, direct flow in the system, and isolate the various pressure zones. PRVs are also used at interties. The system contains 9 PRVs and 11 check valves. Table 2-4 summarizes the type, size, and location of system PRVs and critical valves.

Table 2-4
Tukwila PRVs

Location	Zone	Valve Description	Comment
E. Marginal Way & S. 112th St.	360	16” PRV	Active supply from SS 10
E. Marginal Way & S. Norfolk St.	320	16” PRV	Active Running
44th Ave. S. & S. 115th St.	360	8” PRV	Active supply from SS 11
Southcenter Parkway & Tukwila Parkway	360	12” PRV	Active supply from SS 13
West Valley Highway & S. 158th St.	360	8” PRV	Active supply from SS 14
Christensen Rd. & Black Dr.	360	8” PRV	Active supply from SS 15
S. 158th St. & 53rd Ave. S.	380	6” PRV	Active supply from SS 16
S. 107th St. & 49th Ave. S.	340	8” PRV	Active Running
E. Marginal Way at north City limit	320	12” PRV	Emergency
47th Ave S. and Victor St	340	8” PRV	Emergency
62nd / 151st	400	8” Check Valve	
55th	400	6” Check Valve	
Sunwood / 62nd	400	8” Check Valve	
Sunwood / Behind	400	8” Check Valve	
149th / 60th	400	6” Check Valve	
144th / 59th	400	6” Check Valve	
58th	400	6” Check Valve	
57th / 144th	400	10” Check Valve	
144th / 57th	400	6” Check Valve	
56th / 141st	400	6” Check Valve	
144th East of 53rd	400	6” Check Valve	
150th	400	8” Check Valve	
152nd	400	6 Check Valve	
Klickitat	380	8” Check Valve	

2.7 Control/Telemetry

The water system has a SCADA telemetry control panel at the City’s Maintenance Facility on Minkler Boulevard that monitors reservoir levels, and controls the supply station valves at SS 10, 13 and 15. A separate control system that is not linked to the distribution control system is installed at the reservoir pump station. This system monitors and responds to pressure variations in the distribution system and transmits analog signals back to the control panel at the City’s Maintenance Facility. Detailed facility-specific telemetry capabilities are included in the Operations and Maintenance section of this Water System Plan.

2.8 Adjacent Purveyors

The Tukwila service area shares a common boundary with seven adjacent purveyors. Growth and regionalization of water supply has prompted coordination and cooperation among purveyors. Exhibit 2-1 shows the service areas of Tukwila and adjacent purveyors.

2.8.1 City of Seattle

The Seattle service area is located west of the Duwamish River around the north end of Tukwila, north of the City's limit, and also east of the Ryan Hill area of Tukwila. In addition to its own service area, the Seattle water system also provides wholesale water to Cascade members, Highline Water District, Water District No. 20, Water District No. 125, Skyway Water and Sewer District, and several other cities, water districts and water associations.

2.8.2 King County Water District No. 20

The King County Water District (KCWD) No. 20 is supplied by the City of Seattle through a wholesale purveyor contract. The KCWD 20 service area boundary borders the western boundary of the City of Tukwila south of the City of Seattle service area, along 27th Ave. S. to approximately S. 133rd St. There is a small portion of the KCWD 20 service area within Tukwila's city limits. No interlocal agreement for interties and water purchase exists between KDWD 20 and Tukwila.

2.8.3 King County Water District No. 125

The KCWD 125 is supplied by the City of Seattle through a wholesale purveyor contract. It is located west of Highway 599 and I-5 and also just east of Tukwila within Skyway. KCWD 125 serves customers within Tukwila's city limits in the Riverton and Foster areas, and also customers within Seatac and Seattle city limits. Four interties exist between KCWD 125 and the Tukwila system in the Duwamish, Allentown and Foster areas of Tukwila.

2.8.4 Skyway Water and Sewer District

The area served by Skyway Water and Sewer District is just east of Tukwila between the Cities of Seattle and Renton and is supplied by the City of Seattle through a wholesale purveyor contract. No interlocal agreement for interties and water purchases exists between Skyway Water and Sewer District and Tukwila.

2.8.5 Highline Water District

The Highline Water District is supplied by the City of Seattle through a wholesale purveyor contract. The Highline Water District also uses its own Wellfield for 25% of its water supply. Highline serves customers within Tukwila's city limits in the Segale Park area and the Crystal Springs area in the south-west portion of the City. One intertie exists between Highline and the Tukwila system at the southern end of the City in the Segale Park area.

2.8.6 City of Renton

The City of Renton is supplied by their own groundwater wells. Renton serves some commercial customers within Tukwila's city limits in the south-east corner of the City. The City of Tukwila service boundary is contiguous with the City of Renton water service boundary. An interlocal agreement for interties and emergency water purchase exists between Renton and Tukwila.

2.8.7 City of Kent

The City of Kent is supplied with water from nine wells and surface water from the Green River surface water, treated at five treatment plants. The City of Tukwila service boundary is contiguous with the City of Kent water service boundary. An interlocal agreement for interties and water purchase exists between Kent and Tukwila.

2.9 System Interties

The City of Tukwila has interties with many of their adjacent water purveyors.

Seattle: Tukwila has two emergency interties with the City of Seattle. One intertie is at the boundary between the two cities on E. Marginal Way. The second intertie is at 47th Avenue South and Victor Street. There are no written agreements for these interties.

KCWD 125: The City of Tukwila and KCWD 125 have four emergency interties. The first two interties were established in 1986. The two locations identified in the agreements are in the Allentown and Foster Point neighborhoods. A 6" connection (with meter) was installed at 131st Pl & 44th Ave S. (identified as "131st Pl" on Exhibit 2-4), and a 4" connection (with meter) installed at Interurban Ave S. & 52nd Ave S (identified as "Park & Ride" on Exhibit 2-4). The maximum amount of flow at each of the connection points is 1,000 gpm. These interties were originally established at the request of KCWD 125, primarily to supply additional fireflows above what KCWD 125's system could maintain. The agreement assumes water will be supplied from Tukwila to KCWD 125, although reciprocity is also established. The rate KCWD 125 pays Tukwila for water is written as the "current wholesale new water" rate which Tukwila pays to Seattle plus five cents per CCF. This will need to be updated now that Tukwila receives its water from Cascade Water Alliance. The agreement also establishes the hydraulic grade line at which water will be provided to KCWD 125, as well as estimated available flows and annual consumption. A third intertie between Tukwila and KCWD 125 is a 2" intertie is located at S. 144th St and 53rd Ave S. (identified as "S. 144th St" on Exhibit 2-4). A fourth intertie between Tukwila and KCWD 125 was established in 2002 in the Duwamish neighborhood at S. 116th St. and Interurban Avenue South (identified as "Duwamish" on Exhibit 2-4). Copies of the first two intertie agreements are found in Appendix G; there is no written agreement for the other interties.

Highline: At the south end of the City in the Segale Park area, the City of Tukwila and Highline Water District have an intertie with a 12" pressure reducing valve and a meter. Flow is possible in both directions and is set to flow into the City when pressures drop below 125 psi at the intertie. This intertie is located at Andover Park W. & S. 180th St. This intertie was established

in 1979 when Highline was called King County Water District 75. It is considered an emergency facility only. Costs for purchased water were established as $0.22/ccf and were amended to $0.25/ccf in the following year. A copy of this intertie agreement is found in Appendix H.

Renton: In 1978, Tukwila entered into an agreement with the City of Renton for an 8" connection (with meter and pressure reducing valve) emergency intertie at 17200 West Valley Highway. In 1995 a new agreement was executed that stipulated new rates, quantity of water, and required both cities to install and maintain metering devices. Water is regulated to flow into Tukwila from Renton when pressures drop below 90 psi at the intertie. The maximum amount of flow at the Renton intertie is not to exceed 2.7 MGD. A copy of this intertie agreement is found in Appendix I.

Kent: Tukwila has an 8" connection with Kent located at West Valley Highway & Todd Boulevard. Water is regulated to flow into Tukwila from Kent when pressures drop below 90 psi at the intertie. This emergency intertie was established in 1979. The purpose of the intertie is to "provide emergency water flow and water supply to meet Kent's needs during times of peak demand and for emergency flow and fire protection in both cities." The facility was constructed and financed by Kent, and is owned and operated by Kent as well. Water rates are established in the agreement, as well as notification procedures for both parties when the intertie is used. A copy of this intertie agreement is found in Appendix J.

Section 3
Related Plans, Policies and Agreements

The City of Tukwila's program to ensure a comprehensive and reliable system for delivering water supply to its customers is embedded in a larger network of plans, policies, and agreements that address land uses and water supply within King County. This section provides a brief description of selected plans, policies, and agreements that relate to the Tukwila water system.

3.1 Land Use and Other General Policies

3.1.1 Tukwila Comprehensive Land Use Plan

The City of Tukwila's Comprehensive Land Use Plan (Comprehensive Plan) was originally adopted in 1995 and has been amended several times since then, including a 2004 Supplement. The Comprehensive Plan is a broad statement of community goals and policies that direct the orderly and coordinated physical developments of the city into the future. The Comprehensive Plan was developed pursuant to the State Growth Management Act (GMA). Tukwila's Comprehensive Plan includes the following six GMA required elements: Land Use, Housing, Transportation, Utilities, Capital Facilities, and Shoreline. It also includes the following five optional elements: Community Image, Economic Development, Natural Environment, Annexation, and Roles and Responsibilities.

This Water System Plan is consistent with the policies in Tukwila's Comprehensive Plan. The most pertinent information in the Comprehensive Plan in regards to the Water System Plan is summarized below.

- **Economic Development:** This element includes employment targets and states that Tukwila must plan to accommodate 16,000 additional jobs between 2004 and 2022. It should be noted these numbers can not be directly compared to the demographic projections presented in Section 4 of this WSP since the geographic areas are not identical. The geographic area for the Comprehensive Plan is all land within the city boundaries. The geographic area for the WSP is the water service area, which is far less than the city boundary in the early years of this WSP and comes close to matching the city boundary in later years.
- **Housing:** This element includes housing targets and states that Tukwila must plan to accommodate 3,200 additional housing units (single family and multifamily combined) between 2004 and 2022. Again, it should be noted these numbers can not be directly compared to the demographic projections presented in Section 4 of this WSP for the reasons stated above.
- **Land Use:** This element provides a map showing land use within the city based on city zoning. The map is provided in Section 3.1.2 below along with the zoning definitions.
- **Annexation:** This element identifies two Potential Annexation Areas and discusses associated policies.

- **Utilities:** This element addresses the goal of providing "utility services and facilities that meet the community's current and future needs in a safe, reliable, efficient, economic and environmentally responsible manner." The Utilities chapter from the 1995 Comprehensive Land Use Plan, as well as the 2004 update which references the 1995 version, are provided in Appendix K. The Utilities chapter focuses on the following five key issues.
  - **Service Extensions:** Planned extensions of utility services must be based on level-of-service standards.
  - **Coordination of Service Providers:** The City-managed utilities must be coordinated with adjacent purveyors who serve portions of the City.
  - **Concurrency and Implications for Growth:** Concurrency requires that utility plans, along with other capital facilities, be developed so that improvements, or the funds required for the improvements, are in place at the time they are needed.
  - **Environmental Sensitivity:** Utility improvements often arise from environmental concerns, but may also result in additional environmental impacts, for example, from pipeline siting and construction and from drainage and groundwater management.
  - **Residential Revitalization:** City planned utility improvements and extensions must place priority on improving and sustaining residential neighborhood quality and livability.

3.1.2 Tukwila Zoning Ordinances

Zoning for land within the City of Tukwila is defined in Title 18 Zoning of the Tukwila Municipal Code. The zoning for the City's current and future service area is shown in Exhibit 3-1. Anticipated zoning has been established for the Potential Annexation Area south of current city limits, even though land use decisions are currently technically the responsibility of King County. No major zoning changes are intended in the next 20 years.

The 16 zoning classifications are defined in Table 3-1.

Table 3-1
Zoning Designations

#	Code	Name	Description
1	C/LI	Commercial / Light Industrial	Areas characterized by a mix of commercial, office or light industrial uses.
2	HDR	High Density Residential	Areas characterized by multi-family buildings; 15-21.8 units per net acre, with senior citizen housing allowed up to 60 units per net acre.
3	HI	Heavy Industrial	Areas characterized by heavy or bulk manufacturing uses and distributive and light manufacturing uses, with supportive commercial and offices uses.
4	LDR	Low Density Residential	Areas characterized by detached single-family residential structures; 0 to 6.7 units per net acre.
5	LI	Light Industrial	Areas characterized by distributive and light manufacturing uses, with supportive commercial and office uses.
6	MDR	Medium Density Residential	Areas characterized by residential duplexes, triplexes, and four-plexes; 6.8 to 14.5 units per net acre.

Table 3-1 (cont.) Zoning Designations			
#	**Code**	**Name**	**Description**
7	MIC/H	Manufacturing Industrial Center / Heavy	A major employment area containing distributive, light manufacturing and heavy manufacturing uses, with supportive commercial and office uses.
8	MIC/L	Manufacturing Industrial Center / Light	A major employment area containing distributive, light manufacturing, and limited office uses, with supportive commercial and office uses.
9	MUO	Mixed Use Office	Areas characterized by professional and commercial office structures, mixed with certain complementary retail, and residential uses and senior citizen housing allowed up to 60 units per net acre.
10	NCC	Neighborhood Commercial Center	Pedestrian-friendly areas characterized and scaled to serve multiple residential areas with a diverse mix of uses. Uses include certain commercial uses mixed with residential at second story or above (senior citizen housing allowed up to 60 units per net acre); retail; service; office; and recreational and community facilities, generally along a transportation corridor.
11	O	Office	Areas characterized by professional and commercial office structures mixed with certain complementary retail.
12	RC	Regional Commercial	Areas characterized by commercial services, offices, lodging, entertainment, and retail activities with associated warehousing and accessory light industrial uses, along a transportation corridor and intended for high-intensity regional uses. Residential uses are also allowed in appropriate areas off of the principle arterial with a maximum density determined by code standards and design review criteria.
13	RCC	Residential Commercial Center	Pedestrian-friendly areas characterized and scaled to serve a local neighborhood, with a diverse mix of uses. Uses include certain commercial uses mixed with residential at second story or above, with a maximum density of 14.5 units per acre; retail; service; office; and recreational and community facilities.
14	RCM	Regional Commercial Mixed Use	Areas characterized by commercial services, offices, lodging, entertainment, and retail activities with associated warehousing and accessory light industrial uses. Residential uses mixed with certain commercial uses are allowed, at the second story or above, subject to special design standards, and a maximum density of up to 14.5 units per acre (senior citizen housing allowed up to 60 units per net acre).
15	TUC	Tukwila Urban Center	A specific area characterized by high-intensity regional uses that include commercial services, offices, light industry, warehousing and retail uses, with a portion covered by the TUC Urban Center Mixed Use Residential Overlay.
16	TVS	Tukwila Valley South	A specific area characterized by distributive and light manufacturing uses, with supportive commercial and office uses.

Source: 2004 City of Tukwila Comprehensive Plan.

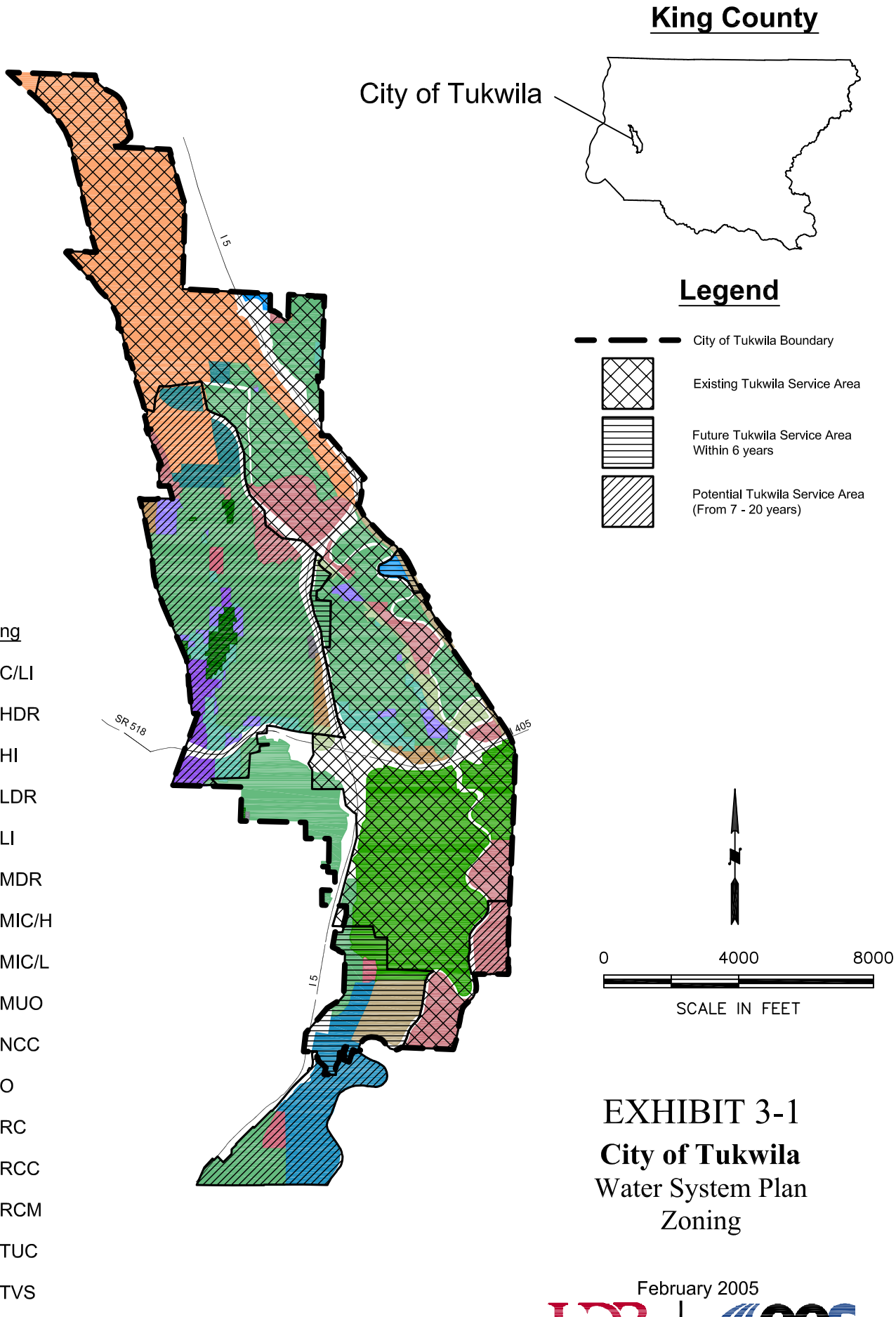

EXHIBIT 3-1

City of Tukwila

Water System Plan

Zoning

February 2005

HDR | ees

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3.1.3 Tukwila Water Service Ordinances

Ordinances related to water service are contained in Title 14 Water and Sewers of the Tukwila Municipal Code. These ordinances cover subjects such as rates, connection policies, and water emergencies. Appendix L contains all water-related Title 14 ordinances.

3.1.4 King County Comprehensive Plan

King County's most recent Comprehensive Plan is a draft version of its 2004 plan, which updates the previous plan created in 2000. The plan guides growth and development in the unincorporated areas in King County and sets county policy on major issues such as annexations, transportation, and environmental protection. The plan includes the following nine elements: Regional Planning; Urban Communities; Rural Legacy and Natural Resource Lands; Environment; Parks, Open Space and Cultural Resources; Transportation; Services, Facilities and Utilities; Community Planning Areas; and Implementation.

The most pertinent information in King County's Comprehensive Plan in regards to Tukwila's Water System Plan is contained in Chapter 2 Urban Communities which contains land use information and Chapter 7 Service, Facilities, and Utilities. Chapter 7 includes the following subsections and references to King County's Countywide Planning Policies: potable water systems (F-225 to F-227); regional water supply planning (F-228 to F-230); utility system interties (F-231 to F-232); and water reuse, conservation, and accounting (F-233 to F-236). This Water System Plan is consistent with the policies in King County's Comprehensive Plan.

3.2 Supply Agreements

3.2.1 Cascade Water Alliance – Potable Water

Tukwila has a supply agreement with the Cascade Water Alliance (Cascade) for potable water. That supply agreement is the Interlocal Contract between Cascade and all its members, including Tukwila and can be found in Appendix M. Section 5.2.1 Commitment to Members of the contract specifies that "Cascade shall provide a Full Supply Commitment to each Founding Member." Tukwila is a Founding Member and Full Supply Commitment is defined as, "those needs, as projected in the Members' lawfully adopted water supply plan…net of independent supply." This supply commitment is explained at length in a discussion paper created by Cascade called Water Supply Commitment, which can be found in Appendix N. The rate charged to Tukwila by Cascade is approximately $1.00/ccf.

Cascade currently receives its water from the City of Seattle. Cascade's contract with Seattle is a 50-year declining block contract which began in 2004 with a 30.3 mgd block and ends in 2053 with the option to continue to purchase 5.3 mgd. This Cascade and Seattle contract can be found in Appendix O.

Cascade, in partnership with its members, is developing other supply options to augment and replace the water obtained from Seattle. Those alternative supply options will be included in

Cascade's water system plan which is currently in progress. Once Cascade finalizes the supply options and its water system plan, Cascade members will in turn update their individual water system plans based on the Cascade water system plan. It is anticipated that in the near term Cascade will receive water from the City of Tacoma and in the longer term will develop its water right associated with Lake Tapps in Pierce County.

3.2.2 King County – Reclaimed Water

Tukwila has a supply agreement with King County for reclaimed water. The reclaimed water is produced at King County's Renton treatment plant. The water is reclaimed to Class A standards under Washington State's Water Reclamation and Reuse Standards. King County is responsible for delivering the reclaimed water to Tukwila, who is in turn responsible for delivering the reclaimed water to the end user. The original supply contract between Tukwila and King County was intended as a three year pilot contract beginning in 1998. It is currently outdated and is expected to be rewritten by early 2005. The contract called for Tukwila to pay King County 80% of the wholesale rate that Tukwila paid to Seattle for potable water for that month. The contract also stipulated that Tukwila would charge its retail customers 85% of the potable water summer rate.

3.3 Intertie Agreements

Tukwila has intertie agreements with the City of Seattle, King County Water District 125, Highline Water District, the City of Renton, and the City of Kent. These intertie agreements are described in Section 2.9

Section 4
Planning Data and Demand

4.1 Customer Categories and Characteristics

The City officially divides its water customers into four categories: single family, multifamily, commercial/industrial, and low income senior/disabled. These categories are defined below.

- **Single Family** – Connections serving one dwelling unit.
- **Multifamily** – Connections serving more than one dwelling unit. A very small number of the meters in this category are irrigation-only meters.
- **Commercial/Industrial** – Connections serving non-residential facilities. Some of the meters in this category are irrigation-only meters.
- **Low Income Senior/Disabled** – Connections serving persons with disposable income less than $32,000 and either at least 62 years old or permanently disabled. These customers qualify for a 50% discount.

Much of the data presented in this WSP breaks out customer categories slightly differently than the official categories for two reasons. First, the single family and low income senior/disabled categories will be combined. This is done because the billing system, from which water sales data was collected, combines these two categories. Second, the commercial/industrial category is split between regular customers and "high demand" customers. This is done in order to properly forecast future water demand. The high demand commercial customers are those with high demand and relatively few employees. These customers would artificially inflate the demand per employee and the resulting demand forecast if not separated from the rest of the commercial customers. This special commercial category consists of four customers: Shasta Beverage, Embassy Suites, Double Tree Hotel, and Jorgensen Forge.

The number of connections per customer category is shown in Table 4-1. Water sales are also included in the table to point out that, as with many utilities, water sales do not follow the same proportions as customer categories. This is particularly the case in Tukwila where there is a large commercial base. Single family customers represent 52.5% of connections, but only 9% of the water sales. Commercial/Industrial customers represent only 39.8% of connections, but nearly double that (78%) in terms of water sales.

Table 4-1 Connections and Potable Water Sold by Customer Category				
Customer Category	**Connections in 2003[1]**	**% Connections**	**Water Sold 1999-2003 avg (gpd)[2]**	**% Water Sold**
Single Family[3]	1,130	52.5%	184,700	9%
Multifamily	166	7.7%	256,627	13%
Commercial – Regular[4]	854	39.6	1,374,371	70%
Commercial – High Demand[4]	4	0.2%	153,140	8%
Total	2154	100%	1,968,838	100%

[1]Source: "Comp Plan Update" spreadsheet provided by the City of Tukwila; as of 12-31-03.
[2]Source: "Sold H2O" spreadsheet provided by the City of Tukwila: 1999-2003 average.
[3]Includes low income senior/disabled customers.
[4]High demand customers are customers with very large demand, but relatively few employees. Since they would artificially inflate the overall demand per employee and the resulting demand forecast, their water and employees are treated separately from the regular commercial customers. There are four high demand customers: Shasta, Embassy Suites, Double Tree, and Jorgensen Forge.

4.2 Demographics – Existing and Projected

Current and future demographic information is based on information obtained from the Puget Sound Regional Council (PSRC). The PSRC makes projections for households and employment based on official projections from Washington State's Office of Management and Budget. These projections are available for 10 year increments from 2000 to 2030. The PSRC allocates the projections across small geographic areas called Transportation Analysis Zones (TAZ).

The process to convert the PSRC data to data specific to the City is as follows.

The geographic boundaries of the TAZs and the City's service area are overlayed to determine which TAZs, or portions thereof, are in the City's service area. For any TAZ fully in the City's service area, all the households and employment in that TAZ are assigned to the City. For any TAZ not fully in the City's service area, the households and employees in that TAZ are assigned to the City based on the percent of the TAZ in the City's service area and reviews of aerial photos and zoning maps. This analysis is done for each year during the planning period, taking into account how service area boundaries grow over the planning period.

