SEATTLE PUBLIC UTILITIES
2013 WATER SYSTEM PLAN

APPENDIX B

WATER SYSTEM INVENTORIES

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SEATTLE PUBLIC UTILITIES
2013 WATER SYSTEM PLAN

B. WATER SYSTEM INVENTORIES

APPENDIX B-1
WATER FACILITIES INVENTORY FORM

COUNCIL CLERK

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Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

Quarter: 1
Updated: 11/29/2011
Printed: 2/22/2012
WFI Printed For: On-Demand
Submission Reason: Annual Update

RETURN TO: Northwest Regional Office, 20435 72nd Ave S STE 200, Kent, WA, 98032

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
77050 Y	SEATTLE PUBLIC UTILITIES	KING	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS	8. Owner Number 005246
WILLIAM B. WELLS [WQ & T MANAGER] PO BOX 34018 SEATTLE, WA 98124-4018	SEATTLE, CITY OF DAVE HILMOE PO BOX 34018 SEATTLE, WA 98124-4018	TITLE: DIRECTOR
STREET ADDRESS IF DIFFERENT FROM ABOVE	**STREET ADDRESS IF DIFFERENT FROM