The results of this analysis are shown in Table 4-2. Single family households in the City's water service area are projected to increase from 1,200 to 2,906 between 2005 and 2024, a growth of 142%. It should be noted that the number of single family households actually decreases between 2020 and 2024. The demographic data obtained from PSRC shows this decrease, which presumably is due to conversion from single family to multifamily households. Multifamily households are projected to increase from 2,049 to 7,021 between 2005 and 2024, a growth of 243%. Employment is projected to increase from 41,017 to 71,556 between 2005 and 2024, a growth rate of 74%. These increases are due partly to overall growth in the current service area, and partly due to addition of new lands to the City's service area, estimated to occur in years 2010, 2015, and 2020.

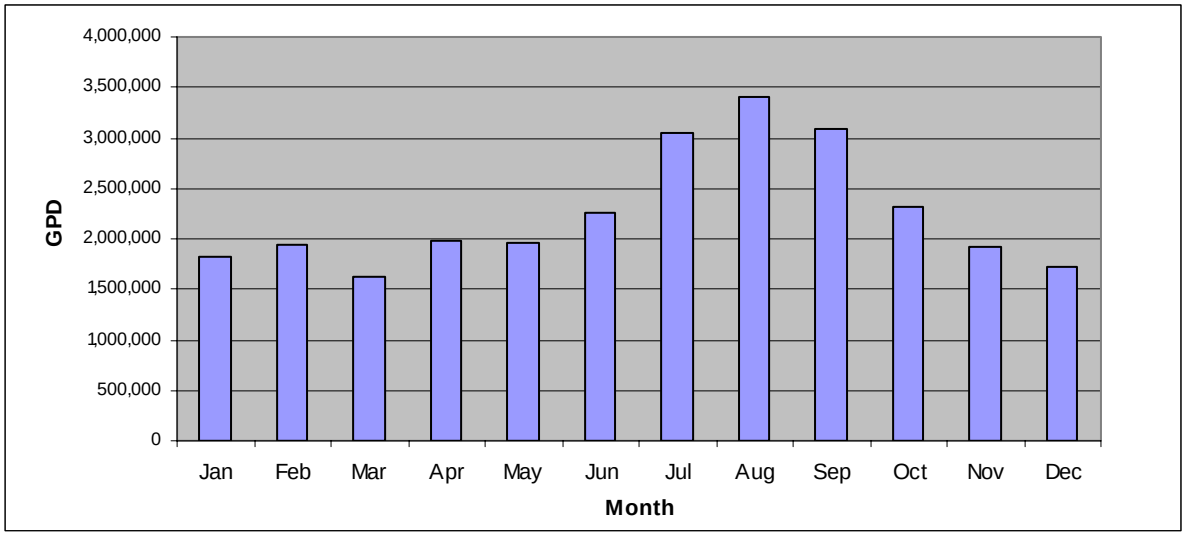
Table 4-2 Current and Future Demographics			
Year	**Single Family Households**	**Multifamily Households**	**Employment**
2005	1,200	2,049	41,017
2006	1,206	2,112	41,538
2007	1,213	2,174	42,059
2008	1,219	2,237	42,580
2009	1,225	2,299	43,101
2010	1,308	2,540	46,430
2011	1,313	2,627	47,173
2012	1,319	2,714	47,915
2013	1,324	2,801	48,658
2014	1,329	2,888	49,400
2015	1,367	2,977	52,470
2016	1,373	3,064	53,277
2017	1,378	3,151	53,982
2018	1,384	3,238	54.738
2019	1,388	3,325	55,493
2020	2,946	6,252	66,730
2021	2,936	6,444	67,935
2022	2,926	6,636	69,143
2023	2,917	6,828	70,300
2024	2,906	7,021	71,556

4.3 Potable Water

4.3.1 Potable Water Purchases

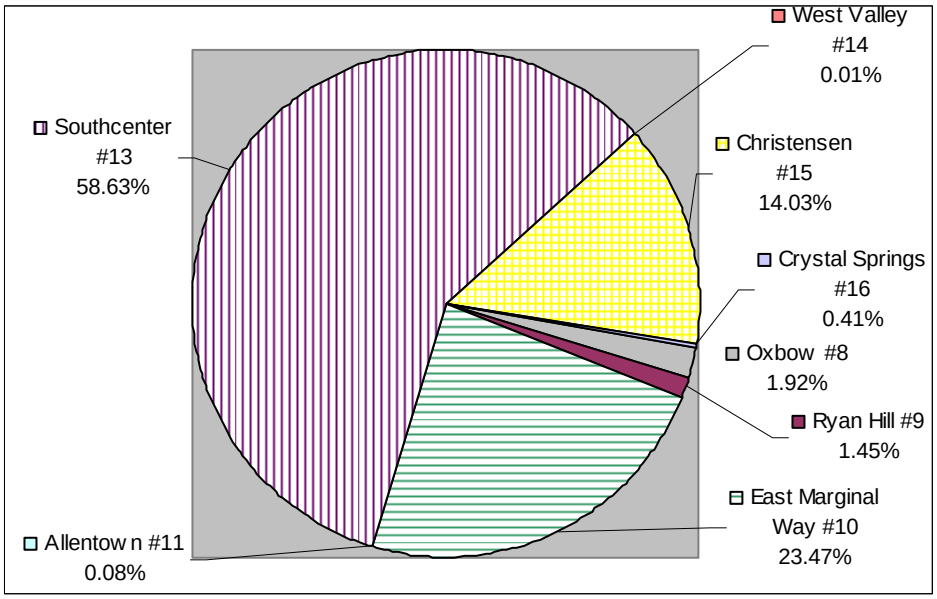
The average of the four most recent years of potable water purchases from the City of Seattle are shown in Table 4-3. (Water formerly purchased from Seattle will now be purchased from Cascade.) The data is presented by month and by location, both of which are shown graphically in Exhibits 4-1 and 4-2. The average annual purchase over the last four years has been 2,259,010 gpd. The City has a monthly distribution typical of most utilities, with higher water purchases in the summer months driven by additional summer uses such as outdoor watering. Purchases come primarily from three of the eight taps off Seattle's pipelines. The Southcenter tap is the largest source at 59%, followed by East Marginal Way at 23% and then Christensen at 14%.

Table 4-3 Purchased Potable Water 2000-2003 Average (gpd)									
Month	**Oxbow #8**	**Ryan Hill #9**	**East Marginal #10**	**Allentown #11**	**Southcenter #13**	**W. Valley #14**	**Christensen #15**	**Crystal Springs #16**	**Total**
Jan	27,656	29,224	200,786	2,093	1,349,651	157	200,219	10,733	1,820,519
Feb	34,172	31,981	213,235	3,373	1,407,871	100	236,767	10,039	1,937,539
Mar	25,942	26,962	232,502	48	1,087,768	115	245,395	7,728	1,626,460
Apr	33,484	32,492	236,474	5,124	1,368,668	330	297,033	11,907	1,985,514
May	31,999	30,280	303,704	1,671	1,433,498	977	144,697	11,396	1,958,224
Jun	43,546	34,706	572,116	873	1,281,819	667	309,034	11,396	2,254,156
Jul	57,730	36,965	1,168,194	567	1,377,518	97	400,523	8,700	3,050,293
Aug	93,579	45,538	1,279,963	145	1,519,687	700	458,682	6,552	3,404,844
Sep	82,347	45,877	1,019,031	187	1,437,692	75	504,943	6,465	3,096,617
Oct	40,379	24,579	578,058	278	1,106,923	84	548,019	9,623	2,307,943
Nov	24,631	27,306	284,596	1,590	1,318,102	62	262,446	8,622	1,927,355
Dec	24,000	28,283	242,101	6,437	1,216,133	139	190,959	6,841	1,714,893
Annual	43,334	32,832	530,142	1,852	1,324,480	294	316,922	9,155	2,259,010
%	2%	1%	23%	0.1%	59%	0.01%	14%	0.4%	100%
Jan	27,656	29,224	200,786	2,093	1,349,651	157	200,219	10,733	1,820,519



Source: "Taps" spreadsheet provided by the City of Tukwila.

Exhibit 4-1
Monthly Distribution of Purchased Potable Water
2000-2003 Average



Source: "Taps" spreadsheet provided by the City of Tukwila.

Exhibit 4-2
Potable Water Purchased by Area
2000-2003 Average

Water purchases have been fairly consistent over the last four years, as shown in Table 4-4. The annual change has ranged from negative 2.4 to positive 1.6.

Table 4-4
Potable Water Purchases and Annual Change 2000-2003 (gpd)

Year[1]	Purchased Water[2]	Annual Growth Rate
2000	2,246,671	
2001	2,256,778	0.4%
2002	2,293,998	1.6%
2003	2,238,594	-2.4%

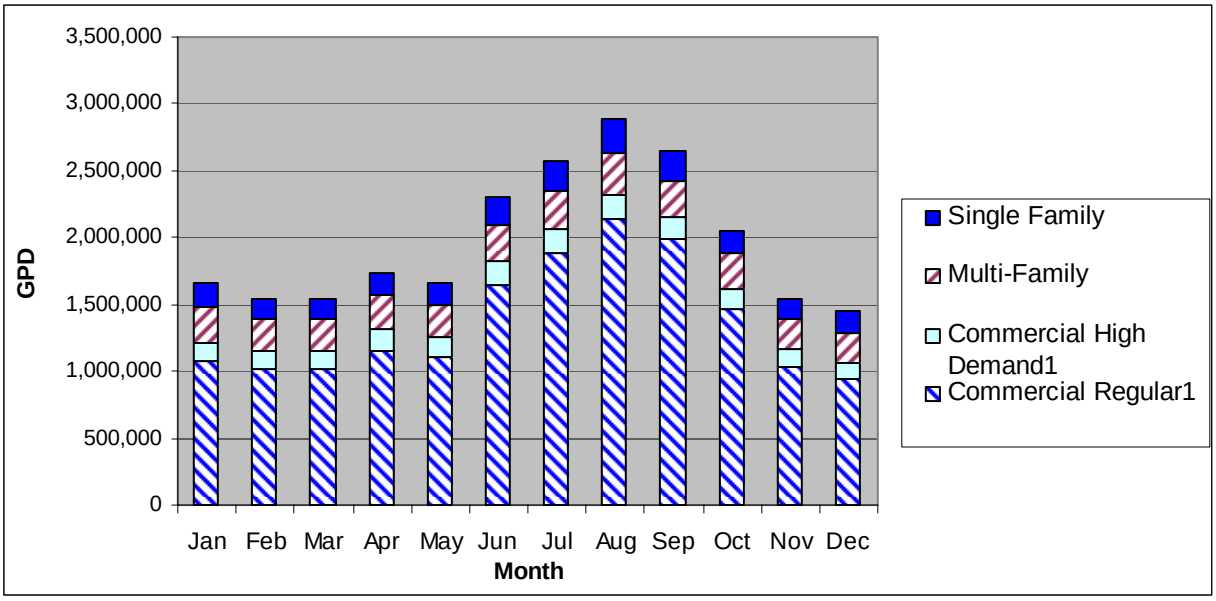
[1]The master meter underegistered the volume purchased by an unknown amount in 2000.
[2]Source: "Taps" spreadsheet provided by the City of Tukwila.

4.3.2 Potable Water Sales

The average of the five most recent years of potable water sales are shown in Table 4-5. The data is presented by month and by customer category, both of which are shown graphically in Exhibits 4-3 and 4-4. Similar to the situation with water purchases, water sales have a typical monthly distribution with higher sales in the summer months. Commercial customers represent the bulk of water sales at 78%, followed by multifamily at 13%, and then single family at 9%. It should be noted that while both water purchases and water sales are based on monthly billings, their time periods have been generalized and will not match perfectly.

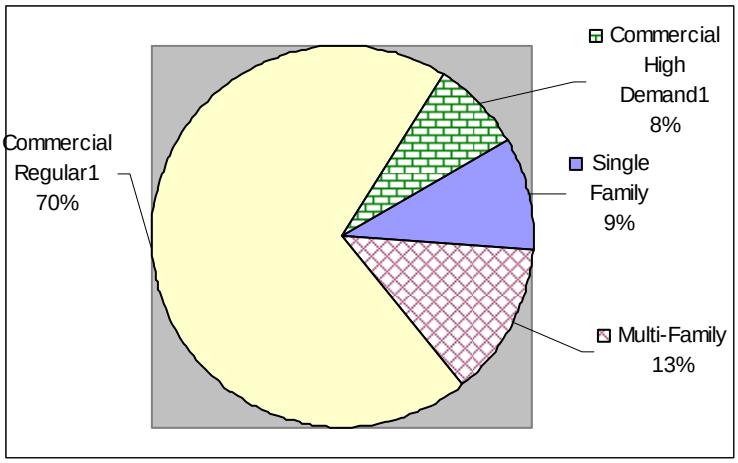
Table 4-5 Potable Water Sales 1999-2003 Average (gpd)					
Month	**Single Family**	**Multi-Family**	**Commercial Regular[1]**	**Commercial High Demand[1]**	**Total**
Jan	184,221	265,397	1,076,501	136,777	1,662,896
Feb	156,198	243,405	1,010,683	136,518	1,546,804
Mar	151,859	239,040	1,017,068	131,608	1,539,575
Apr	171,415	255,346	1,151,266	163,450	1,741,477
May	166,527	234,817	1,106,010	154,287	1,661,641
Jun	202,396	268,189	1,648,244	178,941	2,297,769
Jul	229,498	272,086	1,882,321	188,290	2,572,195
Aug	265,160	302,430	2,144,470	179,597	2,891,657
Sep	214,101	274,827	1,990,036	165,310	2,644,274
Oct	171,199	258,997	1,471,141	148,587	2,049,924
Nov	150,263	233,856	1,030,288	129,955	1,544,363
Dec	150,783	230,034	939,623	123,567	1,444,007
Annual	184,700	256,627	1,374,371	153,140	1,968,838

Source: "Sold H2O" and "Water 99" spreadsheets provided by the City of Tukwila.
[1]High demand customers are customers with very large demand, but relatively few employees. Since they would artificially inflate the overall demand per employee and the resulting demand forecast, their water and employees are treated separately from the regular commercial customers. There are four high demand customers: Shasta, Embassy Suites, Double Tree, and Jorgensen Forge.



Source: "Sold H2O" and "Water 99" spreadsheets provided by the City of Tukwila.
[1]High demand customers are customers with very large demand, but relatively few employees. Since they would artificially inflate the overall demand per employee and the resulting demand forecast, their water and employees are treated separately from the regular commercial customers. There are four high demand customers: Shasta, Embassy Suites, Double Tree, and Jorgensen Forge.

Exhibit 4-3
Monthly Distribution of Potable Water Sales
1999-2003 Average



Source: "Sold H2O" and "Water 99" spreadsheets provided by the City of Tukwila.
[1]High demand customers are customers with very large demand, but relatively few employees. Since they would artificially inflate the overall demand per employee and the resulting demand forecast, their water and employees are treated separately from the regular commercial customers. There are four high demand customers: Shasta, Embassy Suites, Double Tree, and Jorgensen Forge.

Exhibit 4-4
Potable Water Sales by Customer
1999-2003 Average

Water sales and their annual changes over the last five years are shown in Table 4-6. The annual change has ranged from negative 10.5% to positive 2.9%.

Table 4-6
Potable Water Sales and Annual Change 1999-2003 (gpd)

Year	Sold Water[1]	Annual Growth Rate
1999	2,110,329	n/a
2000	2,098,886	-0.5%
2001[2]	1,879,285	-10.5%
2002	1,851,326	-1.5%
2003	1,904,363	2.9%

[1]Source: "Sold H2O" and "Water 99" spreadsheets provided by the City of Tukwila.
[2]2001 was a drought year with extensive conservation efforts made throughout the Seattle/purveyor service area.

4.3.3 Potable Water Large Customers

Customers with large water demand are of particular interest for two reasons. First, changes in their demand could have significant impact on the overall demand for the City. Therefore, it is important to check if these customers have future plans which will significantly alter their demand, such as doubling capacity or closing down. City staff indicated they did not expect any changes from these large customers. Second, certain large customers could skew the demand forecast if not handled properly in the demand forecast calculations. This is true for customers with large demand but relatively few employees since this will artificially inflate the demand per employee, a critical component in the demand forecasting method used in this plan.

The ten largest water customers from 2003 are shown in Table 4-7 and collectively represent approximately 19% of total potable water demand. The last column in the table indicates whether the customer is treated separately for demand forecasting since it would artificially inflate the overall demand per employee. Four customers fit this criteria: Shasta Beverage, Embassy Suites, Double Tree Hotel, and Jorgensen Forge.

Table 4-7
Largest Potable Water Customers

#	Customer	Service Address	2003 Employees[3]	Demand Average 1999-2003 gpd[2]	Demand Average 1999-2003 gpde	Treat separately since inflate gpde data?[1]
1	Shasta Beverage	1227 Andover Park E	42	71,839	1,710	Yes
2	Southcenter Mall	633 Southcenter Pkwy	3,270	64,111	20	No
3	Boeing PSAM 12-0380[4]	9797 E Marginal Way S	2,448	40,516	17	No
4	Boeing PSAM 12-0370[4]	2401 S 98th St	2,448	37,192	15	No
5	Embassy Suites	15920 W Valley Hwy	79	32,839	416	Yes
6	Canyon Estates Condo	15200 65th Ave S	5	32,029	6,406	No - residential
7	Double Tree	16500 Southcenter Pkwy	124	30,167	243	Yes
8	Costco	1162 Costco Dr	411	22,330	54	No
9	Jorgensen Forge	8531 E Marginal Way S	150	18,295	122	Yes
10	Associated Grocers	3301 S Norfolk St	221	17,377	79	No
Total			9,198	366,696	40	

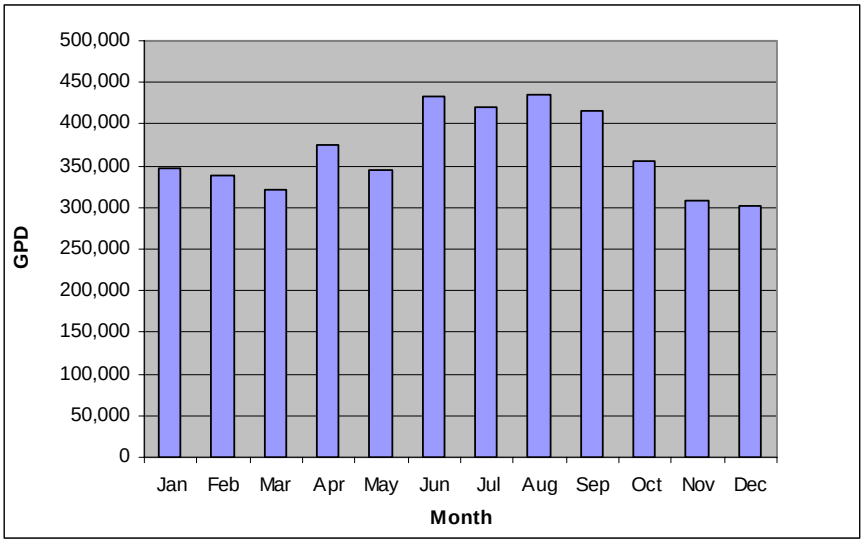
[1]Customers with very large demand, but relatively few employees, artificially inflate the demand per employee and the resulting demand forecast. Therefore, water and employees for these customers (Shasta, Embassy Suites, Double Tree, and Jorgensen Forge) are treated separately.
[2]Source: Billing system printouts provided by the City of Tukwila.
[3]Source: 5-25-04 email from Mike Cusick.
[4]A total of 4,896 employees for both Boeing sites combined was divided equally between both sites.

The five most recent years of sales to 2003's top ten largest customers are shown in Table 4-8 and Exhibit 4-5. It should be clarified that this is not the same as the top ten water customers in each of the last five years. One of these customers (Costco) did not begin water service until mid-2000 and sales data for another customer (Southcenter Mall) was only available beginning in 2000. Some summer peaking does exist, however, the magnitude of the summer peak is smaller for these large customers compared to the overall system.

Table 4-8
Potable Water Sales of 2003's 10 Largest Customers (gpd)

Month	1999	2000	2001	2002	2003	Avg
Jan	286,378	342,630	432,040	367,438	301,146	345,926
Feb	290,770	284,064	417,360	343,912	355,535	338,328
Mar	277,931	330,153	354,141	308,941	334,377	321,109
Apr	300,138	399,136	412,328	401,455	362,903	375,192
May	294,414	356,240	396,228	349,049	325,737	344,334
Jun	323,304	383,252	496,040	414,398	553,270	434,053
Jul	283,747	441,138	446,809	440,197	494,253	421,229
Aug	406,025	479,894	434,308	454,797	405,929	436,191
Sep	300,512	381,406	429,534	452,351	516,189	415,998
Oct	273,563	400,740	345,405	369,006	392,849	356,313
Nov	248,644	292,158	290,288	310,486	403,750	309,065
Dec	208,816	305,563	317,001	307,517	371,323	302,044
Annual	291,169	367,067	397,358	376,700	401,185	366,696

Source: Billing system printouts provided by the City of Tukwila.



Source: Billing system printouts provided by the City of Tukwila.

Exhibit 4-5
Monthly Distribution of Potable Water Sales for 2003's 10 Largest Customers
1999-2003 Average

4.3.4 Potable Water Peaking Factor

The peaking factor is critical to water supply planning since systems must be sized to meet the peak demand, not just average demand. The peaking factor for five of the most recent years available is shown in Table 4-9. An average peaking factor of 1.72 was calculated using four of these five years. 1996 was excluded from the average since it had a much lower peaking factor and was probably not representative of normal conditions. Data for more recent years is not available since 1998 was the most recent year that Seattle performed demand metering. Tukwila staff have indicated they think the peaking factor has not changed significantly.

Table 4-9
Peaking Factor[2]

Year[1]	Peak Day GPD	Average Day GPD	Peaking Factor
1993	2,690,000	1,550,000	1.74
1994	2,820,000	1,770,000	1.59
1996	2,900,000	2,430,000	1.19
1997	4,200,000	2,550,000	1.65
1998	4,494,000	2,340,000	1.92
4 Yr Average[3]	3,420,800	2,128,000	1.72

[1]No data was available for 1995. 1998 is the most current year since it is the most recent year that Seattle performed demand metering.
[2]Based on water purchases
[3]This is the average for 1993, 1994, 1997, and 1998. 1996 was omitted since its peaking factor of 1.19 is much lower than the other years and probably is not representative of normal conditions. Source: "Yrwtr" spreadsheet provided by the City of Tukwila.

4.3.5 Potable Non-Revenue Water

Non-revenue water is defined as the difference between the volume of water produced and/or purchased and the volume of water sold. The volume of non-revenue water for the past several years is shown in Table 4-10 and has averaged 17%.

Table 4-10
Non-Revenue Potable Water (gpd)

Year	Water Purchased[1]	Water Sold[2]	Non-Revenue Water	
			gpd	%
2001	2,256,778	1,879,285	377,493	16.7%
2002	2,293,998	1,851,326	442,672	19.3%
2003	2,238,594	1,904,363	334,231	14.9%
Average	2,263,123	1,878,325	384,799	17.0%

[1]Source: "Taps" spreadsheet provided by the City of Tukwila.
[2]Source: "Sold H2O" spreadsheet provided by the City of Tukwila.

Examining non-revenue water is important for two reasons: part of this water may be a source of additional revenue and part of this water may be associated with leaks that should be fixed. In addition, non-revenue water should be factored into the demand forecast to establish the City's total water supply needs.

In order to fully understand non-revenue water, it is important to understand the overall water balance. A water balance is simply an accounting for all water that is produced and/or purchased. Table 4-11 shows the water balance format developed by the International Water Association (IWA) and recommended by the American Water Works Association (AWWA) Water Loss Committee. The IWA format has been modified slightly to include a sub-category called "Remainder"; this modification is discussed below. The IWA uses several different categorization methods, each having a specific use.

The first categorization method simply splits water between Revenue Water and Non-Revenue Water. As implied by the names, Revenue Water generates income while Non-Revenue Water does not. This is helpful in understanding what percent of water produced and/or purchased actually generates income for the water utility.

The second categorization method splits Revenue Water and Non-Revenue Water into sub-categories. Non-Revenue Water's split into four sub-categories is useful in identifying potential additional revenue sources and identifying the magnitude of leaks that could be fixed.

- The first sub-category is Unbilled Authorized Consumption which includes uses such as water system flushing, firefighting, and contractor use. Typically, it is standard practice not to charge for uses falling into this sub-category. However, the City might want to review these uses to ensure it is not missing a legitimate revenue opportunity.
- The second sub-category is Apparent Losses which includes unauthorized uses and customer meter inaccuracies, both of which are lost revenue opportunities.
- The third sub-category is Real Losses which includes various types of system leaks. A certain level of leaks is unavoidable, however, leaks beyond that level should be fixed in order to not unduly burden both the natural resource and the physical infrastructure.

- The fourth sub-category is Remainder, which is not part of the IWA's official water balance format. Under the IWA's protocol, any amount that can not be assigned to another category is put into the leaks category. For this WSP, any amount that could not be assigned to another category was put into the Remainder category.

Table 4-11
Potable Water Balance 2003

	Category Method #1	Category Method #2	Category Method #3	Volume (gpd)	% of Water Purchased
Water Produced and/or Purchased	Revenue Water	Billed Authorized Consumption	Billed Water exported	0	0.00%
			Billed Metered Consumption – Permanent Meters	1,904,363[1]	85.07%
			Billed Metered Consumption – Temporary Meters	514[2]	0.02%
			Billed Unmetered Consumption	0	0.00%
	Non Revenue Water	Unbilled Authorized Consumption	Unbilled Metered Consumption	0	0.00%
			Unbilled Unmetered Consumption[1]	4,207[3]	0.19%
		Apparent Losses	Unauthorized Consumption	Unknown	Unknown
			Customer Metering Inaccuracies	Unknown	Unknown
		Real Losses	Known Leakage on Mains	21,240[4]	0.95%
			Known Leakage on Service Connections	14,400[4]	0.64%
			Leakage and Overflows at Storage	Unknown	Unknown
		Remainder		296,400[5]	13.13%
TOTAL				**2,238,594[6]**	**100%**

[1]Source: "Sold H2O" spreadsheet provided by the City of Tukwila
[2]Source: 5-6-04 email from Richard Takechi.
[3]Source: 5-6-04 email from Richard Takechi and 9-10-04 email from Pat Brodin, with details described in Table 4-12.
[4]Source: 2003 Utilities Services Associates leak detection report.
[5]This is the difference between water purchased and water accounted for in this water balance. The International Water Association water balance protocol does not include this category, but rather suggests making best estimates for all non-revenue categories and then assigning any remaining water to leaks.
[6]Source: "taps" spreadsheet provided by the City of Tukwila.

Tukwila's 2003 water balance is included in Table 4-11. Tukwila's purchased water is divided into 85% Revenue Water and 15% Non-Revenue Water. The four sub-categories of Non-Revenue Water include 0.19% for Unbilled Authorized Consumption (see unmetered portion in Table 4-12), an unknown amount for Apparent Losses, 1.59% for Real Losses, and 13.13% for Remainder.

Table 4-12
Unbilled Unmetered Consumption for 2003 Potable Water Balance (gpd)

GPD	Activity
1,025	Flushing of water system
250	Flushing of sewer system
389	Flushing of storm water system
12	Street sweeping by city
30	Street sweeping by private entities
500	Fire firefighting
2,000	Fire testing
4,207	Total

4.3.6 Potable Water Projected Demand

The projected demand is shown in Table 4-13 and Exhibit 4-6 which show average day demand rising from 2,461,848 in 2005 to 4,676,374 in 2024. The exhibit breaks down the demand by service area section. This allows the City to examine how demand is expected to increase in its current service area compared to how demand is expected to increase in and because of the five new areas. This distinction is helpful since, as discussed in Section 4.2, the certainty and timing of service area expansion is not fully known. The exhibit also includes the most recent four years (2000-2003) of actual water purchases for comparison purposes.

Table 4-13
Potable Water Projected Demand

Year	Demographics			Water Use Factor (gdhe)[6]			Average Day Demand (gpd)							Maximum Day Demand (gpd)[2]
									Commercial					
	SF HH[4]	MF HH[5]	Employees[3]	SF HH[4]	MF HH[5]	Employee	Single Family	Multi Family	Regular[1]	High Demand[1]	Future	Non-Revenue	Total	
2005	1,200	2,049	40,622	163.0	133.0	35.0	195,600	272,517	1,421,770	153,140	0	418,821	2,461,848	4,234,379
2006	1,206	2,112	41,143	162.2	132.3	34.8	195,613	279,418	1,431,776	153,140	20,000	426,389	2,506,336	4,310,898
2007	1,213	2,174	41,664	161.4	131.6	34.6	195,778	286,098	1,441,574	153,140	20,000	429,801	2,526,392	4,345,394
2008	1,219	2,237	42,185	160.6	130.9	34.4	195,771	292,823	1,451,164	153,140	20,000	433,144	2,546,043	4,379,193
2009	1,225	2,299	42,706	159.8	130.2	34.2	195,755	299,330	1,460,545	153,140	20,000	436,398	2,565,168	4,412,089
2010	1,308	2,540	46,035	159.0	129.5	34.0	207,972	328,930	1,565,190	153,140	20,000	466,422	2,741,654	4,715,645
2011	1,313	2,627	46,778	158.2	128.9	33.8	207,717	338,620	1,581,096	153,140	20,000	471,618	2,772,191	4,768,169
2012	1,319	2,714	47,520	157.4	128.3	33.6	207,611	348,206	1,596,672	153,140	20,000	476,754	2,802,383	4,820,098
2013	1,324	2,801	48,263	156.6	127.7	33.4	207,338	357,688	1,611,984	153,140	20,000	481,781	2,831,931	4,870,922
2014	1,329	2,888	49,005	155.8	127.1	33.2	207,058	367,065	1,626,966	153,140	20,000	486,718	2,860,947	4,920,829
2015	1,367	2,977	52,075	155.8	127.1	33.2	212,979	378,377	1,728,890	153,140	20,000	511,145	3,004,530	5,167,792
2016	1,373	3,064	52,832	155.8	127.1	33.2	213,913	389,434	1,754,022	153,140	20,000	518,756	3,049,266	5,244,738
2017	1,378	3,151	53,587	155.8	127.1	33.2	214,692	400,492	1,779,088	153,140	20,000	526,320	3,093,733	5,321,221
2018	1,384	3,238	54,343	155.8	127.1	33.2	215,627	411,550	1,804,188	153,140	20,000	533,924	3,138,429	5,398,097
2019	1,388	3,325	55,098	155.8	127.1	33.2	216,250	422,608	1,829,254	153,140	20,000	541,457	3,182,709	5,474,259
2020	2,946	6,252	66,335	155.8	127.1	33.2	458,987	794,629	2,202,322	153,140	20,000	743,962	4,373,040	7,521,629
2021	2,936	6,444	67,540	155.8	127.1	33.2	457,429	819,032	2,242,328	153,140	20,000	756,845	4,448,774	7,651,892
2022	2,926	6,636	68,748	155.8	127.1	33.2	455,871	843,436	2,282,434	153,140	20,000	769,751	4,524,631	7,782,365
2023	2,917	6,828	69,905	155.8	127.1	33.2	454,469	867,839	2,320,846	153,140	20,000	782,341	4,598,634	7,909,651
2024	2,906	7,021	71,161	155.8	127.1	33.2	452,755	892,369	2,362,545	153,140	20,000	795,565	4,676,374	8,043,363

[1]High demand customers are customers with very large demand, but relatively few employees. Since they would artificially inflate the overall demand per employee and the resulting demand forecast, their water and employees are treated separately from the regular commerical customers. There are four high demand customers: Shasta, Embassy Suites, Double Tree, and Jorgensen Forge.

[2] Based on a peaking factor of 1.72.

[3] Excludes employees of the 4 high demandl customers.

[4] SF = single family households.

[5] MF = multifamily households.

[6] GDHE = gallons per day per household or employee.

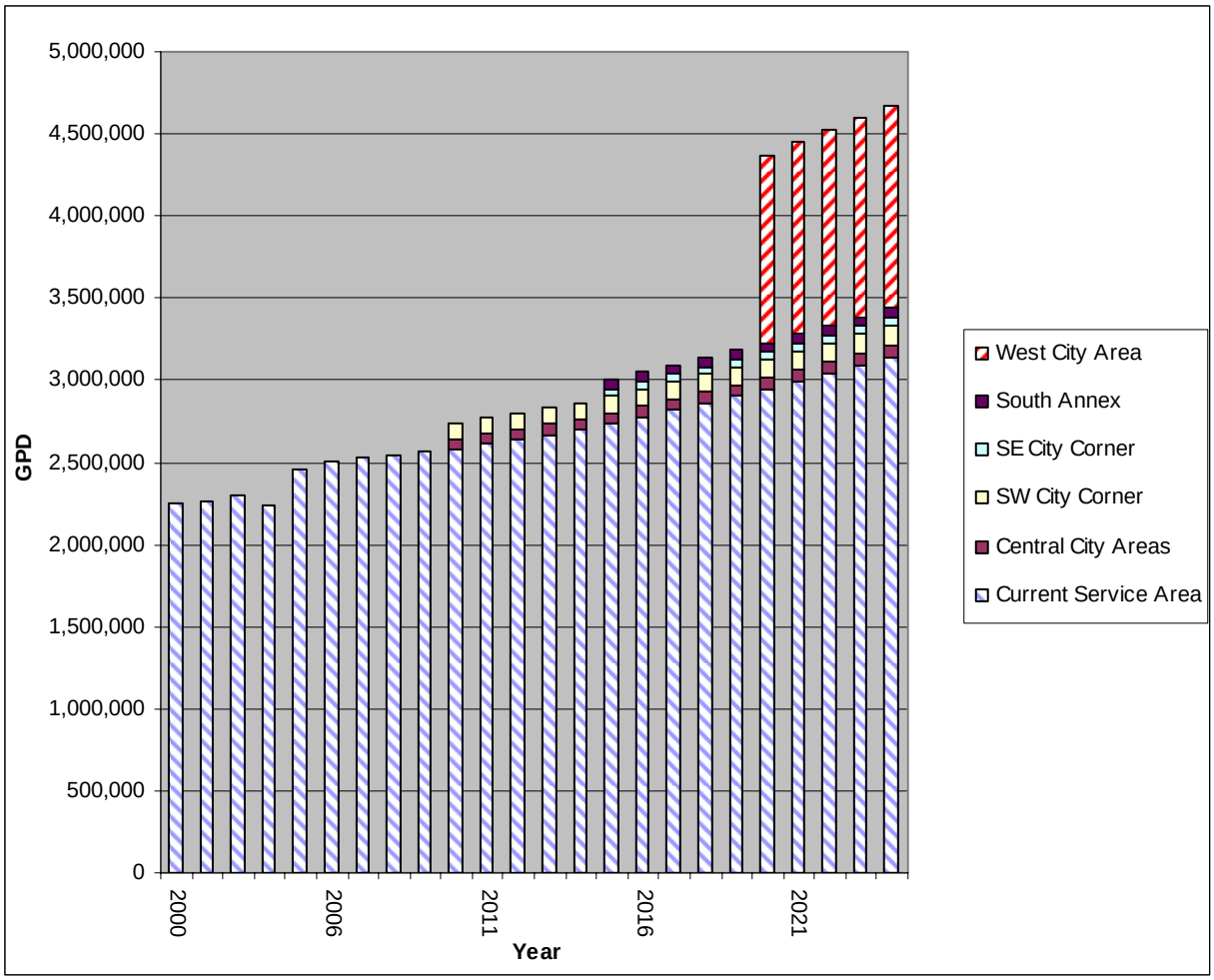


Exhibit 4-6
Potable Water Demand (ADD gpd)
2000-2003 Actual; 2005-2024 Projected

The process for projecting demand involved the following eight steps.

Step 1 Demographic Projections: Demographic projections were generated according to the process described in Section 4.2. It should be noted that the employee demographic numbers in Table 4-13 are slightly less than the numbers presented in Section 4.2. This is because the number of employees from the "commercial-high demand" customer class has been subtracted. As discussed previously, the employees and demand from these customers are backed out and treated separately since these large customers with few employees would artificially inflate the gallons per employee number.

Step 2 Water Use Factors: Water use factors were calculated by dividing the water sales for a customer class by the number of respective households or employees. This was done for the single family, multifamily, and regular commercial customer classes. This results in the number of gallons per day used per household or employee. This water use factor was decreased by

0.5% each year for the first ten years in order to reflect anticipated conservation savings. It was then held constant assuming conservation savings will be more difficult to achieve since easier conservation savings are usually gained first. As shown in Table 4-13, the water use factor for single family households starts at 163.0 gdh in 2005 and decreases to 155.8 gdh by 2014. Similarly, the water use factor for multifamily households starts at 133.0 gdh in 2005 and decreases to 127.1 gdh by 2014. The water use factor for the regular commercial class starts at 35.0 gde in 2005 and decreases to 33.2 gde by 2014.

Step 3 SF, MF, "Commercial-Regular" Demand: The demographics projections (from Step 1) were multiplied by the water use factors (from Step 2) to get the demand for the single family, multifamily, and commercial-regular billing categories. For example, in 2005 the 1,200 single family households are multiplied by the water use factor of 163 gdh to result in 195,600 gpd demand for the single family billing category.

Step 4 "Commercial-High Demand" Customers: The demand for the commercial-high demand customers was calculated separately since these large customers with few employees would otherwise artificially inflate the gallons per day per employee and the resulting demand for the commercial category. The City does not expect any significant changes from the four customers in this category: Shasta, Embassy Suites, Double Tree, and Jorgensen Forge. Therefore, their combined average demand from the last five years (153,140 gpd) was used and held constant over the planning period.

Step 5 Commercial-Future Demand: A block of water for future large commercial customers was added in case a large customer has an unexpected increase in demand or a new large customer is added. The City decided the size of this block of water should be approximately the size of one of their current large commercial customers, Culligan Water Bottling. This amount is 20,000 gpd and is scheduled to begin in 2006.

Step 6 Non-Revenue Demand: The amount of non-revenue water expected was projected by adding the demands projected thus far (from Steps 4-6) and multiplying by a non-revenue water factor. Section 4.3.5 showed that average non-revenue water was 17.0% of water purchases, which equates to 20.5% of water sales. Therefore 20.5% is used as the non-revenue water multiplying factor. For example, 2005 non-revenue water of 418,821 gpd was calculated by multiplying the total projected sales of 2,043,027 by 20.5%.

Step 7 Average Day Demand: The average day demand was calculated by adding the results from Steps 3-6. The average day demand number includes conservation savings, since conservation was factored in to the water use factors, as described in Step 2.

Step 8 Maximum Day Demand: The maximum day demand was calculated by multiplying the average day demand (from Step 7) by the peaking factor. The peaking factor, as discussed in Section 4.3.4, is 1.72. For example, in 2005 the average day demand of 2,461,848 gpd is multiplied by 1.72 to get a maximum day demand of 4,234,379 gpd.

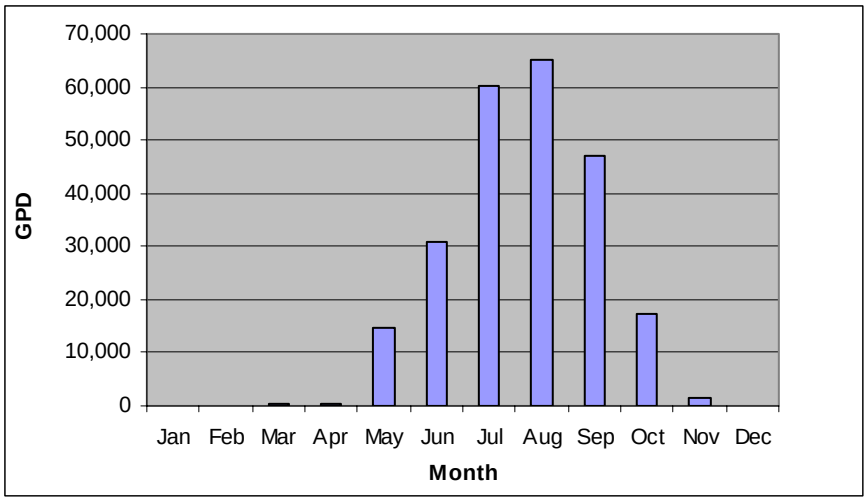
4.4 Reclaimed Water

4.4.1 Reclaimed Water Purchases and Sales

The six most recent years of reclaimed water purchases from King County are shown in Table 4-14. Purchases have ranged from a low of 10,555 gpd in 1999 to a high of 20,336 gpd in 2002. The annual change has ranged from negative 22.1% to positive 37.5%. The average of the most recent three years is shown in the table since these years have been fairly stable and will be used for demand forecasting. The monthly distribution of reclaimed water is very different than that of potable water, as shown in Exhibit 4-7. Reclaimed water is purchased almost exclusively for irrigation of ballfields. Therefore, the purchases are centered on the summer months, with little or no purchases in the non-summer months. Within the summer months, reclaimed water purchases form a bell curve that peaks in August.

Table 4-14
Purchased Reclaimed Water 1998-2003 Average (gpd)

Month	1998	1999	2000	2001	2002	2003	Avg 2001-2003
Jan	0	0	0	0	0	0	0
Feb	0	0	0	0	0	0	0
Mar	0	0	0	1,255	0	0	418
Apr	0	0	249	175	1,247	249	557
May	8,253	1,038	23,770	17,134	11,921	14,479	14,512
Jun	23,864	29,650	13,840	32,617	22,667	37,480	30,921
Jul	25,894	17,255	28,621	47,203	37,622	95,974	60,266
Aug	41,676	36,271	35,185	71,721	81,398	41,918	65,012
Sep	39,998	31,296	24,962	50,447	59,274	31,071	46,931
Oct	20,899	10,739	41,290	9,942	25,170	17,182	17,432
Nov	948	0	4,189	25	2,918	1,696	1,546
Dec	0	0	193	0	0	0	0
Annual Average	13,542	10,555	14,515	19,350	20,336	20,195	19,960
Annual Growth Rate	n/a	-22.1%	37.5%	33.3%	5.1%	-0.7%	n/a



Source: 5-11-04 email from Richard Takechi at the City of Tukwila.

Exhibit 4-7
Monthly Distribution of Purchased Reclaimed Water
2001-2003 Average

Reclaimed water is used for irrigating ballfield parks and streetscapes, as well as for street sweeping. Reclaimed water sales are nearly identical to reclaimed water purchases. There is essentially no non-revenue water for the reclaimed water system. This is not unexpected, since the types of uses that make up non-revenue water, such as water system flushing and leaks, are not common in a reclaimed water system.

4.4.2 Reclaimed Water Projected Demand

Reclaimed water demand was projected by holding the current reclaimed water sales constant into the future, as well as adding in anticipated new customers. This demand projecting process is much simpler than for potable water since reclaimed water is not used for residential purposes, its commercial use is not based on water use factors, and there is no non-revenue component.

Currently, the City sells 19,960 gpd of reclaimed water. By the year 2010, two new reclaimed water customers are expected. The first new customer is the Seattle Rendering Plant which is currently served with potable water by King County Water District 125 (WD 125). Billing records obtained from WD 125 show the demand from this customer to be 59,573 gpd on an average annual basis. The second new customer is the City of Tukwila's golf course which is currently served by a city-owned surface water right. City staff generated an estimate of 99,438 gpd average annual demand, or 167,000 gpd during the main irrigation season of April to October, for the golf course. The results for the projected reclaimed water demand are shown in Exhibit 4-8, which also includes the four most recent years (2000-2003) of actual water purchases.

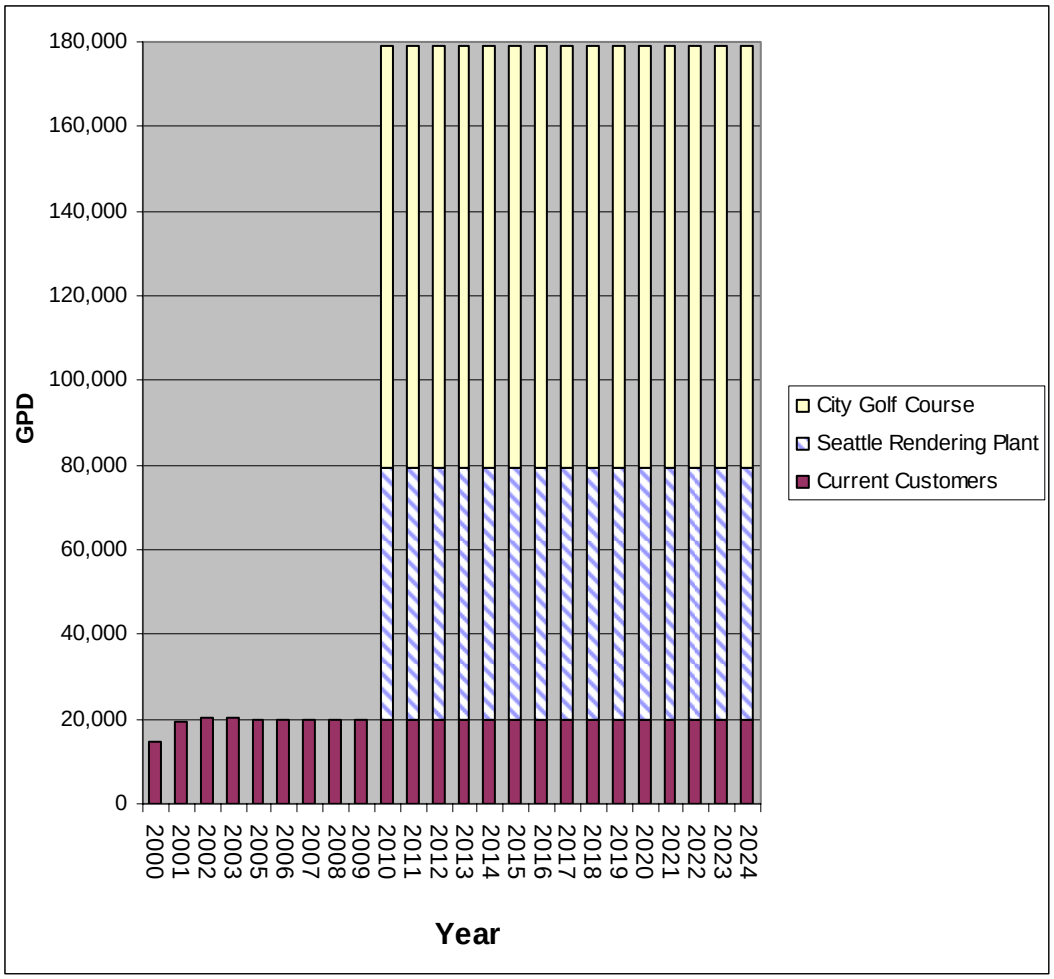


Exhibit 4-8
Reclaimed Water Demand (ADD gpd)
2000-2003 Actual; 2005-2024 Projected

4.5 Raw Water Demand

As discussed in Section 4.4.2 Reclaimed Water Projected Demand, the City has a surface water right on the Green River which it uses to irrigate its public golf course, Foster Golf Links. This source is not metered, but City staff generated an estimate of 99,438 gpd average annual demand, or 167,000 gpd during the main irrigation season of April to October, for the golf course.

4.6 Relationship between Potable, Reclaimed, and Raw Water Demand

It is important to understand the relationship between demands from the potable, reclaimed, and raw water systems. These demands are mutually exclusive, except for two instances.

The Foster Golf Links golf course demand appears in both the raw water demand and the reclaimed water demand. The golf course demand is included in the reclaimed water demand since the City anticipates switching to reclaimed water by 2010. However, the golf course's demand also appears in the raw water demand in the event that this switch does not occur.

Portions of the Seattle Rendering Plant's demand are included in both the potable and reclaimed water demand, and the reclaimed water portion is slightly overstated. The rendering plant is currently served with potable water by King County Water District 125, but is expected to be serviced instead by Tukwila by 2010. Tukwila plans to serve them with reclaimed water for their industrial uses, but will also serve them with potable water for their domestic uses. Therefore, the potable demand includes the plant's domestic use, as represented by their employees included in the PSRC demographic data. The reclaimed water demand includes their entire demand as reported by KCWD 125. Technically, this amount should be reduced by the domestic portion, however, the number of employees was not available to allow for this calculation. This double counting of the plant's domestic use in both potable and reclaimed demand is not a concern since the overstated volume is small and there is not a resource constraint on reclaimed water.

Section 5
Conservation Program

The City of Tukwila has a long standing commitment to water conservation. Historically, Tukwila's conservation program has been administered by the City of Seattle under its 1% Conservation Program since Seattle operates a regional conservation program for all its wholesale customers. In January 2004, Tukwila switched from buying water directly from Seattle to buying Seattle water indirectly through Cascade Water Alliance (Cascade). This also shifted the responsibility of conservation planning and administration from Seattle to Cascade. During 2004, Tukwila operated under Cascade's Transition Water Conservation Program. Cascade's draft Transmission and Supply Plan provides a general framework for its long range conservation program and refinement of that program will occur in 2005.

5.1 Conservation Objectives

Cascade's conservation work is guided by their Conservation Work Group, whose mission is to "produce a regional water conservation program that benefits the ratepayers of Cascade Members and provides long-term sustainability of our water resources." The Conservation Work Group has established the following guiding principles for its conservation program:

- Concentrate efforts on cost-effective and proven conservation measures.
- Emphasize programs that reduce demand during the peak season.
- Work collaboratively with other agencies when appropriate to promote regional conservation.
- Develop programs that provide the most benefit for the greatest number of ratepayers.
- Provide equity among Cascade Members by developing programs that benefit residential, commercial, and institutional customers.
- Continually evaluate and revise program elements for improvement.

5.2 Compliance with Conservation Planning Requirements

Current state conservation requirements are contained in the following DOH documents and have been incorporated into this WSP:

- 1994 Conservation Planning Requirements: Guidelines and Requirements for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology, and Conservation Programs
- 1997 Water System Planning Handbook
- 2004 Municipal Water Law: Interim Planning Guidance For Water System Plan / Small System Management Program Approvals

The State of Washington is currently in the process of revising water conservation planning requirements as a result of the 2003 Municipal Water Law. A preliminary draft conservation rule was released in June 2005 and the final rule was originally intended to be adopted by the end of 2005. In September 2005, DOH announced it will delay adoption until June 2006 in order to address technical issues raised during an informal comment period. The new requirements will be phased in. This Water System Plan is not accountable to the new requirements since it is being submitted prior to final rule language, adoption, and effective date. However, Tukwila intends to be proactive about the new requirements and it is anticipated that Tukwila would meet the substantive requirements of the preliminary draft rule.

Three additional conservation conditions are required of Tukwila, either directly or indirectly, as part of its membership in the Cascade Water Alliance (Cascade):

- **Cascade Interlocal Contract:** Section 7.2 of the contract states, in part, that "Cascade shall develop and carry out, and Members must participate in, water conservation programs that are uniform among Members. The Board shall develop and implement a Cascade conservation management plan that provides a mandatory base conservation program that functions to reduce both average and peak demands….Members that fail to comply with base programs as set forth in Cascade's conservation management plan may be required to assume a disproportionate reduction in water supply or to pay penalty charges, or both."
- **Cascade-Seattle Contract:** Article VI of the contract states that "Each party is committed to the principles of water conservation and each intends to achieve its anticipated savings by implementing water conservation programs either unilaterally or in partnership with other agencies."
- **Cascade Water Right Report of Examination (ROE):** Sections 5.3.20 and 5.3.21 of the ROE require Cascade to prepare a water conservation plan in accordance with DOH's Conservation Planning Requirements.

Table 5-1 lists the conservation requirements for a public water system of Tukwila's size, as well as Tukwila's status regarding those requirements. The requirements are grouped into four categories: public education, technical assistance, system measures, and incentives or other measures. The City of Tukwila strives to meet all these requirements.

Table 5-1 Conservation Requirements for Public Water Systems Serving 1,000-25,000 Connections		
Category	**Item**	**Tukwila Status**
Public Education	**Program Promotion:** Publicize the need for water conservation through media outreach and/or other means.	Historically accomplished through Seattle's 1% Program. Will now be addressed as a part of the Cascade program.
Technical Assistance	**Purveyor Assistance:** Assist wholesale customers to develop and implement conservation programs.	Not applicable. Tukwila does not wholesale water.
	Customer Assistance: Provide assistance and information to customers which facilitate water conservation.	Historically accomplished through Seattle's 1% Program, which will now be addressed as a part of the Cascade program. In addition, City staff meet with customers to help manage irrigation demand.
	Bill Showing Consumption History: Show percentage increase or decrease in water use over the same period from the previous year.	Customer water bills show consumption for the same time period in the previous year.
System Measures	**Source Meters:** Use master source meters for all sources and maintain periodic meter testing and repair program.	All potable water has source meters, which are installed and maintained by Seattle. The raw water from the Green River water right (used for Foster Golf Links irrigation) is not metered.
	Service Meters: Use individual meters for all water uses and maintain periodic meter testing and repair program.	All water users are metered and Tukwila has a meter testing and maintenance program.
	Unaccounted Water / Leak Detection: If unaccounted water is in excess of 20%, conduct a regular and systematic program of finding and repairing leaks.	Unaccounted water is below 20%. Tukwila proactively conducts regular leak detection surveys, with the most recent survey performed in 2003.
Incentives / Other Measures	**Single Family / Multifamily Kit**s: Distribute kits containing easily installed water saving devices to single family and multifamily residences.	Historically accomplished through Seattle's 1% Program. Will now be addressed as a part of the Cascade program.
	Nurseries / Agriculture: Encourage and/or require the use of current technology for large agricultural/irrigation operations.	Not applicable. Tukwila does not have large scale nurseries or agriculture.
	Landscape Management / Playfields: Promote low water demand landscaping in all retail customer classes.	Historically accomplished through Seattle's 1% Program, which will now be addressed as a part of the Cascade program. Tukwila uses reclaimed water for several public ballfields and streetscapes and is exploring using reclaimed water on a public golf course. City staff meet with customers to help manage irrigation demand.
	Conservation Pricing: Use a rate structure that provides economic incentives to conserve water.	Tukwila uses seasonal rates, which is a recognized conservation pricing technique.

The general framework for Cascade's conservation program is provided in the draft conservation chapter of Cascade's Transmission and Supply Plan. Details and refinement of that program will occur in 2005. The program measures are anticipated to be similar to the conservation activities

pursued in recent years. There will be an increased emphasis on reducing peak season demand through irrigation efficiency programs and public education. The proposed savings goal of the Cascade conservation program is a five percent reduction in Cascade's 2010 average daily demand.

5.3 Water Conservation History

As previously stated, Tukwila participated in Seattle's 1% Water Conservation Program through Year 2003. The 1% program began in 2000 for Seattle's purveyors, although previous conservation programs existed prior to 2000. The 1% Program is a comprehensive program that reaches every sector and promotes both equipment upgrades and behavior changes. Table 5-2 provides an overview of the 2003 program components for the residential indoor, residential outdoor, commercial indoor, and commercial outdoor sectors, as well as general customer outreach. The programs are described in more detail below, including participation in these programs by Tukwila'customers.

Table 5-2
Conservation Programs Offered Through Seattle's 2003 1% Program

Sector	Program
Residential Indoor	Washing machine rebates
	Toilet rebates
	Free showerheads
	Free faucet aerators
Residential Outdoor	Irrigation system audits
	Irrigation system equipment rebates
	Public & professional outreach: Northwest Yard Days, nursery partnerships, Natural Lawn & Garden hotline, professional workshops.
Commercial Indoor	Rebates for domestic uses (toilets, etc)
	Rebates for non-domestic uses (laundry, ice machines, cooling, process, etc)
Commercial Outdoor	Irrigation system audits
	Irrigation system equipment rebates
General Customer Outreach and Youth Education	Print, radio, bus, website, community festivals, youth education.

5.3.1 Residential Indoor

In the residential indoor sector, the program focuses on reducing indoor water use by both single family and multifamily customers. Program information is provided to customers through targeted and regional print, radio and transit advertising; point of purchase materials at retailers; and direct contact with customers. Washing machine rebates of $50-$100 were offered to customers purchasing qualified efficient machines. 123 rebates have been issued to Tukwila customers since the program inception in 2000. Toilet rebates of $60-$125 have been offered to single family and multifamily customers, with a focus on multifamily customers in 2003. The total number of rebates in Tukwila is not available. Free showerheads and bathroom faucet aerators have been distributed, although the quantity distributed in Tukwila is not available.

5.3.2 Residential Outdoor

In the residential outdoor sector, the program focuses on outdoor water use by both single family and multifamily customers. Program information is provided to customers through targeted and regional print and radio advertising, point of purchase materials at retailers, direct contact with customers, and training of industry professionals. Irrigation system audits and equipment rebates were offered to encourage customers to keep irrigation systems operating as efficiently as possible. While this program was promoted in all Seattle water purveyor areas, no Tukwila customers participated in this program in 2003. Extensive public and professional outreach has been conducted related to outdoor watering. In 2003, this included nearly 100 ads in 18 newspapers featuring the Better Way To Beautiful campaign, over 300 Better Way To Beautiful radio ads on KING FM and KPLU FM, the Northwest Natural Yard Days promotion including discounted water smart gardening supplies, brochure distribution through nursery partnerships, the Natural Lawn & Garden Hotline, and staff training to over 200 nursery professionals. These efforts include the Tukwila market.

5.3.3 Commercial Indoor

The Water Smart Technology program provides free 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, installing high efficiency commercial clothes washers, upgrading air compressors and other medical equipment, process water recycling and reuse, cooling tower improvements, and other water use efficiency technology. Financial incentives provide standard rebates or custom incentives of up to 50% of the installed cost of any cost-effective conservation measure. The amount of Water Smart Technology programming performed in Tukwila since the program inception is unknown.

5.3.4 Commercial Outdoor

In the commercial outdoor sector, the program focuses on irrigation efficiency for commercial, industrial, and institutional customers. Conservation opportunities include improved irrigation controls and scheduling; upgraded system components; and soil amendment and plant selection. No-obligation professional site audits are offered and are accompanied by financial incentives when cost-effective. In 2003, audits were performed at three Tukwila customers.

5.3.5 General Customer Outreach and Youth Education

In addition to program-specific outreach, the 1% program promoted general conservation messaging intended to continue to build and reinforce a water conservation ethic among customers. This included promoting a conservation website (www.savingwater.org) and financially supporting the Water Use It Wisely regional radio campaign sponsored by the Water Conservation Coalition of Puget Sound. Youth education efforts included free distribution of conservation kits, posters, and shower timers; developing web-based education programs; advertising during children's television programming; and staffing booths at children's events.

5.4 Effects of Conservation on System Demand

Conservation has reduced Tukwila's water demand in the past and will continue to do so in the future. Seattle's 1% program has documented saving 4.9 mgd since 2003 throughout the total program service area, including Tukwila. The exact savings in Tukwila are not available.

The demand forecast presented in Section 5 includes conservation savings. These savings were incorporated by assuming a 0.5% per household or employee reduction in water use for each of the first 10 years of this water system plan. A more conservative reduction was used compared to previous conservation planning (0.5% compared to 1%) in the event that transferring conservation program administration from Seattle to Cascade results in less savings due to changes in economies of scale or other factors. While Tukwila will continue conservation programs in years 11-20, those savings are not incorporated into the demand forecast in order to plan conservatively. This is based on the reality that future conservation will presumably be harder to achieve since easier conservation savings are generally undertaken first, leaving harder conservation savings for later years.

Section 6
Water Rights, Source of Supply, and System Reliability

6.1 Water Rights

Under the Interlocal Agreement among the eight Members of Cascade, Cascade is to provide a full supply commitment to Tukwila. See Section 3.1.1 for further discussion of the full water supply commitment.

In the past, Tukwila purchased water under contract from Seattle Public Utilities. This supply was supported by Seattle's water rights in the Cedar River Basin, South Fork Tolt River Basin, and Highline Wellfield. As of January 1, 2004, Tukwila receives this supply under a different contract arrangement. As a Member of Cascade Water Alliance (Cascade) Tukwila has entered into an interlocal agreement with the seven other Members. These Members, acting collectively as Cascade, have a contract with Seattle for delivery of water. This contract is structured as a declining block contract, with the first block of 30.3 mgd extending to December 31, 2023. A copy of the contract is included as Appendix O. This supply relies on Seattle's water rights described above.

Cascade is also in the process of negotiating a water supply agreement with Tacoma Public Utilities for delivery of water from the Green River Basin related to Tacoma's Second Supply Project. Under the agreement, Tacoma will supply Cascade with 15 mgd average day demand (20 mgd maximum day demand) beginning in 2006 through December 2025. This arrangement will be supported by Tacoma's water rights in the Green River Basin.

In addition to these supplies, Cascade is in the process of acquiring a water right from Puget Sound Energy (PSE) for water from Lake Tapps, located in Pierce County. Ecology issued a Report of Examination for this water right in June 30, 2003. The Muckleshoot and Puyallup Tribes, as well as the City of Auburn, filed a lawsuit challenging issuance of the water right, and the ROE has been remanded to Ecology. At this time Tukwila anticipates that issues related to the remand can be resolved successfully and that Cascade has a high probability of acquiring the Lake Tapps water right for municipal use. This will further augment water rights available to support water supply from Cascade.

Tukwila does hold one water right of its own. This is a certificate for use of surface water from the Green River. Tukwila uses this water for irrigation of the Foster Golf Links. The water right is for 104.0 maximum acre feet per year, which translates to 34 mg or 0.09 mgd on an average annual basis. Existing (2005) and forecasted (2024) consumption at the golf course is estimated to be 37 mg or 0.10 mgd on an average annual basis. This results in a water right deficit of 3 mg or 0.01 mgd on an average annual basis. The City plans to augment irrigation at the Foster Golf Links with reclaimed water, which will contribute towards eliminating this deficit.

A summary of this water rights information is provided in Table 6-1, which is adapted from DOH's Water System Planning Handbook.

Table 6-1
Water Rights Status

Time Period and Water Right Ownership	Permit, Certificate or Claim #	Name of Rightholder or Claimant	Priority Date	Source Name / Number	Primary or Supplemental	Water Rights - Annual Volume Qa (mg)	Consumption - Annual Volume (mg)	Water Right Excess/Deficit - Annual Volume Qa (mg)
Existing (2005)								
Own Supply	S1-23433C	City of Tukwila	7/11/1979	Green River	Primary	34 [1]	37 [2]	-3 [3]
Intertie	City of Seattle (CWA block contract)					n/a [4]	898 [5]	n/a [4]
Intertie	City of Tacoma (pending CWA block contract)					n/a [4]		
Forecasted (2024)								
Own Supply	S1-23433C	City of Tukwila	7/11/1979	Green River	Primary	34 [1]	37 [2]	-3 [3]
Intertie	City of Seattle (CWA block contract)					n/a [4]	1,708 [6]	n/a [4]
Intertie	City of Tacoma (pending CWA block contract)					n/a [4]		

[1] Equates to 104 acre feet per year and 0.09 mgd.
[2] Equates to 0.10 mgd.
[3] Equates to -0.01 mgd. This deficit will be addressed by Tukwila's plans to augment raw water use at the Foster Golf Links with reclaimed water.
[4] Tukwila accesses these water rights through its membership in the Cascade Water Alliance. These water rights and CWA's "full supply commitment", which explain that Tukwila's consumption is covered by water rights, is described in the text of Section 6.1.
[5] Equates to 2.46 mgd.
[6] Equates to 4.68 mgd.

6.2 Source of Supply Analysis

A source of supply analysis is required by DOH for water systems that will be pursuing water rights within 20 years to meet the demand forecast. Collectively, Tukwila's own water right and its arrangements for a full supply commitment from Cascade are adequate to meet needs for the next 20 years. Therefore a source of supply analysis is not technically required of Tukwila. However, the following information is provided relevant to the alternative sources of supply suggested by DOH:

- **Enhanced Conservation Measures:**

  The conservation program under which Tukwila operates is in transition from management by the City of Seattle to management by Cascade Water Alliance. The exact content of the new conservation program is currently under development. The proposed savings goal of the Cascade conservation program is a five percent reduction in Cascade's 2010 average daily demand. For further information, see Section 5.

- **Water Right Changes:**

  See discussion of water rights above.

- **Interties:**

  Tukwila has several continuous supply interties with City of Seattle transmission pipelines. As Tukwila's access to Seattle water is decreased per the Seattle/Cascade 50 year declining block contract, Cascade will provide water from alternative sources. Use of the existing interties with Seattle may be continued or discontinued, depending on exact supply arrangements from Cascade.

  Tukwila's emergency interties with the City of Seattle, King County Water District 125, Highline Water District, and the City of Renton are expected to remain as emergency interties only. It should be noted that Tukwila's emergency intertie to SPU's distribution system is different than the continuous supply interties to SPU's transmission pipelines discussed above. Discussions are underway, as part of Tukwila's membership in Cascade, to potentially convert Tukwila's current emergency intertie with the City of Kent to a continuous supply intertie.

- **Artificial Recharge**:

  No artificial recharge programs are expected.

- **Use of Reclaimed Water:**

  Tukwila considers reclaimed water a valuable component of its water supply strategy. The City has been using Class A reclaimed water from King County's Renton Treatment Plant (reclamation permit number WA-002958-1) since 1998. A supply line extends from the treatment plant to Fort Dent Park in Tukwila. The reclaimed water is used primarily for irrigation of ball fields, as well as a few minor uses such as street sweeping.

  Tukwila is examining strategies to increase its use of reclaimed water. While opportunities certainly exist, they are constrained by the combination of distribution issues (building new pipelines since the reclaimed system is separate from the potable system) and finding customers with large non-potable water needs. Therefore, ideal candidates are customers with large non-potable needs located near the current reclaimed water pipeline. Typical candidates for reclaimed water in any community include large water customers and irrigation customers. Tukwila has reviewed possibilities for reclaimed water use at its ten largest water customers (identified in Section 4.3.3) and its irrigation customers. None of the large customers are strong candidates for reclaimed water due to location and their need for potable water. Two strong possibilities for reclaimed water do exist. The first is irrigation at the Foster Golf Links. The City is planning to use reclaimed water to help offset demand from its water right on the Green River which is currently the sole source of irrigation for the golf course. The second strong reclaimed water possibility is the Seattle Rendering Plant. The plant is currently served potable water from King County Water District 125, however, it is scheduled to be served by Tukwila in approximately 2010. The City is in discussions with the plant to determine the feasibility of using reclaimed water.

- **Treatment:**

  No treatment changes are expected.

6.3 Water System Reliability

The reliability of Tukwila's water system is based on its water right adequacy, source reliability (including a water shortage response plan), facility reliability, and interties. Each of these issues is discussed below.

Tukwila has access, via Cascade Water Alliance, to sufficient water rights to meet projected demand throughout the 20 year planning period of this water system plan. Details of this water rights adequacy is discussed in Section 6.1. That section discusses Cascade's "full supply commitment" to Tukwila which ensures Tukwila will have sufficient supply back by water rights.

Tukwila's source reliability is tied to its current ultimate source of supply, the City of Seattle, since Cascade's current primary source of water is its block contract with Seattle. Seattle's system is flexible and redundant. Seattle has the capability to draw from three sources: the Cedar River watershed, the Tolt River watershed, and the Highline Wellfields. This is particularly helpful in the event of an emergency such as a pipeline break or earthquake. Seattle also maintains emergency interties with other systems for backup.

Seattle has a Water Shortage Contingency Plan, which Tukwila would rely on in the case of a water shortage. The plan can be found in Appendix P. It should be noted that a water shortage response plan is distinct from a water conservation plan, primarily in the purpose and time frame involved. A water shortage response plan provides guidelines to manage water supply and demand during short term supply disruptions, such as a pipeline break or drought. A water conservation plan addresses long term demand management and sound water resource management. The SPU water shortage response plan discusses operating actions and communication strategies for both a phased curtailment (such as affiliated with a drought) and an immediate curtailment (such as affiliated with a pipeline break). A partial list of the operating actions and communication strategies includes:

- Intensify data collection and computer modeling;
- Eliminate non-essential supply side uses such as flushing and reservoir overflows;
- Request and/or require the elimination and/or reduction of non-essential demand side uses such as non-recirculating fountains, vehicle washing, fire fighting training, and irrigation;
- Activate interties to increase supply availability;
- Request that purveyors with alternative sources use them;
- Brief elected officials;
- Create an internal shortage advisory team;
- Initiate a major public outreach campaign;
- Consult with major customer groups.

Facility reliability with respect to storage and hydraulic capacity is analyzed in detail in Section 7. The storage capacity analysis, presented in Section 7.2, indicates there is sufficient storage capacity, as provided by the SPU transmission mains and storage. The hydraulic analysis, presented in Section 7.1, entailed modeling several scenarios to determine if sufficient water pressure is present to meet maximum day demand plus fire flows, as well as to meet peak hour demand, throughout the planning period. The modeling results found that the peak hour demand is sufficiently met through 2024. The modeling results found that maximum day demand plus fire flow was not always met and resulted in a total of 13 system improvement recommendations. Those improvements are discussed in Section 7 and are also included in the Capital Improvement Plan in Section 10.

Another facility reliability issue is that Tukwila's distribution system is well looped. This provides flexibility in the event of the loss of a particular pipeline.

Tukwila's emergency interties contribute towards system reliability since they can serve as sources of supply if Tukwila's own sources were to be compromised. Tukwila maintains emergency interties with the City of Seattle, King County Water District 125, Highline Water District, the City of Renton, and the City of Kent. These interties are discussed in detail in Section 2.9. It is important to note that three of these interties (Kent, Renton, and Highline) have sources that are independent of the Seattle system. Therefore, if a major catastrophe were to debilitate the Seattle system, Tukwila would still have access to water.

Section 7
System Analysis

This section presents analysis of the City of Tukwila's water system. Hydraulic modeling was performed to evaluate the adequacy of existing facilities for conveying current and future flows, and to aid in determining improvements that would ensure future viability of the distribution system.

7.1 Hydraulic Analysis

7.1.1 Methodology

Tukwila's water system was analyzed using the stand-alone version of the hydraulic modeling software program, WaterCAD, version 3.1. The model was obtained from Tukwila and modified to include new pipes that have been installed since the model was last updated. The WaterCAD software is a Microsoft Windows-based program that has the capability of operating as a stand-alone, or could interface with AutoCAD to enter all of the system properties and display them on the monitor as an AutoCAD drawing file.

The water system model was created by Gray & Osborne, Inc. for the 1999 WSP. This model was then modified to include system upgrades that have occurred since the model was first created. Details related to the construction of the model (i.e., a list of pipes (Appendix Q) and nodes (Appendix R), and a system map, (Appendix S) are provided in the appendices.

To accurately reflect the configuration of the existing distribution system, six pressure zones were evaluated, the 320, 340, 360, 380, 400 and 465 pressure zones. The storage facility and booster pump station, as presented in earlier sections of this plan is located in the 400 Zone.

Each pressure zone was apportioned a percentage of the total water demand based on the area served by each zone, with the exception of the 10 largest potable water customers listed in Table 4-7. The total demands projected in Section 4.3.6 were broken out by the City's six pressure zones for each of the customer categories. The demands for the 10 largest potable water customers were assigned to the appropriate nodes in the particular zone in which they are located, while the remaining demands were distributed evenly among all of the nodes in each particular zone. Table 7-1 shows the largest potable water customers and the pressure zones in which they are located, and Table 7-2 shows the forecasted demographics and potable water demands by customer categories and pressure zones.

Table 7-1 Largest Potable Water Customers						
Pressure Zone	**Customer Category**	**Customer**	**Service Address**	**2005 ADD[1] (gpd)**	**2010 ADD (gpd)**	**2024 ADD (gpd)**
PZ 320	Commercial	Jorgensen Forge	8531 E Marginal Way S	18,295	18,295	18,295
PZ 320	Commercial	Boeing PSAM 12-0380	9797 E Marginal Way S	40,516	40,516	40,516
PZ 360	Commercial	Associated Grocers	3301 S Norfolk St	17,377	17,377	17,377
PZ 360	Commercial	Boeing PSAM 12-0370	2401 S 98th St	37,192	37,192	37,192
PZ 360	Multifamily	Canyon Estates Condo[2]	15200 65th Ave S	32,029	36,263	46,734
PZ 360	Commercial	Southcenter Mall	633 Southcenter Pkwy	64,111	64,111	64,111
PZ 360	Commercial	Double Tree	16500 Southcenter Pkwy	30,167	30,167	30,167
PZ 360	Commercial	Costco	1162 Costco Dr	22,330	22,330	22,330
PZ 360	Commercial	Embassy Suites	15920 W Valley Hwy	32,839	32,839	32,839
PZ 360	Commercial	Shasta Beverage	1227 Andover Park E	71,839	71,839	71,839
Total				366,696	370,929	381,401

1. Source: Billing system printouts provided by the City of Tukwila from 1999 to 2003.
2. Canyon Estates Condo is a residential customer, and demands are projected to increase over time with increase in population. The demands for the remaining customers are not anticipated to change over the planning period and therefore are held constant over the planning period.

Pressure is the primary hydraulic parameter analyzed via computer modeling to identify system deficiencies. The target minimum system operating pressure is 30 pounds per square inch (psi) during peak hour demand (PHD) conditions with equalizing storage depleted. During fire flow conditions, a residual pressure of 20 psi (with equalizing and fire flow storage depleted) must be maintained throughout the analyzed pressure zone under maximum day demand (MDD).

The general methodology of this hydraulic modeling analysis was to examine the current distribution system during various demand and fire flow conditions. According to the above pressure criteria, deficiencies were noted and distribution system improvements proposed. Further analysis was performed to verify that additional improvements associated with growth of the City meet the minimum distribution system criteria. All distribution system improvements, relating either to remedy of current deficiencies or accommodation of future growth are presented in Section 10.

Table 7-2
Potable Water Projected Demand by Pressure Zone (for existing service area only)

Year	Demographics			Average Day Demand (ADD gpd)										Maximum Day Demand (MDD gpd) [2]
	SF HH	MF HH	Employment[3]	SF	MF - Regular[4]	MF - Canyon Estates[4]	Commercial - Regular[1]	Commercial - Largest[1]	Commercial - Future Block	Subtotal	%	Non-Revenue	Total	
2005 total	1,200	2,049	40,622	195,600	240,488	32,029	1,240,244	334,667	0	2,043,027		418,821	2,461,848	4,234,379
PZ 320	1	0	7,196	163	0	0	251,860	58,811	0	310,834	15%	63,721	374,555	644,235
PZ 340	95	23	290	15,485	3,059	0	10,150	0	0	28,694	1%	5,882	34,576	59,471
PZ 465	48	12	145	7,824	1,596	0	5,075	0	0	14,495	1%	2,971	17,466	30,042
PZ 400	64	179	543	10,432	23,807	0	19,005	0	0	53,244	3%	10,915	64,159	110,354
PZ 380	72	141	155	11,736	18,753	0	5,425	0	0	35,914	2%	7,362	43,276	74,435
PZ 360	920	1,694	32,293	149,960	193,273	32,029	948,729	275,855	0	1,599,846	78%	327,969	1,927,815	3,315,841
2010 total	1,308	2,540	46,035	207,972	292,667	36,263	1,383,664	334,667	20,000	2,275,232		466,422	2,741,654	4,715,646
PZ 320	1	0	6,859	159	0	0	233,206	58,811	0	292,176	13%	59,896	352,072	605,564
PZ 340	105	31	335	16,695	4,015	0	11,390	0	0	32,100	1%	6,580	38,680	66,529
PZ 465	53	16	168	8,427	2,072	0	5,712	0	0	16,211	1%	3,323	19,534	33,599
PZ 400	62	203	615	9,858	26,289	0	20,910	0	0	57,057	3%	11,697	68,753	118,255
PZ 380	71	175	178	11,289	22,663	0	6,052	0	0	40,004	2%	8,201	48,204	82,911
PZ 360	1,016	2,115	37,880	161,544	237,630	36,263	1,106,394	275,855	20,000	1,837,686	81%	376,725	2,214,411	3,808,786
2024 total	2,906	7,021	71,161	452,755	845,635	46,734	2,181,019	334,667	20,000	3,880,809		795,565	4,676,374	8,043,364
PZ 320	2	0	7,168	312	0	0	237,978	58,811	0	297,101	8%	60,906	358,006	615,770
PZ 340	130	66	443	20,254	8,389	0	14,708	0	0	43,350	1%	8,887	52,237	89,848
PZ 465	65	33	221	10,127	4,194	0	7,337	0	0	21,659	1%	4,440	26,098	44,889
PZ 400	53	296	811	8,257	37,622	0	26,925	0	0	72,804	2%	14,925	87,729	150,894
PZ 380	69	285	260	10,750	36,224	0	8,632	0	0	55,606	1%	11,399	67,005	115,248
PZ 360	2,587	6,341	62,258	403,055	759,207	46,734	1,885,439	275,855	20,000	3,390,290	87%	695,009	4,085,299	7,026,714

1. The 9 largest commercial customers are separated from the regular commercial customers. It should be note that the "Commercial - 9 Largest" category is not the same as the "Commercial - High Demand" category used elsewhere in this WSP. The "Commercial - High Demand" category contains only 4 of the 9 largest commercial customers.
2. Based on a peaking factor of 1.72.
3. Excludes employees of the 4 high demand customers: Shasta, Embassy Suites, Double Tree, and Jorgensen Forge.
4. Canyon Estates Condo is separated from the rest of MF since it has a very large demand.

7.1.2 Calibration

Model calibration was conducted by comparing the results of actual fire hydrant flow tests with results generated by the model at the same locations. The City has performed a number of hydrant flow tests throughout the system to determine flow and static and residual pressure in known segments of pipe. For the model analysis, a single "snapshot" computer simulation was used which calculates flow throughout the system for a single point in time. This simulation assumes that the system reaches equilibrium with respect to flows instantaneously. The pressures resulting from the model run were compared with the static and residual pressures associated with the hydrant tests to determine the accuracy of the model. Successful calibration of the static pressure indicates that the network components are operating correctly, demand is appropriately allocated, and the reservoir levels are correct. Successful calibration of the residual pressure indicates that the pipe roughness coefficients are set at the appropriate levels, similar to actual conditions.

Eleven (11) hydrant flow tests that covered the 340, 360, 380 and 400 pressure zones were used for calibration purposes in this modeling exercise. Table 7-3 shows the results of each hydrant flow test along with the results of the model simulations at each location.

For all the hydrant flow tests, the calculated values of the model in the static condition corresponded well with the field measurements. In all but one of the cases, the calculated static pressure is within 6.5 psi of the field measurement, indicating that the model network components are operating reasonably accurately and that the current water system demand is being appropriately modeled. In some cases the modeled pressure is higher and in some cases lower than the field measurement. Additional work to bring one set more in line would only worsen the other. The average net difference between the modeled static pressure and the field static pressure is 0.2 psi.

The calculated static pressure at a private hydrant at the north-east corner of Costco Wholesale is 12.57 psi lower than the field measurement. However, the City staff present at the time of the testing recalls that the static pressure at the time of testing did seem to be unusually low and the test was done in 1998. There has been significant new development in that area since the test. Variances between measured and modeled static pressures are likely due to the fact that all demands were apportioned evenly throughout pressure zones with the exception of the 10 largest water customers.

The difference in the drop in pressure (i.e., static minus residual) between the field measurements and the calculated model results is less than 9 psi in all cases except at Hydrant #242 on Cascade Avenue S., located at the south-east City limit of Tukwila. Any adjustments to the friction factors to improve calibration at this location would offset calibration for another. Pressure drops in the majority of the hydrants are close between field and model. As with static, some modeled pressure drops are greater than the field and some smaller. The average net difference is approximately 2.5 psi. The differences between field and model results can be attributed to a number of factors: closed (or open) line valves that are not included in the model, inaccurate pipe friction factors or misappropriation of pressure zone demands in the model.

Table 7-3 City of Tukwila – Calibration Data									
Flow Test ID (Zone)	**Date of Flowtest**	**Location Description**	**Node ID**	**Hydrant Flow (gpm)**	**Static Pressure (psi)**	**Residual Pressure (psi)**	**Static Pressure (psi)[1]**	**Residual Pressure (psi)[2]**	**Difference in Pressure Drop (psi)[3]**
					Field Measurement		**Model Value**		
1 (340 Zone)	-	104th Pl. at 47th Ave. S	Flow: Hydrant-360 Test: Hydrant-360	1,037	72	34	70.8	35.6	2.8
2 (360 Zone)	1991	Andover Park West and Baker Blvd. (Acura of Seattle)	Flow: Calib Acura Test: Calib Acura	4,828	149	113	144.7	113.6	5.0
3 (360 Zone)	-	Tukwila Parkway and Christensen Rd. (Eagle Hardware)	Flow: Calib Eagle Test: Calib Eagle	3,605	140	127	144.7	128.8	-2.8
4 (360 Zone)	04/07/95	Southcenter Mall at Sears	Flow: SC-Hyd221 Test: SC-Hyd221	1,750	150	139	144.7	138.6	4.8
5 (360 Zone)	11/06/97	Interurban Ave. S and Gateway Dr.	Flow: Hyd-1 Test: Hyd-2	1,900	153	140	151.6	144.8	6.3
6 (360 Zone)	02/23/98	Cascade Ave. S and S Glacier St.	Flow: Hyd-242 Test: Hyd-241	1,750	155	122	151	128.9	10.8
7 (360 Zone)	02/23/98	Andover Park E (north-east corner of Costco Wholesale)	Flow: Calib Costco Test: J-329	2,466	132	108	144.6	120.6	0.0
8 (360 Zone)	05/28/03	Fort Dent Park	Flow: Calib Ft. Dent Test: Calib Ent. Ft. Dent	990	142	132	142.5	127.9	-4.5
9 (360 Zone)	06/27/04	Southcenter Parkway (Levitz Furniture Corporation)	Flow: Calib Levitz Test: Calib Levitz	3,037	146	93	146.8	92.5	-1.3
10 (380 Zone)	11/06/97	Crystal Springs Park	Flow: Hyd-112B Test: Hyd-112B	1,107	74	58	69.3	58	4.7
11 (400 Zone)	04/07/95	62nd Ave. S and S 153rd St.	Flow: Hyd-62 Test: Hyd-62	1,048	60	45	64.6	50	0.4

1. Average Day Demand was used to determine static pressures under the above-mentioned operating conditions.
2. Average Day Demand with hydrant flow was used to determine residual pressures.
3. Difference in Pressure Drop = (Static Pressure – Residual Pressure)$_{field}$ - (Static Pressure – Residual Pressure)$_{model}$

Calibration is sufficient for planning purposes, but will need additional work if the model is to be used for detailed localized design projects.

7.1.3 Modeling Scenarios

The WaterCAD model was constructed with a number of different modeling scenarios to reflect system demands and piping configurations in year 2004. This section presents a description of the general setup of the modeling conditions, followed by discussion of the modeling results.

7.1.4 General Setup

Some modeling scenarios were run as extended period simulations (EPS), meaning that they were evaluated under diurnal operation requirements. This incorporates demand variations that exist during the course of a 24-hour period and aids in identifying deficiencies in the ability to fill reservoirs during peak day conditions. The diurnal curve used for the extended period simulations is assumed to be equivalent to the diurnal demand curve in the 1991 WSP, prepared by Horton Dennis & Associates, Inc. The equivalent diurnal curve is shown in Exhibit 7-1. A value of 1.0 equals the average demand on the day of concern.

Scenarios not noted as extended period simulations were run as steady-state, evaluating the system at a single point in time. This method is used primarily for investigating fire flow conditions. In the following discussion of modeling results, comparisons are made between fire flow goals and available fire flow. Fire flow goals represent the applicable fire flow requirement as set by the City Fire Department. In general, the City meets the fire flow goals in the future with implementation of the capital improvements listed in Section 10. Appendix T presents a comparison of modeled fire flows with fire flow goals under modeled scenarios for 2005 and 2025. In each case, it has been assumed that projected capital improvement projects have been built.

Available fire flow is the amount of water that can be withdrawn from a single hydrant without dropping pressure throughout the zone to less than 20 psi. Thus, a pressure somewhat remote from the flowing hydrant (but in the same pressure zone) could limit available fire flow. Fire flow simulations assume that water levels in storage reservoirs are set with equalizing and fire flow storage fully depleted.

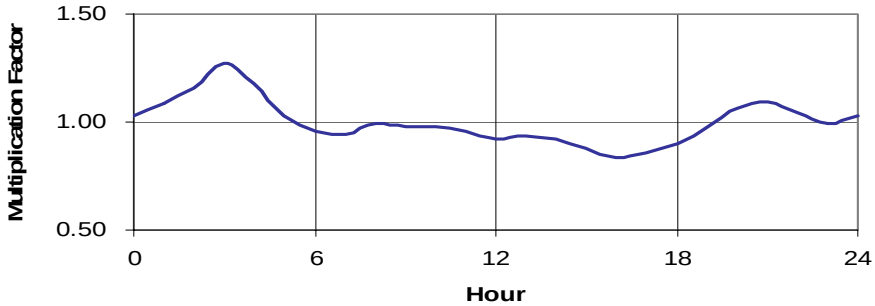


Exhibit 7-1
City of Tukwila's Diurnal Curve based on 1991 WSP

7.1.5 Modeling Results

The City provided a list of capital improvements that are in progress of design or are currently being proposed for the 2005 to 2010 time frame. These improvements were entered into the model base prior to analysis and will be shown in the Capital Improvement listing in Section 10, if they have not been funded as yet. The following scenarios assume that the capital improvements identified by the City have been completed and any improvements listed are in addition to those.

Scenario 1 – Fire Flow Analysis, 2005 Demands

For this scenario, the existing distribution system is evaluated under present conditions (i.e., year 2005 maximum day demands and current fire flow requirements). Fire flow requirements for this stage of modeling generally consisted of 1,000 gpm at each node in residential areas and 1,500 gpm at each node in commercial areas, except for specific areas of the City where higher flows are required. The fire flow requirements are listed in Table 7-4. Reservoir levels assume equalizing and fire flow storage are fully depleted, i.e. the conditions at the end of the 1 hour fire flow.

Table 7-4
Fire Flow Requirements[1]

Area/Neighborhood	Description	Pressure Zone	Range of Fire Flow Required (gpm)
Residential Areas	General	All	1,000
Commercial Areas	General	All	1,500
North Boeing Field	Bounded by the north city limits, East Marginal Way S, and the Duwamish River.	PZ 320/ PZ 360	3,000 to 4,000
Boeing PSAM 12-0380	East marginal way, north of S. Norfolk St.	PZ 320	13,000
Foster (Gateway Plaza)	East of Interurban Ave. S. to the Green River between 42nd Ave. S. and Martin Luther King Jr. Way S.	PZ 360	2,000 to 3,000
Tukwila Hill (North end)	West of Interurban Ave. S., bounded by 52nd Ave. S., 53rd Ave. S., and S. 139th St.	PZ 360	3,000
Tukwila Hill (Commercial area)	East of Interurban Ave. S. to the Green River between S. 139th St. and S. 144th St.	PZ 360	3,000 to 4,000
Tukwila Hill (Canyon Estates)	East of 65th Ave. S. between S. 151st St. and S. 153rd St.	PZ 360	3,000 to 4,000
Central Business District	Bounded by the area just north of Southcenter Blvd, West Valley Highway, S. 180th ST. and Southcenter Parkway.	PZ 360	4,500 to 8,000

1. *As provided by City of Tukwila Fire Department.*

The modeling for this scenario resulted in a number of nodes unable to meet the fire flow requirements. In some of the cases water lines less than 8-inches in diameter were feeding junction nodes on "dead-end" lines. Water lines of this size are physically unable to supply 1,000 gpm, therefore these nodes are classified as deficient. There were 12 such nodes scattered throughout the different pressure zones. The remainder of the analysis excludes these "dead-end" lines.

There were 24 nodes where the required fire flow was not met. Of these, 2 of the nodes were in the north end of the City in the North Boeing Field 320 Zone, and the northern extent of the City 360 Zone. The remainder of the nodes was in the Tukwila Hill neighborhood and the CBD area of the City 360 Zone.

The hydrants at Boeing on East Marginal Way S. and at Associated Grocers were limited by 20 psi at the hydrants to less than the required fire flow. The hydrant at Boeing along East Marginal Way S. is estimated to deliver 11,200 gpm as compared to the requirement for 13,000 gpm, while the available fire flow at Associated Grocers is estimated at 2,160 gpm as compared to a requirement of 3,000 gpm to 4,000 gpm. Moving the PRV south of South Norfolk Street would correct the deficiency.

The following improvements are needed to address inadequate available fire flow in the Tukwila Hill neighborhood and the CBD areas:

- Construct new 8" water main along S. 137th Street and 53rd Avenue S. to S. 139th Street (W-002).
- Upgrade of the water main along 53rd Avenue S. (W-003) between S. 139th Street and S. 140th Street from 6" to 8" diameter pipe.
- Construct new 8" water line along Macadam Road (W-005) between S. 152nd Street and Southcenter Blvd.
- Upgrade of the transmission main along Southcenter Blvd. (W-011) between Andover Park East and 65th Avenue S. from 8" to 10" diameter pipe.
- Upgrade of the transmission main along 65th Avenue S. (W-012) between S. 151st Street and Southcenter Blvd. from 8" to 16" diameter pipe.
- Construct new 8" water main along Christensen Road to the corner of Christensen Road and Christensen Trail (W-015). This is currently private property.
- Upgrade of the water main along Minkler Blvd. east from the intersection of Industry Drive (W-019) from 8" to 10" diameter pipe.
- Upgrade of the water main along S. 180th Street east from the intersection of Andover Park East (W-021) from 10" to 12" diameter pipe.

Scenario 2 – Peak Hour EPS, 2005 Demands

For this scenario, the existing distribution system is evaluated under present conditions (i.e., year 2005 peak hour demands). Almost all nodes maintain pressures of at least 30 psi throughout the 24-hour period modeled. For every hour of operation, there was only 1 node in the 400 Zone (out of 339 total nodes) that modeled pressure less than 30 psi. However, this node is located on the suction side of the high pumps at North Hill pump station and can be ignored for this criterion. There are no Capital Improvements needed to meet this criterion.

Scenario 3 – Peak Hour EPS, 2024 Demands with 2005 CIP

For this scenario, all the proposed capital improvements were included in the modeled distribution system and evaluated to identify any system deficiencies under 2024 peak hour demands assuming that the 2005 Capital Improvements were constructed. Again, there is only 1

node in the water system that encounters a pressure drop to below 30 psi during the peak hour demand at the hours of 1-3 (1:00am to 3:00am) and this is the node on the suction side of the high pumps at North Hill pump station. No Capital Improvements are needed to meet this criterion.

Scenario 4 – Fire Flow Analysis, 2024 Demands with 2005 CIP

For this scenario, all the proposed capital improvements were included in the model and evaluated to see fire flow deficiencies in the system. Four fire hydrants (nodes) in the City 360 zone are limited by 20 psi at the hydrant to less than the required fire flow. Two of these are located in the Tukwila Hill neighborhood and the remaining are in the Central Business District. The following additional improvements are needed to address inadequate available fire flow:

- Upgrade of the water main along 52nd Avenue S. (W-001) between Interurban Avenue S. and 53rd Avenue S. from 6" to 8" diameter pipe.
- Upgrade of the water main along S. 153rd Street (W-012) from 65th Avenue S. to the corner of the loop from 8" to 10" diameter pipe.
- Upgrade of the water main along Black Drive (W-015) from 8" to 10" diameter pipe.
- Upgrade of the water main along Corporate Drive S. (W-016) from 8" to 10" diameter pipe.
- Construct new 12" water line along Minkler Blvd. (W-017) from existing dead-end line east of Southcenter Parkway to Andover Park West.

Scenario 5 – Peak Hour EPS, 2010 Demands with 2005 CIP

This scenario was run to determine which of the 2024 improvements were needed by 2010. Again, there is only 1 node in the water system that encounters a pressure drop to below 30 psi during the peak hour demand at the hours of 1-3 (1:00am to 3:00am) and this is the node on the suction side of the high pumps at North Hill pump station. Since there were no improvements needed to meet this criterion in 2024, none are needed here.

Scenario 6 – Fire Flow Analysis, 2010 Demands with 2005 CIP

This scenario was run to determine which of the 2024 improvements were needed in 2010. There were no problems with meeting the minimum fire flow requirements in the system with only the 2005 Capital Improvements. No additional capital improvements are needed.

A full list of the improvements considered during this analysis is included in Section 10, Capital Improvement Plan. Construction sequence should be coordinated with other capital improvements scheduled for the city such as road or wastewater improvements.

7.2 Storage Analysis

Tukwila has limited storage available within the system boundaries. There is a single 2.0 mg tank that is set at an elevation that requires pumping operate. Following conversations with DOH staff, it has been assumed for this WSP that the SPU transmission mains and storage will provide additional storage for the Tukwila distribution system. The number and location of

SPU/Tukwila connections, in conjunction with numerous emergency interties with neighboring districts and municipalities, provide for sufficient flow at sites throughout the Tukwila system to meet any needs that are typically supplied through system storage.

Thus, there is no system specific analysis for storage, and no additional storage is needed.

7.3 Source Analysis

Tukwila receives water from the SPU transmission system through its membership in the Cascade Water Alliance. Cascade is obligated to supply Tukwila with water to meet the demand discussed in this Water System Plan. More information on the supply agreement between Tukwila and Cascade is found in Section 3.2.1.

Section 8
Drinking Water Quality Compliance and Monitoring

8.1 Introduction

This section is a review of current Washington Administrative Code (WAC) 246-290 and Federal drinking water regulations and an assessment of Tukwila's compliance between 1999 and 2004. This section provides a brief overview of the existing water system and describes system components in regard to applicable regulations, monitoring practices, and compliance status. This section also identifies possible future regulations and assesses the implications for Tukwila.

Because Tukwila purchases all of their drinking water through Cascade Water Alliance from Seattle Public Utilities (SPU), Tukwila does not own or operate a source of supply. SPU is responsible for meeting requirements that apply to source water and treatment. Because Tukwila owns and operates their distribution system, Tukwila is responsible for meeting requirements that apply to drinking water within this system. Table 8-1 indicates which system is responsible for compliance with each regulation.

Table 8-1 presents a list of the Federal drinking water regulations that are currently effective. All of these rules have been adopted by Washington State in the Washington Administrative Code (WAC) 246-290 and are administered by the Washington State Department of Health (DOH).

Table 8-1
Drinking Water Quality Requirements and Compliance Responsibilities

Rule and Date Rule Became Effective	Parameters Regulated	Monitoring location	Responsible utility
National Primary Drinking Water Requirements (1976)	Physical and chemical	Distribution system entry-point	SPU
Total Trihalomethane Rule (1979)	Trihalomethanes	Within the distribution system	Tukwila
Phase I (VOCs) and Phase II and Phase V (IOCs and SOCs) - 1989, 1993 respectively)	Volatile Organic Chemicals (VOCs), Inorganic chemicals (IOCs), and Synthetic Organic Chemicals (SOCs)	Distribution system entry-point*	SPU and Tukwila*
Total Coliform Rule (1990)	Coliform and Disinfectant Residual	Within the distribution system	Tukwila

Rule and Date Rule Became Effective	Parameters Regulated	Monitoring location	Responsible utility
Surface Water Treatment Rule (1990)	Turbidity, Disinfection, viruses, and *Giardia lamblia*	After treatment, at the distribution system entry-point, and within the distribution system	SPU and Tukwila
Lead and Copper Rule (1992) and Lead and Copper Rule Minor Revisions (2000))	Lead and Copper	At taps and within the distribution system	Tukwila
Interim Enhanced Surface Water Treatment Rule (2002)	Turbidity and *Cryptosporidium*	After treatment, and at the distribution system entry-point	SPU
Arsenic Rule (2002)	Arsenic	Distribution system entry-point	SPU
Radionuclides Rule (2003)	Radionuclides	Distribution system entry-point	SPU
Stage 1 Disinfectant/Disinfection By-Products (2002)	Disinfectant Residual, Total Trihalomethanes, and Haloacetic Acids	Within the distribution system	Tukwila

*Asbestos is monitored in distribution system. All other contaminants covered in these Rules are measured after treatment.

8.2 Compliance with Drinking Water Regulations

As shown in Table 8-1, Tukwila is responsible for complying with regulations that apply in Tukwila's distribution system. This section describes Tukwila's monitoring and compliance with these rules. These regulations and associated parameters are:

- Total Coliform Rule – total coliform
- Surface Water Treatment Rule - disinfectant residual
- Inorganic Compounds Phase II - asbestos
- Lead and Copper – lead, copper, and water quality parameters
- Stage 1 Disinfectant/Disinfection By-Products Rule – disinfectant residual, total haloacetic acids (HAA5), and total trihalomethanes (TTHM).

Tukwila coordinates monitoring of these parameters with SPU. For all distribution system monitoring, SPU collects samples and provides laboratory analysis as part of the purchasing agreement with Tukwila. Additionally, since SPU provides drinking water to other utilities throughout the region, DOH-approved monitoring plans have been developed for compliance with the Total Coliform and Lead and Copper Rules.

8.2.1 Total Coliform

The Total Coliform Rule, as adopted by Washington State and included in WAC 246-290, requires drinking water suppliers to collect coliform samples from representative points throughout the distribution system each month. The required number of samples is determined based on population. As part of compliance, the supplier must develop and document a monitoring plan. If a system collects less than forty samples per month, a maximum contaminant level (MCL) violation occurs if more than one sample per month is positive for the

presence of coliform. The system must then collect a repeat sample to determine the presence of fecal coliform or *E. coli*. The presence of these bacteria in a repeat sample comprises an acute violation.

SPU and its wholesale customers have participated in a regional, DOH-approved coliform monitoring program since 1972. Under this agreement, SPU and its purveyors sample at a rate of at least 0.7 samples per 1000 customers per month. Tukwila establishes and maintains coliform sampling sites, including adding new sites as population increases. SPU conducts the coliform monitoring within Tukwila's system. However, Tukwila is responsible for conducting any repeat sampling following a positive coliform result. Tukwila's last update to their individual monitoring plan was completed in 2004. This plan is located in Appendix U.

Tukwila's required number of monthly coliform samples is based on the number of residential and non-residential customers Tukwila serves each month. According to population information presented in Section 4, Tukwila currently serves a residential population of more than 7,700. In its most recent Water Facilities Inventory, Tukwila reported serving an estimated transient population of 12,000 people between February and October, 14,000 people in November and January, and 15,000 people in December.

Based on previous assessments of Tukwila's residential population, Tukwila collected 12-14 samples per month in 2004. The number of samples varied due to the increasing population of non-residents during November, December, and January. However, now that newer residential population data are available (Section 4 of this Plan), Tukwila will need to collect 14 samples between February and October (when serving a residential population of 7,700 plus 12,000 non-residents); 15 samples in November and January (when serving a residential population of 7,700 plus 14,000 non-residents); and 16 samples in December (when serving a residential population of 7,700 plus 15,000 non-residents).

Table 8-2 lists the locations of Tukwila's four existing sample stands. Multiple coliform samples are collected from each location each month. Sample Site TU-4 was added in 2000.

Table 8-2
Tukwila's Total Coliform Monitoring Locations

Sample Stand ID	Location	Pressure Zone
TU-1	65th Ave S & Southcenter Blvd.	360
TU-2	S. 122nd St. & 46th Ave. S.	360
TU-3	1232 Andover Park West.	360
TU-4	53rd Ave S. Near S. 140th St.	360

Tukwila has been in compliance with the Total Coliform Rule since 1999. In April, 2003, Tukwila detected coliform in two samples, exceeding the non-acute coliform MCL. Repeat sampling indicated that no fecal coliform were present.

8.2.2 Disinfectant Residual

The Surface Water Treatment Rule (SWTR) establishes treatment techniques for surface water systems, including those using groundwater under the influence to reduce the risk of waterborne disease. Additionally, this regulation requires a minimum disinfectant level of 0.2 mg/L free chlorine at the entry point of the distribution system and maintenance of a detectable residual or heterotrophic plate count samples with 500 or less CFU/ml in at least 95% of samples collected throughout the distribution system each month. Distribution system samples are collected by SPU at the same locations and times as Tukwila's total coliform monitoring samples. SPU is responsible for meeting the required disinfectant residual level at the point of entry to Tukwila's distribution system.

In addition to the monitoring requirements and minimum level required by the SWTR, the Stage 1 Disinfectant/Disinfection By-Products Rule establishes a Maximum Residual Disinfectant Level (MRDL) of 4.0 mg/L free chlorine in the distribution system. Disinfectant residual measured in samples collected at the same time and location as total coliform samples is used to determine compliance. Compliance is calculated using the running annual average of each of these samples.

According to compliance data collected between 2000 and 2004, Tukwila's disinfectant residual has ranged from 0.08 mg/L to 2.5 mg/L of residual with an average of about 1 mg/L throughout the distribution system.

8.2.3 Asbestos

Asbestos, which was regulated as part of the Phase 2 Rule, is the only inorganic contaminant that must be monitored in the distribution system. The MCL for asbestos is 7 million fibers longer than 10 microns per liter. Systems containing asbestos cement piping must complete monitoring at one location once every nine years.

Tukwila's distribution system contains about 300 lineal feet of asbestos cement water main (0.12% of total feet of pipe). The asbestos cement piping is located in the Fort Dent Park. Historically, DOH has not required systems to monitor for asbestos if asbestos cement piping makes up less than 10% of the distribution system piping material. Tukwila is not required to conduct monitoring.

8.2.4 Lead and Copper

The Lead and Copper Rule establishes action levels, monitoring, and compliance requirements for lead and copper levels at customers' taps. To meet the established action levels, ninety percent of all samples have lead levels equal to or less than 0.015 mg/L and copper levels equal to or less than 1.3 mg/L. If these action levels can not be met, systems must implement public education and a strategy for meeting these levels.

A regional, DOH-approved lead and copper monitoring program was adopted by SPU and its purveyors. This type of program is appropriate because SPU applies corrosion control as part of

their drinking water treatment. The most recent lead and copper monitoring effort was begun in 2003 and completed in 2004, consisting of lead and copper samples collected at 375 customers' taps in the region. Samples were collected twice within a one-year period. Three homes were sampled in Tukwila. Table 8-3 presents the results.

Table 8-3
2003 Lead and Copper Monitoring Results

Parameter	Action Level	Regional Results		Tukwila
		90th Percentile	# of homes exceeding Action Level	# of homes exceeding Action Level
Lead (mg/L)	0.015	0.0079	11	0
Copper (mg/L)	1.3	0.2	0	0

The next round of lead and copper tap sampling will take place in 2005.

8.2.5 Disinfection By-Products

The USEPA has developed two rules to address disinfection by-products (DBPs). The Total Trihalomethane (TTHM) Rule was finalized in 1979 and set an MCL of 0.10 mg/L for the total levels of trichloromethane, dibromochloromethane, bromodichloromethane, and tribromomethane. The TTHM Rule applied to all systems providing a disinfected water supply.

The Stage 1 Disinfectant/Disinfection By-Products Rule was finalized in 1998 and systems had to comply in 2002 or 2004, depending on system size and source of supply. The Stage 1 DBP Rule applies to all systems that add disinfectant to their drinking water supply and completely replaced the TTHM Rule in 2004. As adopted in the WAC 246-290, the Stage 1 DBP requirements are not enforced in systems that purchase all of their water and do not apply any treatment.

Table 8-4 presents the MCLs established by the Stage 1 DBP Rule. The MRDL for chlorine established by the Stage 1 DBP Rule is described above. The requirements for TTHMs, HAA5, and bromate apply to Tukwila's drinking water supply. TTHMs and HAA5 are for systems using chlorine or chloramine to provide a disinfectant residual in the distribution system. SPU implemented ozonation at the Cedar River Water Treatment Facility in 2004. As part of this change in treatment, the MCL for bromate established by the Stage 1 DBP Rule applies to Tukwila's drinking water.

Table 8-4 Stage 1 DBP Rule MCLs	
Disinfection By-Product	**MCL (mg/L)**
Total Trihalomethanes (sum of chloroform, bromodichloromethane, dibromochlormethane, and bromoform)	0.080
Haloacetic acids (sum of dichloracetic acid and trichloroacetic acid)	0.060
Chlorite[1]	1.0
Bromate[2]	0.010

[1] Applies to systems using chlorine dioxide as a disinfectant.
[2] Applies to systems using ozone as a disinfectant

Between 1999 and 2004, Tukwila conducted TTHM monitoring to meet requirements in WAC 246-290. Tukwila's running annual average TTHM ranged from 0.020 to 0.027 mg/L from 2000 to 2003.

It is recommended that Tukwila implement monitoring per Stage 1 DBP Rule requirements. While this Rule does not currently apply to Tukwila, a future DBP Rule will. DBP monitoring in compliance with Stage 1 would assist Tukwila by:

1. Establishing baseline information on DBPs in Tukwila's distribution system. Tukwila will have an understanding of DBPs in their system and have an understanding of potential compliance issues before the Stage 2 DBP Rule is promulgated.
2. Preparing for DBP requirements. As part of compliance with the next DBP Rule, Tukwila will be expected to meet Stage 1 DBP requirements.

8.3 Anticipated Future Regulations

Table 8-5 summarizes regulation that the USEPA has proposed that would affect drinking water provided by Tukwila. Currently, the USEPA is also reviewing the Total Coliform Rule to determine the best method for regulating distribution system water quality with respect to microbial contaminants. Revisions may include requirements to address finished water quality in the distribution system as well as evaluate additional or alternative monitoring strategies that would be more cost effective and maintain or improve public health. A proposed rule is anticipated by 2006.

Table 8-5 Proposed Drinking Water Regulations		
Rule	**Status**	**Description**
Long Term 2 Enhanced Surface Water Treatment Rule	Proposed – 2003 Promulgated – 2005 Effective -2008	This regulation will add to existing *Cryptosporidium* requirements and enhance public health protection from waterborne pathogens.
Stage 2 Disinfectants/Disinfection By-Products Rule	Proposed – 2003 Promulgated – 2005 Effective -2008	This regulation will lower disinfection by-product MCLs and change monitoring.

Of the regulations shown in Table 8-5, Tukwila will be responsible for carrying out compliance activities for the Stage 2 Disinfectants/DBP Rule. The Long Term 2 Enhanced Surface Water Treatment Rule will apply to drinking water quality during and after treatment. The Stage 2 DBP Rule was proposed in August 2003 and will likely be effective in 2008. This Rule is implemented in two stages, each stage establishing a set of MCLs. In the first stage, the TTHM MCL is 0.120 mg/L and the HAA5 MCL is 0.100 mg/L. In the second stage, the MCLs are decreased to 0.08 mg/L and 0.06 mg/L for TTHM and HAA5, respectively. Compliance will be determined using the annual averages for each sampling location instead of an annual average across results for entire system. Systems will also need to be in compliance with Stage 1 DBP requirements. Systems will need to identify appropriate DBP sampling locations within the distribution system using the Initial Distribution System Evaluation approach to determine locations with a potential for high DBPs. As a consecutive system, purchasing all their drinking water from SPU, Tukwila will comprise a portion of a combined system consisting of SPU and any utilities purchasing Seattle's water. Because the combined system serves more than 10,000 people, Tukwila will need to comply with the Stage 2 Rule two years after promulgation.

8.4 Water Quality Complaints

Tukwila investigates water quality complaints to eliminate the possibility of a cross-connection and implements corrective action such as flushing, as needed. Tukwila began documenting customer water quality complaints in 2003. Tukwila estimates that they receive less than 20 water quality complaints each year. In the past, Tukwila has received seasonal taste and odor complaints due to seasonal algae at the Cedar River source. However, Tukwila does not anticipate receiving these complaints because of SPU's new treatment plant, including ozonation which will address taste and odor, at Lake Youngs. Other complaints are typically water discoloration, which can be caused by dead-end mains or activities such as hydrant usage.

8.5 Consumer Confidence Reports

Under the Consumer Confidence Report Rule promulgated in 1998, community water systems are required to provide an annual Consumer Confidence Report (CCR) describing the source of their drinking water and levels of any contaminants found. The annual report must be supplied to all customers by July 1 and must include:

- Name and phone number of a contact person;
- Description of source water;
- Definitions;
- A table describing detected regulated and unregulated contaminants, measured levels, MCLs and Maximum Contaminant Level Goals, and likely sources;
- If an MCL is violated, information on health effects; and
- If EPA requires it, information on levels of unregulated contaminants.

Tukwila is in compliance with the CCR Rule. Annual CCRs have been published as required.

8.6 Summary of Regulatory Status and Monitoring Requirements

Review of water quality data between 1999 and 2003 indicates that Tukwila has been in compliance with all effective Federal and State drinking water regulations. Table 8-6 summarizes applicable regulations and Tukwila's compliance status.

Table 8-6
Summary of Regulations and Compliance Status

Regulation	Requirements	Status	Compliance?	Recommendations
Phase I, Phase II, Phase V Regulations	• Written Plan • Monitoring	• N/A – applies to water prior to entering Tukwila's system.	N/A	None
Radionuclides	• Monitoring	• N/A – applies to water prior to entering Tukwila's system.	N/A	None
Surface Water Treatment Rule	• Monitoring chlorine residuals where surface water enters distribution system	• Monitors chlorine residuals throughout distribution system • Meets minimum Cl_2 requirement • SPU monitors at point of entry to distribution system.	Yes	None
Interim Enhanced Surface Water Treatment Rule	• Monitoring turbidity where surface water enters distribution system	• N/A – applies to water prior to entering Tukwila's system.	N/A	None
Source Water Protection Program	• Watershed Protection Plan	• N/A – applies to water prior to entering Tukwila's system.	N/A	None
Filter Backwash Rule	• Monitoring	• N/A – applies to water prior to entering Tukwila's system.	N/A	None
Total Coliform Rule	• Written Plan • Monitoring	• Monitors throughout distribution system • Meets MCLs	Yes	It is recommended that Tukwila update their Coliform Monitoring Plan and review sample locations.
Stage I D/DBP Rule	• Written Plan • Monitoring	• N/A – Applies to systems that disinfect	N/A	It is recommended that Tukwila implement monitoring per Stage 1 requirements
Asbestos Rule	• Monitoring distribution system	• N/A – System does not contain Asbestos piping.	N/A	N/A
Lead and Copper Rule	• Monitoring • Treatment Optimization	• Monitors • Meets MCLs	Yes	None

Regulation	Requirements	Status	Compliance?	Recommendations
CCR and Public Notification Rules	• Annual Reports • Reporting as needed	• Consumer Confidence Reports published annually	Yes	None

Table 8-7 provides a summary of water quality monitoring requirements for Tukwila. The table includes the parameters to be monitored, sampling location, and frequency. Table 8-7 is intended to be a guide; detailed requirements are available in WAC 246-290 and by contacting DOH. Table 8-7 does not include any DOH-granted monitoring waivers.

Table 8-7 Summary of Existing Monitoring Requirements			
Parameter	**Regulatory Requirement[1]**	**Distribution System Location**	**Frequency**
Inorganic Chemicals			
Asbestos	NPDWR	One location within distribution system	Once every nine years
Lead Copper	Lead and Copper Rule	Customer taps:	Once every three years (2003, 2006)
Bacteriological			
Total Coliform	Total Coliform Rule	Throughout distribution system	9 samples per month
Chlorine Residual	Stage I D/DBP Rule	Throughout the distribution system in same location as Total Coliform Sites	40 samples per month
Disinfection By-Products			
Trihalomethanes Haloacetic Acids	Stage I D/DBP Rule	Distribution System (4 per disinfected source): 3 at average hydraulic residence time 1 at maximum hydraulic residence time	Quarterly

1. *All drinking water parameters are also regulated by WAC 246-290*

Section 9
Operations and Maintenance

9.1 Introduction

This section summarizes the operation and maintenance programs and procedures implemented by the City of Tukwila to maximize performance and reliability of the potable water supply system.

Extensive research has been made to Tukwila's Water Utility Operations Plan (Appendix V). This was supplemented by Direct Review of Water Operations and Maintenance Procedures.

9.2 Organization Structure and Responsibilities

The City of Tukwila Public Works Department is responsible for water, sewer, drainage, construction, engineering, construction inspection, fleet and facilities and street functions. The Tukwila Water Utility operates under the direction of the Public Works Director. The Public Works Operations Manager oversees the supervisory responsibilities for the Water Utility's operation and maintenance as well as sewer and surface water. Day to day activities are conducted by the Water System Supervisor who reports to the Public Works Operations Manager. The Water Supervisor also oversees water quality monitoring and cross-connection control. The Public Works Engineer covers budgeting, new or upgraded system design, operations analysis, and the construction of capital improvements as outlined in the Water Comprehensive Plan. Figure 9-1 shows the organizational structure for water operations.

9.2.1 Director of Public Works

The Director of Public Works directs all activities and programs within the Public Works Department including the City's services for potable water.

9.2.2 City Engineer

The City Engineer plans, organizes, staffs and manages the Engineering Division. Responsibilities involve development of the six-year capital improvement program for the water utilities. The City Engineer is also responsible for annual capital projects including development of scopes-of-work and consultant selection.

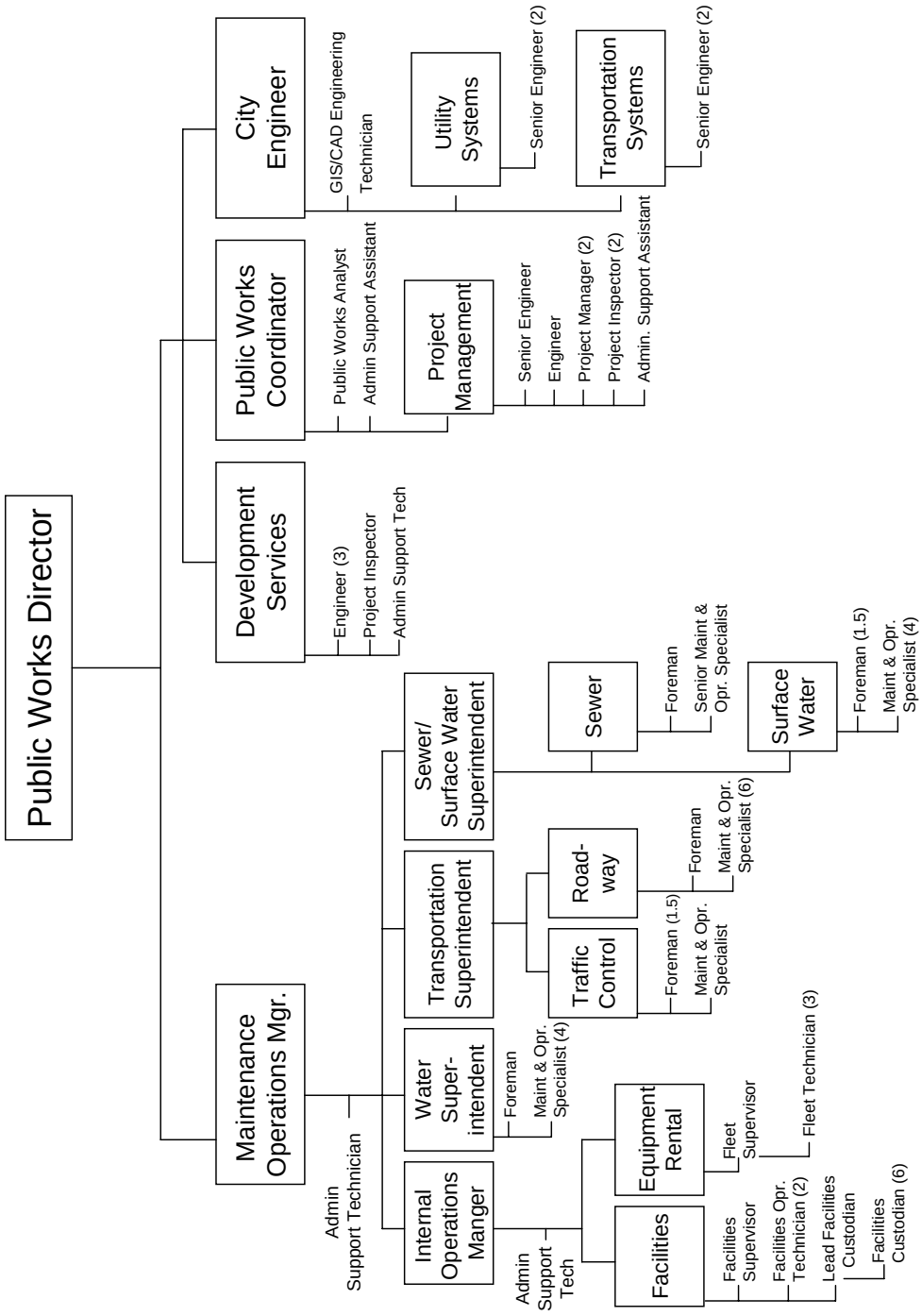


Exhibit 9.1

Tukwila Public Works Department - Water Utility Organization

9.2.3 Senior Project Engineer

The Senior Project Engineer, under the direction of the City Engineer, is responsible for overseeing assigned annual capital projects. Tasks include development of project schedules, scope-of-work and consultant selection. The Project Engineer also tracks progress through the development of PS&E, coordinates bidding and contract execution, and is tasked with submittal review and approval, progress reports, pay estimates, construction management/inspection and project closeout.

9.2.4 Maintenance Operations Manager

The Maintenance Operations Manager oversees maintenance activities within the public works department. For the water supply system, the Maintenance Operations Manager has budgetary responsibility and directs the Water Maintenance Superintendent in carrying out water system maintenance responsibilities.

9.2.5 Water Maintenance Superintendent

The Public Works Water Maintenance Superintendent is responsible for planning, organizing, staffing and managing within the Operation and Maintenance Division. For the water supply system, responsibilities include repair and maintenance of the City's water system including transmission and distribution mains, storage facilities, and booster pump stations. The Superintendent oversees all annual maintenance programs including flushing, valve exercising, and source water quality and reservoir inspections. The Superintendent is also tasked with budget development for the Water Enterprise Fund.

9.2.6 Water Utility Foreman

The Water Utility Foreman is responsible for all operation and maintenance activities associated with water supply, distribution, pumping and storage systems including distribution main flushing, valve exercising, and well monitoring. Responsibilities also include meter reading/repair, water quality monitoring and record keeping, and Water Conservation and Cross Connection Control programs.

Responsibilities include construction throughout the distribution system including looping of dead-end lines, extension of water mains, valve installation and hydrant replacement/installation. The Water Utility Foreman oversees emergency repairs of water main breaks and utility locates.

The Water Utility Foreman also manages customer inquiries related to dirty water, pressure extremes and taste and odor. This position tracks and coordinates all inquiries with the Operations Manager until the problem is resolved.

9.2.7 Utility Maintenance Worker

Utility maintenance workers, along with the foreman, perform all field maintenance and operation functions for the City's water utility.

9.3 Operator Certification

The City of Tukwila is in full compliance with current laws and regulations regarding staff certification and training. 6 Tukwila Public Works employees possess Department of Health certifications. Table 9-1 is a summary of personnel certifications and experience in water system operations.

Employees are supported and encouraged to meet continuing education (CEU) requirements by attending work related classes, refresher courses, safety training and regional conferences. To meet the staff educational needs, the City includes a budget line item in the annual O&M budget devoted to training.

Table 9-1
Water Utility Personnel Certification

Position	Name	Certification
M&O Superintendent Water	Bryan Still	WDM4, WDS, CCS, WTPO-IT
M&O Foreman, Water	Jim Peterson	WDM2, WDS, CCS
M&O Specialist, Water	Rod Langford	WDM2, WDS, CCS
M&O Specialist, Water	Todd Reedy	WDM2, CCS
M&O Specialist, Water	Joe McCain	WDM1, WDS, CCS
M&O Specialist, Water	Stan Harris	WDM1, CCS, WTPO-IT

9.4 System Operation and Control

9.4.1 Source of Supply

The source of Tukwila's water is the City of Seattle's Cedar River Supply System. Raw water is diverted from the Cedar River at Landsburg, where it is screened, chlorinated, and fluoridated before being sent to Lake Youngs. At the outlet of the Lake Youngs regulating basin, located east of Renton, water receives further disinfection treatment through the use of ozone and UV light. The water is then treated with lime to adjust pH levels for corrosion control and chlorinated for disinfection prior to customer delivery. The water is then transmitted to the Puget Sound area via four high-pressured transmission mains, known as the Cedar River Pipelines. The City of Seattle exercises all control over source treatment and transmission.

9.4.2 Major Water Facilities

The Tukwila water system consists of seven primary supply stations, one secondary supply intertie, one storage reservoir, one booster-pump station, about 45 miles of transmission and distribution pipelines, and many valves and other appurtenances. Table 9-2 summarizes the major facility and valve elements of the Tukwila water system.

The City of Tukwila uses pressure reducing valves (PRVs) and check valves to maintain adequate system pressures, direct flow in the system, and isolate the various pressure zones. PRVs are also used at supply stations and interties. The system contains 9 PRVs and 11 check valves.

The Tukwila water system currently operates the 2 million gallon (MG) North Hill Reservoir storage reservoir that operates at the nominal water surface elevation of 250 feet mean sea level (MSL). The reservoir is the sole storage facility for the City.

Tukwila operates a single booster pump station with two sets of pumps configured to pump from the North Hill reservoir to the North Hill pressure zone and/or to the 360 zone. Normal operation involves pumping only to the North Hill zone.

Table 9-2
Major Tukwila Water Facilities

Location	Zone	Description	Comment
Interties			
Beacon Ave. S. & S. Leo St.		Supply Station (SS) 169	From CRPL 3
E. Marginal Way & S. 112th St.		SS 10	From WSPL
44th Ave. S. & S. 115th St.		SS 11	From WSPL
Southcenter Parkway & Tukwila Parkway		SS 13	From CRPL 4
West Valley Highway & S. 158th St.		SS 14	From CRPL 4
Christensen Rd. & Black Dr.		SS 15	From CRPL 4
S. 158th St. & 53rd Ave. S.		SS 16	From CRPL 4
E. Marginal Way at north City limit		Emergency	Seattle Intertie
Emergency Interties			
S. 116th Street & E. Marginal Way			W. Dist 125
S. 131st Place			W. Dist 125
52nd Avenue S. & Interurban Ave			W. Dist 125
S. 144th Street & 53rd Ave S.			W. Dist 125
Todd Blvd. & Cascade Ave S.			Kent
W. Valley Hwy			Renton
Andover Park West & 180th			Highline WD
Valves			
E. Marginal Way & S. 112th St.	360	16” PRV	Active supply from SS 10
E. Marginal Way & S. Norfolk St.	320	16” PRV	Active running from SS 10-A
44th Ave. S. & S. 115th St.	360	8” PRV	Active supply from SS 11
Southcenter Parkway & Tukwila Parkway	360	12” PRV	Active supply from SS 13
West Valley Highway & S. 158th St.	360	8” PRV	To be abandoned
Christensen Rd. & Black Dr.	360	8” PRV	Active supply from SS 15
S. 158th St. & 53rd Ave. S.	380	6” PRV	Active supply from SS 16
S. 107th St. & 49th Ave. S.	340	8” PRV	Active running from SS 169
E. Marginal Way at north City limit	320	8” PRV	Emergency from SS 168

Table 9-2 (cont.) Major Tukwila Water Facilities			
Location	**Zone**	**Description**	**Comment**
High Zone Check Valves			
62nd/151st	400	8”	Globe style check (no remote control) typical of 14
55th	400	6”	
Sunwood/62nd	400	8”	
Sunwood/Behind	400	8”	
149th/60th	400	6”	
144th/59th	400	6”	
58th	400	6”	
57th/144th	400	10”	
144th/57th	400	6”	
56th/141st	400	6”	
144th East of 53rd	400	6”	
150th	400	8”	
152nd	400	6”	
Klickitat	380	8”	
North Hill Reservoir		2 million gallon	
North Hill Booster Pump Station		2 pumps @ 490 gpm to North Hill zone 2 pumps @ 1050 gpm to main 360 zone	

9.4.3 Control/Telemetry

The water system’s supervisory control and data acquisition (SCADA) system consists of remote telemetry units (RTUs) located at individual supply stations, linked to a master control computer at the City’s Maintenance Facility on Minkler Boulevard. The telemetry control panel serves to display important system status information. This system monitors the reservoir water level, and controls the supply station valves at supply stations SS10, SS13 and SS15. A separate control system that is not linked to the master control system is installed at the reservoir pump station. This system monitors and responds to pressure variations in the distribution system and transmits analog signals back to the control panel at the City’s Maintenance Facility.

The telemetry system enables tracking and storing of system operating information. Table 9-2 is a summary of telemetry instrumentation and control for source, booster pumping, intertie, and the storage facility.

Seasonally, certain supply stations are alternated from straight PRV to flow control mode. In straight PRV mode, flow from the Seattle system changes to meet demand in the Tukwila system. In flow control mode, flow at these selected stations is controlled so as to not exceed a set maximum rate.

The RTUs at supply stations, North Hill Booster Pump Station and North Hill Reservoir are the heart of the City's water SCADA system. These units perform the function of receiving input from and controlling the local equipment as well as communicating operational and alarm status back to the master computer. Each of the RTUs have battery backup.

Communication between the RTUs and the master control computer at the Minkler shops is via radio. To facilitate communications a radio signal repeater station is located at the North Hill reservoir. This repeater does not have an uninterruptible power supply (battery backup). If a power failure were to occur, loss of the repeater station could limit the ability of the water utility (and all of public works) to communicate with other units of the system. Battery backup of critical SCADA and communications elements is a common and desirable feature of modern SCADA systems.

System alarms are communicated back to the master control panel at the operations center. The panel is monitored by utility staff. A response to an alarm may mean remote adjustment of a valve setting, however, in most cases, a trip is initiated to the station reporting the alarm.

During evenings, and on weekends, an alarm triggers an autodialer which alerts water utility maintenance personnel of an alarm condition. There is no ability to look at the system status and assess the specifics of the alarm. The ability to have computer to access the SCADA system from off-site, via the internet or direct dial-in, is a common and desirable feature of modern SCADA systems. This feature provides supervisory staff with a more complete picture of the status of the system, reduces the need for unproductive trips to the operations center or remote sites, and promotes better operational control of the system.

9.5 Maintenance

The hub of the City's water maintenance operations is at the City's Maintenance Facility on Minkler Boulevard. Water, streets, sewer and stormwater maintenance operations are headquartered at the facility.

Water quality and utility maintenance technicians conduct daily inspections and perform preventative/corrective maintenance on pump stations, reservoirs, PRV's and other distribution system components. Job standards have been developed for most maintenance tasks/activities performed by these technicians and are on file with the City. The following is a brief summary of system maintenance activity.

9.5.1 Maintenance Management

The Public Works Superintendent sets goals, establishes work priorities and makes plans to help achieve the organization's goals for the year. The Public Works Division Supervisors have the responsibility to plan, organize, direct and control the workforce to achieve department goals. The supervisors have the additional responsibility to develop Maintenance Work Standards that are used in the development of the annual work plan.

The annual work plan includes capital projects, system operations work, replacement work, routine corrective maintenance, equipment and distribution main service and project management. The annual plan is then divided into monthly schedules for project tracking purposes.

Currently, projects are either tracked on paper or by using Excel spreadsheets.

9.5.2 Reservoir Maintenance

The reservoir is inspected daily, quarterly, and on a five-year cycle employing an increasing degree of activity at each level. The objective of the daily visual inspections is evidence of vandalism, forced entry or damage and control functionality. On a quarterly basis a detailed inspection of access manholes, vents, overflow piping and valve exercising is conducted. Approximately every five years the reservoir undergoes a comprehensive engineering inspection and evaluation. Future draining and cleaning work will be accomplished in conjunction with the program schedule.

9.5.3 Valve Maintenance

The city conducts a formalized, scheduled valve maintenance program so that system control is available to staff when needed. The Water Main Control Valve Maintenance and Flushing Program consists of locating and activating control valves in the distribution system. Valve exercising is scheduled for completion annually, particularly for main line valves. The objective of the program is to detect malfunctioning valves and prevent valves from becoming inoperable due to freezing or build-up of rust or corrosion. The program also ensures that valve locations are documented correctly and that valves are accessible. Malfunctioning valves are reported and maintenance work orders issued for repair or replacement.

9.5.4 PRV and Check Valve Maintenance

Preventative maintenance for PRV and check valves is scheduled and conducted monthly as part of the Public Works work plan. The testing and maintenance performed includes pressure checks and adjustments, cleaning of strainers, and replacement of parts as necessary.

9.5.5 Hydrant Maintenance

The primary function of fire hydrants is for supply of water for fire protection; however, hydrants are often used for other purposes. The City has a Hydrant Maintenance Program designed to maintain hydrants in proper working condition to provide available fire flow in the event of an emergency.

The maintenance program parallels the service area grid pattern used by the Tukwila Fire Department. This grid system divides the service area into distinct units. The maintenance procedure is to perform hydrant maintenance sequentially, one grid at a time. This sequential grid approach ensures every hydrant is checked and maintenance performed before moving to the next grid. Upon completion of a grid, notice is sent to the Fire Department for their records. Anytime a hydrant is off-line for any reason notification is provided to the Fire Department.

The hydrant maintenance checklist includes the following:

- Removal of all grass, weeds, etc. in hydrant area.
- Hydrants are tested in an approved manner for proper operation.
- Each hydrant is recorded.
- Caps are checked for cracks/operability.
- Threads and chain races are cleaned and lubricated.
- Hydrants are painted as necessary.
- The street shutoff valve is checked for accessibility and ease of identification from water main valves.

9.5.6 Meter Maintenance/Replacement

The City has one full time meter reader and one meter repair person on staff. The repair person has additional duties allowing approximately 1.5 weeks a month dedicated solely to meter repairs. Meter readers dedicate approximately seventy-five percent of the work time to meter reading and the remaining twenty-five percent to meter maintenance activities. In addition to the three meter employees, the Public Works Construction crew makes repairs whenever heavy equipment is required or repairs are needed on larger meters in the distribution system.

To identify meter maintenance projects in the field, meter readers code their handheld computer to a maintenance code whenever a malfunctioning meter is identified. A printed copy of the report is forwarded to the Utility Maintenance Supervisor. The supervisor is responsible for planning and coordinating the repair activity.

Currently the service area is 100% metered, and 30% of meters 2” and larger are automatic read. In the commercial industrial district 100% of meters are automatic read. Studies are underway to assess on the benefits, capital cost, and O&M cost of converting all meters to automated metering.

9.5.7 Flushing Program

Tukwila conducts a distribution system flushing program 3 times per year (February, June and October) or as required based on water quality complaints. This approach allows the City to combine its hydrant inspection and flushing activities. Utility personnel also practice regular scheduled flushing of distribution system dead-ends and in response to customer water quality complaints. Chlorine residuals are measured before and after flushing, then documented.

The City is considering developing a uni-directional flushing program designed to systematically flush the distribution system. Such a program would reduce flushing water demands, improve flushing efficiency, reduce water quality complaints resulting from flushing activity, and possibly improve water quality.

9.6 Emergency Response Operations

The City of Tukwila's objective is to provide and support effective planning, disaster management, and education services to enable citizens and employees of Tukwila to prepare for, respond to, and recover from an emergency.

The Public Works Department has in place an "Emergency Action Plan" that outlines procedures to protect the water supply and the city's infrastructure. The Emergency Action Plan identifies potential threats or hazards that may jeopardize the city's water supply. The Emergency Action Plan is available from the City and addresses:

- Drought Response
- Water Quality Emergencies
- Earthquake Response
- Emergency Power Requirements
- Outside Agency Coordination
- Specific Emergency SOPs
- Floods
- Terrorism
- Volcanic Eruption

9.7 Safety

The Tukwila Public Works Department prides itself on having a keen sensitivity to the needs and concerns of the community and their employees. To meet some of those needs, the Public Works Department works as a partner in the development of safety programs and awareness for all utility employees. This has been accomplished by the implementation of an "Accident Prevention Program" and can be obtained from the City.

Additionally, the Public Works Department maintains safety records for every employee and monitors renewal dates. New employees are issued proper safety equipment particular to the job assigned, and equipment is replaced with new as required. Each section of Public Works has an assigned safety representative to help manage the program. Department and individual divisions within the organization hold monthly safety meetings as well as on-site safety briefings before a major project is undertaken. Particular emphasis is placed on the following topics:

- Confined Space Entry
- Trenching and Shoring
- Chlorine Safety
- Heavy Equipment Operation
- Use of Personal Protection Gear
- Flagging
- First Aid/CPR
- MSDS Tracking

The City of Tukwila has an assigned Safety Manager to oversee the actions of the Public Works Department and to monitor new state or federal requirements.

9.8 Design and Construction Standards and Specifications

Tukwila Public Works conducts all construction of water mains and appurtenances in accordance with City Development Guidelines and Design and Construction Standards, applicable American Water Works Association (AWWA) standards and Section 7-11 of the WASDOT/APWA Standard Specifications. Chapter 7 of City's Development Guidelines and Design and Construction Standards addresses water supply specifically (Appendix W).

These standards and specifications are intended to meet or exceed the design and construction standards referenced in WAC 246-290. This material is intended to meet the requirements of the DOH submittal exception process for distribution mains construction. By qualifying for this process and following the approved procedures and standards, the City is provided a waiver from the requirement of DOH approval for individual projects.

9.9 Water Quality Operations

The City of Tukwila takes an aggressive approach to protecting the quality of distributed water. The City contracts with the City of Seattle which conducts monitoring and testing of the distribution system to protect water quality from source to tap. Trained water quality employees from the City of Seattle conduct daily monitoring at 15 locations throughout the service area. Seattle water quality personnel collect and transport all water samples in accordance with state and federal regulations, and DOH approved monitoring plans. Water samples are sent to the City of Seattle laboratory for testing by certified technicians. Records are kept of all water tests and on file for DOH inspection. A detailed description of monitoring requirements is provided in Section 8.

If a water quality violation occurs, requiring customer notification, the City notifies the Department of Health in accordance with WAC 246-290-320 and the public notification process is employed. All radio, television, or printed public notification includes a clear explanation of the violation, discussion of potential health effects and the population at risk, a list of protective measures, and the city's address and phone number.

Annually, every household and business in the city's service area is sent a Consumer Confidence Report explaining the test results and any presence of regulated contaminants. The Consumer Confidence Report also notifies customers of any water quality violations in the past twelve months.

9.9.1 Backflow Prevention and Cross Connection Control

Under WAC 246-290-490, the City has the responsibility to protect the public water system from ill effects associated with contamination due to cross-connections and backflow events. The following is a summary of the activities the city would like to perform in meeting DOH requirements contained in WAC 246-290-490. The activities and procedures are contained in the City's Cross Connection Control program (CCP).

- ***Establishment of Local Authority***. The City's legal authority to implement and enforce a cross-connection control program is established by Tukwila Municipal Code Chapter 14.0431, Water Supply Cross-Connections.
- ***Procedures for Evaluation of Service Connections Hazards***. Procedures and schedules for determining the degree of hazard posed by new and existing service connections are provided in the CCP. For new services, the City performs an initial cross-connection review prior to construction. For existing services, evaluations are performed on a schedule, with those posing the greatest potential hazard designated as having the highest priority. Evaluations of existing connections consist of meeting customers, reviewing facility drawings, and a physical survey of all exposed piping (if allowed by the customer). After the evaluation, the customer is notified if installation of a backflow prevention assembly is required. If, after 90 days, the customer has not installed a proper assembly, the City may install an assembly at the service connection. The City also reserves the right to disconnect the customer's service, in the event that immediate corrective action is required and is not taken by the customer.
- ***Procedures for Eliminating or Controlling Cross-Connections***. The City requires that cross-connections be eliminated if possible. If they cannot be eliminated, cross-connections are to be controlled and prevented by backflow prevention assemblies appropriate for the given situation.
- ***Utilize Qualified Cross-Connection Specialists***. The City's program is implemented by certified Cross-Connection Control Specialists (CCS). As of October 2004, the City has 6 employees holding state certifications as CCS, as well as employing 0 certified Backflow Assembly Testers (BATs).
- ***Assembly Testing and Inspection Procedures***. The City does not test backflow prevention assemblies.
- ***Quality Insurance Program for Testing***. The City's program requires that all backflow prevention assembly test reports submitted to the City document that the tester is on the City's list of certified testers and that the test kit used is in proper calibration.
- ***Incident Response Procedures***. Select City personnel are trained to respond to reported backflow incidents. Procedures for such responses and notification of the Seattle/King County Health District and DOH are contained within the CCP.
- ***Consumer Education.*** The CCP incorporates information on cross-connection control into the City's existing consumer education program. The City provides all new water customers with a Customer Information Kit, which includes guidelines on installation, inspection, and testing procedures to ensure compliance with cross-connection control regulations.
- ***Maintenance of Program Records***. The City utilizes a database for storing, organizing, and tracking CCP records, including an inventory of known backflow prevention assemblies. In 2003, the City's database contained information on 975 backflow prevention assemblies at 279 different sites throughout the service area.

Due to insufficient staffing, not all of the aspects of the desired program have been implemented by the City. Operations staff estimates that approximately 0.5 to 1.0 additional Full Time Equivalent (FTE) staff would be required to provide the level of program described above.

9.9.2 Customer Water Quality Inquiries

The Public Works Department receives and monitors all customer complaints. The customer service employee writes a work order and sends it to the proper division within the department for follow-up. Whether it is a complaint on cloudy water, chlorine, low pressure or leaking water meter this employee tracks the service order to completion. The representative is also responsible for tracking streets, construction, traffic lights as well as all water related issues.

If the call is an emergency, the customer service representative will radio the field crew to respond to the phone call. If it is a non-emergency call such as cloudy water, high chlorine taste, etc. the representative will write a service order and the supervisor will schedule the work. After the service order has been responded to, the order is returned to the customer service representative with the corrected action taken outlined on the order.

All service orders are tracked by number and division. Each week every division receives an order status sheet that has all service orders issued to that division during the week. If the service order has not been responded to or if it has and not been returned as completed a status of the service order is requested.

9.10 Supplies and Equipment

9.10.1 Standby Power Generators

The only water facility which could require standby power from a generator is the North Hill Booster Pump Station. The facility is not considered critical to maintenance of service and therefore, a permanent standby power generator has not been installed.

A 35 KW trailer-mounted diesel generator is positioned at the Public Works Department yard and available for emergency use at various sites in the service area.

9.10.2 Spare Parts

The Public Works Department keeps an inventory of commonly needed parts as well as emergency supplies at the Public Works yard and stockroom. The City's supply department tracks the inventory and orders additional supplies as required. The City expects critical spare equipment kept in stock include meters, meter boxes, various valves of all necessary sizes, pipe fittings, pipe, emergency clamps of various sizes etc. Large non-emergency items are purchased on an as needed basis.

9.10.3 Tools and Equipment

Smaller commonly used tools and equipment are carried in the employee's trucks or are readily available from the stockroom. Tools and equipment such as pumps, small compressors, portable generators, pressure washers, and power tools are available from the stockroom. Larger infrequently used items are rented from various equipment rental companies located in Tukwila.

9.10.4 Heavy Equipment

The Public Works Department owns heavy equipment such as dump trucks, rollers, forklifts, and backhoes. If necessary, larger equipment is leased or rented on an as needed basis from local suppliers. The City's maintenance and construction crews have personnel trained and experienced in heavy equipment operation.

9.11 Recordkeeping and Reporting

The City of Tukwila utilizes an Information and Records Management system. By computer network tracking, the City's Public Works Department has developed a filing system that breaks down the reservoirs, distribution system, water meters and other necessary components that make up a service area. The city also involves department heads and supervisors to maintain and track their areas of responsibility. On an annual basis maintenance records are reviewed for the annual report. In addition, the city has contracted out the maintenance of the SCADA system within the service area. All telemetry maintenance is conducted by the contractor.

Records include, but are not limited to the following:

- Water quality
- MCL violations
- Water quality complaints
- Backflow prevention
- Maintenance and construction
- O&M manuals
- Personal records
- Flushing and distribution system

9.12 O&M Improvements

- Provide improve SCADA communications capability allowing off-site access of control data by means of a remote computer via the internet of direct dial-in.
- Provide an additional 1.0 FTE staffing position to focus on water quality assurance including developing and carrying out the Cross Connection Control program (CCP).

Section 10
Capital Improvement Plan

10.1 Identification of Recommended System Improvements

A number of system improvements have been identified during the completion of this plan. The development of the specific improvements has been described in the appropriate chapter. This chapter combines the various improvements identified into a single listing that can be prioritized and scheduled.

In addition to those improvements identified during WSP preparation, City operations personnel have identified new facilities or facilities that require replacement. These facilities have been included in the Capital Improvement Plan.

10.2 Improvements

A listing of improvements to Tukwila system has been created through the combination of two separate sources. These sources include:

- A list of capital improvement projects provided by the City of Tukwila that are the process of design or are currently being proposed for the 2005-2010 Capital Improvement Plan,
- A list of additional projects identified during the hydraulic analysis evaluation of the Tukwila storage water system.

The two sources have been combined into Table 10-1 showing project name, scheduled range of years of activity, estimated project cost, and a comment about what the improvement is meant to affect. Twenty-three projects have been identified. Estimated project costs (construction, sales tax, engineering, administration, etc.) are presented in year 2004 dollars.

Exhibit 10-1 is a map showing the location of each improvement listed in Table 10-1. A large scale version of this map is included as Appendix X.

Table 10-1
City of Tukwila
Recommended Capital Improvements

Project No.	Project Title	Description	Year of Construction and Cost ($2004) 2005-2011	2011-2024	Comments
W-001	52nd Avenue S: Interurban Avenue S. to 53rd Avenue S.	Replace approximately 280LF of existing 6-inch line along 52nd Avenue S. with 8-inch.		$ 15,680	This replacement will improve fire flows to the north side of Tukwila hill.
W-002	S. 137th Street and 53rd Avenue S.	Install approximately 635LF of new 8-inch line along S. 137th Street and 53rd Avenue S. to S. 139th St.	$ 35,560		This provides needed loop within the distribution system and will improve water service and fire flows to the north side of Tukwila hill.
W-003	53rd Avenue S: S. 139th Street to S. 140th Street	Replace approximately 300LF of existing 6-inch line along 53rd Avenue S. with 8-inch.	$ 16,800		This replacement will improve fire flows to the north side of Tukwila hill.
W-004	Macadam Road S: S 144th Street to S 152nd Street	Replace approximately 960LF of existing 8-inch and 1,740LF of existing 6-inch line with 8-inch.	$ 151,200		This replacement will improve water service and water quality to the north side of Tukwila hill.
W-005	Macadam Road S Extension: S 152nd Street to Southcenter Blvd.	Install approximately 1,355LF of new 8-inch line along Macadam Road.	$ 75,880		This provides needed loop within the distribution system and will improve water service and fire flows to the north side of Tukwila hill.
W-006	Maule Avenue: S. 143rd Street and S. 144th Street	Replace approximately 725LF of existing 2-inch line with 10-inch line along Maule Avenue.	$ 50,750		This replacement will improve fire flows to the commercial area on the east side of Tukwila hill.
W-007	S. 143rd Place: East of Maule Avenue	Replace approximately 670LF of existing 6-inch line along S. 143rd Place with 10-inch and install approximately 100LF of new 10-inch to connect the two existing dead-end lines.	$ 53,900		This replacement and extension will improve fire flows to the commercial area on the east side of Tukwila hill and will provide a needed loop in the distribution system.
W-008	58th Avenue S: S 142nd Street to S 144th Street	Replace 660 LF of existing 6-inch line with 8-inch.	$ 36,960		Replacement of aged piping.
W-010	Southcenter Blvd.: SW Grady Way to Andover Park East	Install approximately 1,250LF of new 10-inch line along Southcenter Blvd. Includes a bridge crossing.	$ 131,250		This will replace the existing 12-inch main connecting from Interurban Avenue S. to Southcenter Blvd, and improve water service and fire flows to the areas around City Hall and the residential area north of Southcenter Blvd. To be constructed in conjunction with W-009.
W-011	Southcenter Blvd.: Andover Park East to 65th Avenue S.	Replace approximately 400LF of existing 8-inch with 10-inch.	$ 42,000		This replacement will improve water service and fire flows to the areas around City Hall and the residential area north of Southcenter Blvd.
W-012	65th Avenue S.: Southcenter Blvd. to S. 151st Street	Replace approximately 1,985 LF of existing 8-inch with 16-inch.	$ 222,320		This replacement will improve fire flows to the east side of Tukwila hill (Canyon Estates).
W-013	S. 153rd Street: East of 65th Avenue S.	Replace approximately 490LF of existing 8-inch line with 10-inch along S. 153rd Street.		$ 34,300	This replacement will improve fire flows to the east side of Tukwila hill (Canyon Estates).

Table 10-1
City of Tukwila
Recommended Capital Improvements

Project No.	Project Title	Description	Year of Construction and Cost ($2004) 2005-2011	2011-2024	Comments
W-014	Christensen Road.: North of Baker Blvd. to Southcenter Blvd.	New 10-inch line along Christensen Rd.	$ -		Complete water main extension along Christensen Rd. This provides a needed loop within the distribution system.
W-016	Black Drive: West of Andover Park East	Replace approximately 540LF of existing 8-inch line with 10-inch along Black Drive.		$ 37,800	This replacement will improve fire flows to this area.
W-017	Corporate Drive S.: West of Andover Park West	Replace approximately 460LF of existing 8-inch line with 10-inch line along Corporate Drive South.		$ 32,200	This replacement will improve fire flows to this area.
W-018	Minkler Blvd. Extension	Install approximately 995LF of new 12-inch line along Minkler Blvd. from the end of the existing dead-end line to Andover Park West.		$ 83,580	This extension will improve water service to the CBD area and provides a needed loop within the distribution system.
W-019	Minkler Blvd.: East of Industry Drive	Replace approximately 490LF of existing 8-inch line with 10-inch along Minkler Blvd.	$ 34,300		This replacement will improve fire flows to this area.
W-020	Southcenter Parkway: Minkler Blvd. to S 180th Street	Replace approximately 2,615LF of existing 10-inch line with 12-inch.	$ 329,490		This replacement will improve water service to the Tukwila Valley South area.
W-021	S. 180th Street: East of Andover Park East	Replace approximately 880LF of existing 10-inch line with 12-inch.	$ 73,920		This replacement will improve fire flows to this area.
W-022	49th Ave. S: S 107th St to S 114th St.	Install approximately1,970 LF of new 8-inch line along 49th Ave. from the S 107th St to S 114th St..	$ 110,320		This extension will close a loop.
W-023	W.Seattle Pipeline ROW: SS10 to Pacific Hwy S.	Install 950 LF of new 8-inch line along the existing West Seattle Pipeline R-O-W between SS 10 and Pacific Highway South	$ 53,200		This extension will close a loop.
W-024	S 113th St Upsize	Replace existing 2-inch diameter pipe with new 8-inch (approx 900 LF)	$ 50,400		Improve local fire flow
W-025	East marginal Way S. and S. Norfolk St.	Move zone valve PRV to south of Norfolk Street on East Marginal Way S.	$ 35,000		Improve Fire Flow

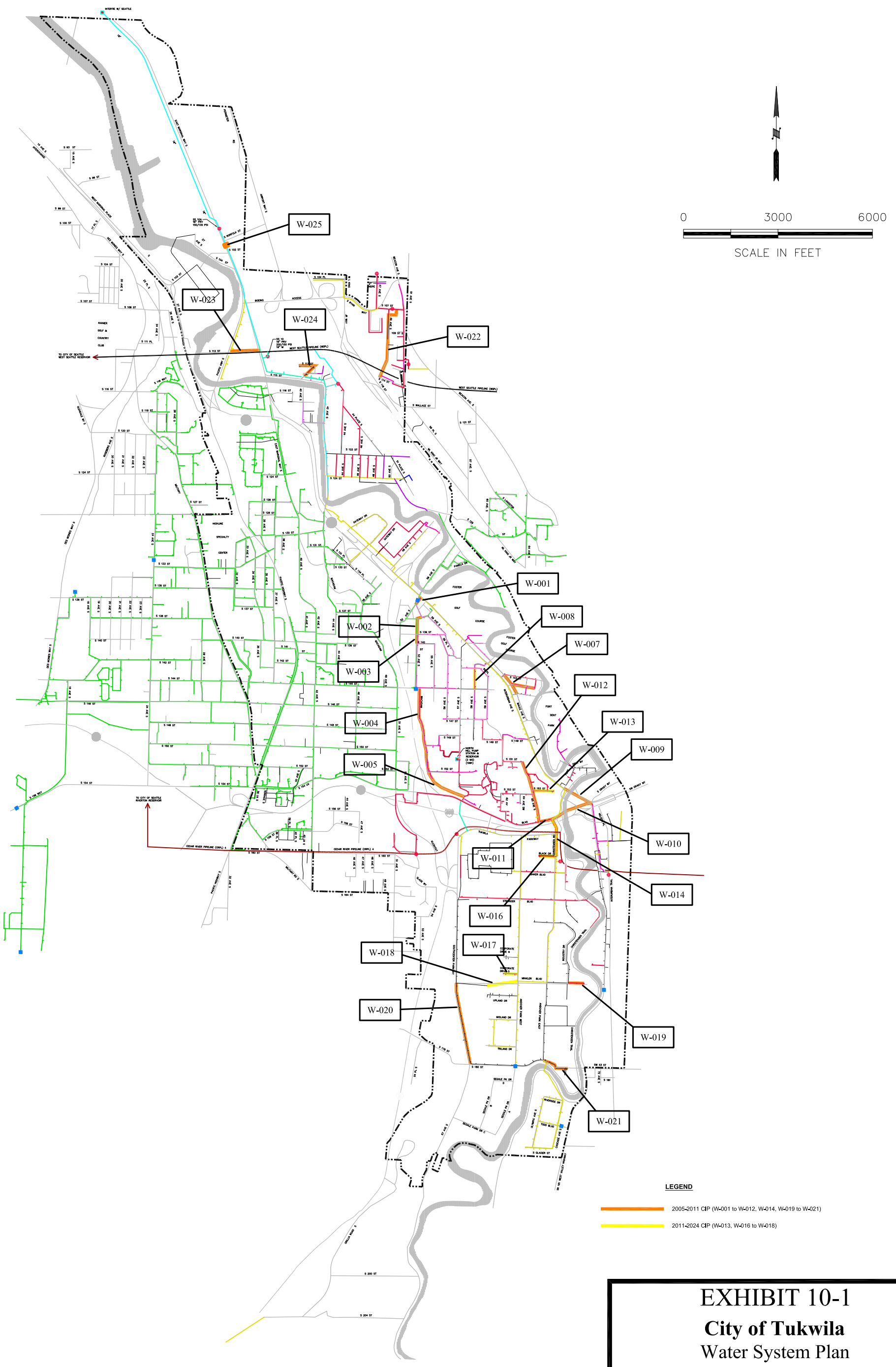


EXHIBIT 10-1

City of Tukwila

Water System Plan

Capital Improvement Projects

February 2005

Section 11
Financial Plan

11.1 Introduction

The effective implementation of a Water System Plan (WSP) is dependent upon accurately developing a document that can be financially supported by the utility; will meet State and local regulatory requirements; and provides the flexibility to deal with unforeseen changes.

This section presents a financial plan that reviews the sources of funds (revenues) and applications of funds (expenses) for the City of Tukwila's (City) water system. The financial plan includes projected operating and capital costs of the system for the six-year time horizon of 2005-2010. The revenues and expenses used in the financial plan were obtained from the City's 2004 budget in conjunction with historical consumption information. The capital costs contained within the financial plan utilize the Capital Improvement Plan (CIP) presented in Section 10 of this Plan. The results of the financial plan outline the annual operating and capital needs of the water system and determine if the current water revenues are sufficient to cover costs. This analysis is not sufficient to provide a detailed review of cost of service or alternative rate designs. However, the City may consider performing a rate study independent of this planning document to address those issues.

11.2 Past Financial History

The past six years of financial information for the water utility were evaluated to gain an understanding of the past performance of the utility, and at the same time, gain perspective of the current financial status of the water utility.

Table 11-1 is a summary of a six-year financial history (2003 - 1998) for the City's water utility.

Table 11-1 Water System Financial History						
	2003	**2002**	**2001**	**2000**	**1999**	**1998**
Sources of Funds						
Rate Revenue	$3,950,027	$3,463,302	$3,476,086	$3,773,510	$3,532,525	$3,146,338
Other Revenue	194,409	407,126	227,363	240,461	147,049	104,733
Total Revenue	**$4,144,436**	**$3,870,428**	**$3,703,449**	**$4,013,971**	**$3,679,575**	**$3,251,071**
Applications of Funds						
Operating Costs						
Source of Supply	$1,252,284	$1,161,497	$1,045,437	$1,026,823	$905,598	$706,978
Pumping	50,454	26,856	22,751	28,990	35,286	31,388
Distribution	342,705	313,115	237,000	265,563	254,236	264,816
Customer Accounts & Services	27,188	22,158	28,178	20,039	18,971	19,917
Administrative & General Expenses	745,435	737,379	670,852	625,869	568,533	577,142
Other Expenses	574	3,360	4,388	2,111	2,793	3,496
Total Operating Expenses	**$2,418,640**	**$2,264,365**	**$2,008,607**	**$1,969,393**	**$1,785,417**	**$1,603,738**
Debt Service	**$654,862**	**$698,205**	**$673,087**	**$692,738**	**$694,718**	**$720,661**
Taxes & Transfers	**$318,020**	**$283,868**	**$172,260**	**$182,787**	**$171,411**	**$147,975**
Total Revenue Requirements	**$3,391,522**	**$3,246,438**	**$2,853,955**	**$2,844,918**	**$2,651,545**	**$2,472,374**
Balance For Capital/Reserves (Deficit)	$752,915	$623,990	$849,494	$1,169,053	$1,028,030	$778,697

The utility has a strong financial position. As Table 11-1 illustrates, the utility is showing a positive cash flow for the historical test period. The balances are used for capital improvements and/or reserved for future capital needs. While some capital improvements are funded through low-interest loans and revenue bonds, resulting in debt service payments, the utility also historically has funded a substantial level of capital improvements through rates. Target levels for funding capital improvements for future years is discussed later in this section.

11.3 Development of the Financial Plan (Revenue Requirement)

A six-year financial plan is developed to determine the City's ability to meet its capital improvement and operating needs over the six-year review period. In developing the financial plan, fund balance and reserve levels were also analyzed. The financial plan was developed to review the projected revenues and expenses of the water system for 2005-2010. The City's 2004 budget was used as a base. Future years were escalated by applying factors for inflation and growth, as described below.

11.3.1 Revenue

The first component of the financial plan is a review of the sources of revenue of the water system. The different revenues received from operations are:

- Rate revenues – water sales to customers;
- Other revenues – service repairs, fines and penalties, ancillary fees; and
- Interest Revenue –interest earnings on fund balance.

Projections for future year revenues were developed by applying a projected growth rate of 1 percent to the 2004 budgeted rate revenue. The one percent growth level appeared to be

appropriate when reviewing the swing in potable water sales from 1999-2003. The trend appeared to be increasing as shown by a 2.9% growth rate from 2002 to 2003. However, with continual emphasis on conservation, the one percent growth rate was used for future periods. Other miscellaneous revenues, including investment interest, penalties and other revenue, are projected to increase approximately 2 to 3 percent per year through 2010.

Rate revenues are projected to be $3.8 million in 2005. The rate revenues of the City come from retail sales to the residential and commercial customers. With growth applied at 1 percent per year, the rate revenue increases to $3.98 million by 2010.

Other revenues for 2005 total approximately $180,000, with a majority coming from hydrant rental (transfers-in), investment interest, and reclaimed water sales. The other revenue increases over the six years, reaching $250,000 by 2010.

The total revenue available to offset the operating and capital requirements of the water system total $4.0 million in 2005 increasing to $4.2 million by 2010.

11.3.2 Expenses

Operating expenses, or the application of funds, are based on the 2004 budget. These expenses are then projected for future years by applying escalation factors dependent upon the type of expense being reviewed. The second part of the financial plan is a review of the applications of funds. In developing the financial forecast, four main cost components were reviewed:

- Operations and Maintenance (O&M) Expenses
- Taxes and Transfer Payments
- Debt Service
- Capital Improvements Funded From Rates

Operation and Maintenance Expenses

Using the 2004 budget as a starting point, expenses were escalated by factors representing assumed inflationary rates to obtain projected costs. Escalation factors range from employee benefits at an average annual increase of 18 percent, to miscellaneous items, materials and supplies at 2 percent. Labor escalated at 4 percent and purchased water at 3 percent per year. Detailed escalation factors are provided in Appendix Y, accompanied by a copy of the financial plan.

The financial plan also includes an additional full-time utility worker in 2006 for water quality assurance, which includes the cross-connection control and back-flow control programs. This position is included at a salary of $65,000 plus the related benefits.

It should be noted that no other program cost increases, above budget year 2004 figures, were assumed as part of the projected costs. O&M expenses ranged from $2.4 million in 2005 to $3.0 million in 2010.

Taxes and Transfer Payments

The water system currently has tax obligations to the State in the form of excise taxes. The state public utility tax is calculated as 5.029 percent of the water utility rate revenues. For 2005 these taxes/transfer payments total approximately $200,000 and increase to $210,500 by 2010. Projected taxes for the period assume constant tax rates over time.

Debt Service

There are currently five outstanding loan obligations for the City's water system. There is a 1993 combined water/sewer revenue bond issue, of which 98 percent of the benefit (and debt payments) are attributed to the water utility. The 1995 revenue bond issue is allocated 100 percent to the water utility.

According to Finance Department records, there are three Public Works Trust Fund (PWTF) loans relating to the water utility. One 2001 PWTF loan for Foster Point is allocated to water, sewer and stormwater. The water utility's part of the water/sewer portion is 20%. The annual payment of $3,800 is completed in 2005. Another 2001 PWTF loan is a payment made to Val Vue for loan debt service paid to King County. The water utility share is 55% of the total City of Tukwila share (35%), with the balance attributed to the stormwater utility. The annual payment for this loan is estimated at $14,400 per year for the test period. Finally, the 2004 PWTF loan that the City is currently receiving proceeds for will result in a payment from the water utility of $38,600 per year through 2023.

The combined debt service on the existing debt averages approximately $745,000 between 2005 and 2006. The 1993 bond issue has a final payment in 2006. This reduces the average annual debt service total to approximately $450,000 from 2007 through 2010.

The model used to develop the financial plan shows that the City will require no new bond issues or loans through 2010 to meet the capital needs identified earlier in this plan.

Meeting debt service coverage requirements is an important financial indicator for well managed utilities. Debt service coverage is a financial measurement of an entity's ability to repay debt. A debt service coverage ratio is a comparison of net income before debt service payments to the total debt service on revenue bonds. The City must meet a 1.40 coverage ratio test according to existing bond covenants. The City meets this requirement through the test period. The City will need to be watchful of this requirement during its financial evaluations.

Capital Improvement Projects from Rates

Capital improvement projects are related to the infrastructure of a utility. Capital improvement projects are generally divided into two categories: capital improvements related to renewal and replacements of existing plant and depreciated facilities, and growth related projects including system expansion and upgrades to accommodate new customers.

The City capitalizes some staff time and benefits for those staff working on capital projects. In addition, there are planning and construction projects included within the capital component of

the financial plan. The financial analysis conducted for this plan has incorporated the capital projects outlined in Section 10 of this Plan. These projects have been allocated by year in order to quantify the annual capital requirements for the review period. Identified capital improvement projects average approximately $300,000 to $400,000 per year from 2005 to 2010.

The City has strong reserve funding available, which has helped to fund planned and unanticipated capital improvements in the past. It is anticipated that the City will use some reserve funding, and continue to maintain reserve balances through the test period. Reserve funds are discussed later in this section.

This financial analysis assumes that the City will fund renewals and replacement projects at a rate of 1.25 times the annual depreciation expense of the utility. The 1.25 factor will assist in the funding difference required when comparing the replacement cost of the asset to the depreciated value. The city may want to target funding a higher factor in the future such as 1.5 or 2.0 times depreciation expense. The City's records reflect that the annual depreciation expense for the water utility in 2003 was $405,000. In 2005, funding for replacement capital is established at $530,000. The 2005 figure applies a 3% increase per year and a 1.25 factor to the 2003 depreciation amount. This level of funding capital improvements from rates continues to grow through the test period, totaling $615,000 by 2010.

The capital analysis assumes that any additional funding beyond what is necessary to meet the annual capital requirements will be placed into the working capital reserve for future capital needs.

11.3.3 External Sources of Funds for Capital Projects

The City has the ability to apply for grant and loan funds available to public entities for water system projects. The City has been successful at obtaining a number of low-interest loans, as described earlier under the debt service section. Table 11-2 provides a summary of the contacts for various funding agencies. These sources rarely provide full funding of a construction project. The City would need to supplement any of these funds with matching funds to meet eligibility criteria and to ensure that implementation of the recommended capital improvement projects can occur.

Table 11-2
Funding Agency Contacts

Program	Address	Phone	Fax	Internet
Centennial Clean Water Fund	Department of Ecology P.O. Box 47600 Olympia, WA 98504-7600	(360) 407-6566	(360) 407-6426	www.ecy.wa.gov
Drinking Water State Revolving Fund	Department of Health DWSRF PO Box 47822 Olympia, WA 98504-7822	(360) 236-3095	(360) 236-2253	www.doh.wa.gov

Program	Address	Phone	Fax	Internet
Public Works Trust Fund	Public Works Board P.O. Box 48319 Olympia, WA 98504-8319	(360) 586-7186	(360) 664-3029	www.pwb.wa.gov
Infrastructure Database (over 200 funding programs)	Infrastructure Assistance Coordinating Council (IACC)	(360) 725-5002		www.infrafunding.wa.gov

A brief description of these funding sources is provided below.

Department of Ecology

The Centennial Clean Water Fund (CCWF) is available to local governments and tribes for measures to prevent and control water pollution. Both grants and loans are available on a yearly funding cycle.

CCWF is the largest State grant program for water projects. It provides grants for planning, design, and construction of facilities and other activities related to water quality. The primary focus of the program is pollution prevention and funding projects with a quantifiable water quality benefit. Funds are available to protect a source of water supply, as well as funding of water conservation or water reuse projects, if they can be shown to be the cost-effective alternative to solve a water quality problem. Funding from this program is not available to provide excess capacity, but must be used to meet existing residential needs. Funding can also not be used to provide a source of supply. Grants and loans from this program are also available for the wellhead protection activities.

Interest rates are 0.5 percent for loans up to five years while those over five years but less than 20 years have a 1.5 percent rate. Grant funding of 50 to 75 percent of a project is available depending on the type of project.

Another source of Washington Department of Ecology (Ecology) grant funding provided by the Remedial Action grant program is normally used only to mitigate contamination events.

Washington Department of Health

The Safe Drinking Water Act (SDWA) appropriates funding for states to develop their Drinking Water State Revolving Fund (DWSRF) loan programs. Each state receives annual allocations in the form of a capitalization grant. In Washington State, the DWSRF is jointly managed by the Department of Health (DOH), Division of Drinking Water, the Public Works Trust Fund Board (Board), along with its partner, the Department of Community, Trade and Economic Development.

DWSRF loans are available to all community public water systems, and non-profit, non-community public water systems, except federally owned and State-owned systems. The loans may be used to address SDWA health standard violations, replace infrastructure for SDWA compliance, or consolidate supplies and acquire property if needed for SDWA compliance.

The interest rates on DWSRF loans range from 0 percent to 2.5 percent with a 2 percent loan fee on all loans. The interest rate is dependent on the economic situation of the area. If 51 percent of the area's households are below the medium income then the loan repayment period is 30 years, otherwise, they are 20-year loans or the life of the project, whichever is less.

Public Works Trust Fund

The PWTF loan program is set up by the Legislature to assist cities, towns, counties, or special districts with funding for different types of public works projects. The projects can include streets, roads, drainage systems, water systems, and sanitary sewer systems. The emphasis of allocating funds is for replacement and/or repair of existing systems. Funds are not allocated to install new water systems. Rather, funds are granted to rehabilitate or replace existing systems serving an existing population.

The loans are issued at up to 2 percent interest rate for a maximum term of 20 years for applications requesting 95 percent project funding. The interest rate decreases to 0.5 percent when applicants provide at least 15 percent of the project funding. Debt service coverage is not imposed on the PWTF loan.

Infrastructure Assistance Coordinating Council

There are numerous other programs with funding available for various other aspects of water utility capital projects. The Infrastructure Assistance Coordinating Council (Council) provides resources and conferences on the available funding sources. This Council is comprised of State and local organizations whose function is to provide funding for infrastructure repair and development. The purpose of the Council is to assist local governments in coordinating funding efforts for infrastructure improvements. This is an important resource as the Council will be aware of any new funding opportunities that may arise.

While the above list of possible grant and loan opportunities for the City is not exhaustive, it does highlight the most probable outside funding sources, excluding revenue bonds and other external sources of funds, available to the City for its water capital improvement needs. These other external sources of funds are described below.

Revenue Bonds

Revenue bonds are supported by the income generated from monthly utility charges. The City Council can issue revenue bonds at its discretion. Water rates must be high enough to pay system operation and maintenance costs plus the annual principal and interest cost (debt service) of the bond issue.

For investors to buy revenue bonds, rates must include adequate revenue to provide for "coverage". The normal coverage is 20 to 40 percent of the debt service, depending on the financial strength of the City. In the City's existing debt service bond covenants the coverage requirement is 40 percent.

Utility Local Improvement Districts (ULID)

Projects benefiting adjacent properties can be funded through utility local improvement districts (ULID). After a ULID is formed, the cost of the project can be assessed against the benefited properties in proportion to their share of the total benefits. The amount of the assessment cannot exceed the increase in the value of the property resulting from the project.

A ULID combines property assessments and revenue funding from water rates. The additional security of the bonds tends to bring lower interest rates. There is also added flexibility and equity as the City can accommodate the cost of special construction problems or of upsizing the distribution system.

Developer Extension

Under a developer extension, the owner of a development requests water service. Filing fees usually cover administration costs only. The developer pays all costs of the extension and turns it over to the City for operation and maintenance.

Internal funding sources available to offset capital costs include contributions received from new water connections and existing reserves. The City's contributions appear low. A review of the connection charges of the utility may be warranted to ensure they are consistent with system planning criteria and are keeping pace with inflation.

11.4 Summary of the Financial Projections

A summary of the financial plan and resulting financial status of the water system is provided in Table 11-3. This is an abbreviated summary of the detailed financial plan and analysis, which is provided in Appendix Y.

Table 11-3 Summary of the City's Projected Six-Year Financial Plan	Budget	Projected					
	2004	2005	2006	2007	2008	2009	2010
SOURCES OF FUNDS							
Present Rate Revenues	$3,750,000	$3,787,500	$3,825,375	$3,863,629	$3,902,265	$3,941,288	$3,980,701
Miscellaneous Revenues	159,343	181,672	185,878	225,888	233,046	241,563	253,858
TOTAL SOURCES OF FUNDS	**$3,909,343**	**$3,969,172**	**$4,011,253**	**$4,089,517**	**$4,135,311**	**$4,182,850**	**$4,234,558**
TOTAL O&M EXPENSE	**$2,608,980**	**$2,352,444**	**$2,520,925**	**$2,619,792**	**$2,724,329**	**$2,833,810**	**$2,948,591**
TOTAL TAXES/TRANSFERS	**$180,000**	**$200,359**	**$202,362**	**$204,386**	**$206,430**	**$208,494**	**$210,579**
CAPITAL PROJECT BUDGET							
Capital Improvements - Preliminary Eng.	$56,000	$59,640	$63,678	$68,174	$73,201	$78,844	$85,200
Capital Improvements - Infrastructure	2,226,000	485,960	497,987	510,035	522,045	533,948	545,660
Less: Outside Funding	1,907,000	15,150	15,301	15,455	15,609	15,765	15,923
TOTAL CIP FROM RATES	**$375,000**	**$530,450**	**$546,364**	**$562,754**	**$579,637**	**$597,026**	**$614,937**
DEBT SERVICE	**$747,179**	**$745,613**	**$743,748**	**$450,092**	**$452,893**	**$449,415**	**$450,397**
TOTAL REVENUE REQUIREMENTS	**$3,911,159**	**$3,828,865**	**$4,013,400**	**$3,837,024**	**$3,963,289**	**$4,088,746**	**$4,224,504**
Balance/(Deficiency) Before Added Taxes	($1,816)	$140,307	($2,146)	$252,492	$172,022	$94,105	$10,054
Plus: Additional Taxes w/ Rate Increase	$96	$0	$113	$0	$0	$0	$0
Net Balance/(Deficiency) of Funds	($1,912)	$140,307	($2,260)	$252,492	$172,022	$94,105	$10,054
RATE ADJUSTM'T AS A % OF RATE REV	**0.0%**	**-3.7%**	**0.1%**	**-6.5%**	**-4.4%**	**-2.4%**	**-0.3%**
Debt Service Coverage Ratio:							
Before Rate Adjustment	1.52	1.92	1.75	2.85	2.69	2.57	2.42

When interpreting the results of Table 11-3 it is important to understand that the "Rate Adjustment As A % of Rate Revenue" is cumulative. That is, any rate adjustments made in previous years would reduce what is required in the following years. It is also important to keep in mind that the model assumes expenses are completely expended within each year. Typically, utilities receive additional revenue and often actual expenditures do not total 100 percent of budget appropriations. Therefore, the city has a number of options for deferring the adjustment until the latter part of the test period. Those options would include adjusting capital improvement timing, use more reserves for capital improvements, reducing some other operating expenses, and closely monitoring additional revenue or increased growth beyond the 1% assumed.

The results of Table 11-3 show that existing rates are sufficient throughout the time period under review. With the reduction in debt service in 2007, the balance of funds increases to $250,000. This surplus slowly diminishes by 2010 when revenue and expenses are close to balancing.

It is important to note that the financial plan presented in this section is predicated upon an assumed level of growth on the system (1.0 percent per year), and assumptions related to inflation. Should this growth increase, slow down, or not occur, the level of rate adjustment required will be affected. Likewise, if costs escalate faster or slower than indicated in this plan, the rate adjustments needed would also be affected.

11.5 Reserve Levels

A key indicator of financial health and viability is a utility's reserve levels. Because a majority of the utility's revenue is consumption based, and therefore dependent upon optimal weather conditions, maintaining adequate reserve levels is important for stable fiscal management of the utility. A discussion of the utility's reserves is provided below.

Industry standards (American Waterworks Association – AWWA) recommend that utilities maintain working capital reserves at a level adequate to handle unexpected occurrences, including unexpected cash flow fluctuations. A balance for an O&M reserve, or operating reserve, is recommended to be a minimum of 45 days of operations and tax expense. For the City, that minimum balance would equate to approximately $320,000 to $350,000 in the first half of the review period, and increasing to $390,000 by 2010. The City begins the test period in 2004 with a balance of $4.2 million in working capital. Use of $1.3 million for capital improvements is included in the 2004 budget. The balance increases throughout the time period due to capital needs being lower than available funding. The 2010 ending balance is approximately $4.2 million. Maintaining this balance will provide the city with flexibility in meeting future capital requirements.

The City also has a balance in the construction fund. In 2004 this reserve has approximately $280,000 and grows slightly over the review period to $304,000 by 2010. Sound financial policies indicate that a fund balance equal to an average year's worth of capital projects is a healthy reserve amount. Between the Construction Fund balance and the working capital reserve, the City's reserve levels are more than adequate to meet this target.

The City maintains a revenue bond fund, with a balance beginning in 2004 of $690,000 and growing to $808,000 by 2010. This fund is used to make debt service payments. The City also maintains a bond reserve fund to meet bond covenant requirements. This reserve begins 2004 with a balance of $577,000 and grows to $630,000, due to interest accrual. These funds can only be used as bonds are retired and the reserve is no longer required.

The reserve review indicated that the City has adequate reserve funding to meet unanticipated obligations and general operating fluctuations. The City could improve upon and clarify their financial planning goals by establishing policies that define the appropriate reserves to establish and identify a target or minimum funding level for each reserve.

11.6 Review of the Existing Water Rates

There are various "generally accepted" water rate structures that can be used to establish or develop rates. The initial starting point in considering a rate structure is the relationship between fixed costs and variable costs. Fixed costs are generally collected as a fixed charge on a monthly basis (e.g. $5.00 per month/meter). This charge may be called by various names (e.g. customer charge, meter charge, base charge, etc.) but in all cases, it is intended to collect those fixed costs that the utility incurs.

Currently, the City has both a meter charge for service and a consumption charge based on usage. In addition, the consumption rate is seasonal. That is, the consumption charges are higher in summer, the peak demand period, than they are in the winter months (October through May). For residential customer the meter charge is a minimum charge. For multi-family customers, the $6.00 customer charge is a "per unit" charge. There are different rate schedules for commercial and residential customers. For purposes of this overview, the rates in effect as of January 2004 are presented in Table 11-4.

Table 11-4
Overview of the City's Current Water Rates

Metered Rates	Residential[1]	Commercial
¾"	**$6.00**	**n/a**
1"	**6.00**	**25.00**
1 ½"	**6.00**	**35.00**
2"		**50.00**
3"		**75.00**
4"		**100.00**
6"		**150.00**
8"		**200.00**
10"		**250.00**
12"		**300.00**
Consumption Charges: Per Hundred Cubic		
Winter (October – May)	**$2.15**	**$2.78**
Summer (June – September)	**2.98**	**$3.83**

[1] Multi-family customers are billed $6.00 per unit.

The consumption charge uses a seasonal rate structure. This type of rate structure is designed to send a price signal to customers that use of water in the high demand period (peak use period) of summer costs more. Therefore, customers pay a higher rate per hundred cubic foot of water used in the summer period (June to September). This rate design structure was also likely established to tie to how the City purchased water from the wholesale provider. This rate structure is commonly used and considers the way costs are incurred by the city. There are a number of rate options the City could consider should conservation become more of a priority. For instance, a tiered rate structure (usage priced higher at higher water use levels) could be incorporated to assist in meeting a conservation objective.

The City's meter charge is based on the size of the customer's meter. This approach is used often to identify that different meter sizes place different demands and capacity requirements on the system. It is common to base the meter charge rate differential on the American Water Works Association safe operating capacity of the meter. The meter capacity approach is summarized in Table 11-5.

Table 11-5 Example of the Development of Fixed Meter Charges Based Upon Meter Capacity			
Meter Size	**Safe Maximum Oper. Capacity GPM [1]**	**Capacity Meter Weights**	**Meter Charges at Capacity Weightings**
3/4”	30	1.00	$12.00/month
1”	50	1.67	20.00
1-1/2”	100	3.33	40.00
2”	160	5.33	64.00
3”	300	10.00	120.00
4”	500	16.67	200.00
6”	1,000	33.33	400.00
8”	1,600	53.33	640.00
10”	2,300	76.67	920.00
12”	3,375	112.50	1,350.00

[1] AWWA C-700-77 Cold Water Meters - Displacement Type

As Table 11-5 indicates, the fixed meter or base charge increases in relationship to the safe operating capacity of the various meter sizes. Meter capacity is an important concept in that a customer that has a 2” meter is regarded, from a capacity perspective, as the equivalent of 5.33 - 3/4” customers. Another way of saying this is the commercial customer with a 2” meter is, from a capacity perspective, the equivalent of five (5.33) single-family homes with 3/4” meters. Since a large portion of costs are generally related to meeting capacity requirements, one can see the importance of taking into account capacity in establishing rates for customers. Recalculating the City’s current ¾” meter charge by the capacity meter weightings indicates that the City’s meter charges could be adjusted to more accurately reflect the capacity costs of the system.

A majority of the utility’s revenue (80%) comes from the commercial customers. An additional 10% comes from multi-family and another 10% from the single-family residential customer class. The monthly bill for a City residential customer in winter, using 10 hundred cubic feet of water (10 CCF) would be $27.00. A monthly bill in the summer for the same customer would be $35.80 (or higher for higher usage). Likewise, a monthly bill for a commercial customer with a ¾ inch meter with 10 CCF of consumption would be $39.80 in winter and $50.30 in summer.

The conceptual rate review undertaken indicates that the City’s rates are contemporary and attempt to capture the cost differential to serve customers with varying usage characteristics and facility requirements. Completion of a comprehensive rate study would assist the city identify if any rate structure changes are warranted based on the city’s goals, objectives and the manner in which costs are incurred.

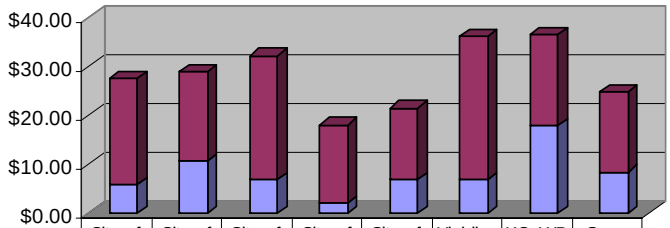
11.7 Overview of Future Water Rates

Based upon the results of the financial analysis, the City will require some minor adjustments in rates in future years to meet the on-going needs of the water utility system, as identified within this document.

The City may wish to conduct a cost of service study in the near future to verify that the rates charged to residential and commercial customers are cost-based. A cost of service study would also review the current rate structure and provide alternative approaches that meet the goals and objectives of the City.

11.8 Neighboring Utility Rate Comparison

To assist in developing a sound financial plan for the water utility, the City of Tukwila requested a comparison of the City's water utility rates with the rates of surrounding utilities. The comparison with neighboring water utilities is provided in Exhibit 11-1. In developing any rate comparison, it is important to understand that such comparisons are not "apple to apple" comparisons. We have found that such comparisons do not account for differences in source of supply (Kent, Auburn and Renton having all or partial aquifer supplies), customer makeup, capital funding mechanisms, treatment plants, etc. Each of these factors can radically alter rates, and thus any rate comparison. Given that understanding, a simple comparison between these neighboring utilities for single-family residential and commercial customers was developed.



	City of Tukwila	City of Renton	City of Seattle	City of Kent	City of Auburn	Highline WD	KC WD #125	Soos Creek
Winter 10 ccf	$21.50	$18.10	$25.30	$15.93	$14.60	$29.10	$18.60	$16.25
Monthly Meter Charge	$6.00	$10.82	$6.90	$2.20	$6.95	$7.00	$18.00	$8.50

Exhibit 11-1
Winter 2004 Monthly Residential Rate Comparisons

A bill comparison was developed for residential customers of seven surrounding jurisdictions and Tukwila's current rates. As noted earlier in this section, Tukwila's current rates are shown to be adequate through the review period of 2010. The rates compared were those for the winter months. As shown in Exhibit 11-1, the meter charge and commodity charge are identified separately for comparison purposes. The bill comparison considered a single family, residential customer with 5/8" meter and an average consumption for the month of 10 hundred cubic feet (10 CCF, or 7,500 gallons).

With these assumptions, monthly bills were developed. Based upon this analysis, it appears that the City's rates are within the range of other neighboring utilities for the single family, residential rates. When these other entities have rate adjustments, over the next few years, Tukwila's rates will move to the lower mid-range.

Similarly, a comparison for small commercial customers was developed. This assumed a ¾" meter and again, 10 CCF of water usage in a month. This comparison is provided in Exhibit

11-2. It should be noted that for consumption over 10 CCF, which is typical of larger commercial enterprises, the Highline water district has higher commodity charges per CCF than Tukwila's. Thus, for larger commercial customers, the district's monthly bills will be higher than Tukwila's.

11.9 Summary

The financial plan results presented in this section indicate that water rates for the six-year projected time horizon of 2005 to 2010 will adequately fund the projected O&M, capital, and debt service requirements. The City has been proactive in its financial management in the past. It has demonstrated its commitment to responsible management of the utility by funding adequate levels of operations, capital and reserves. Continued fiscal management will enable the water utility to operate on a financially sound basis.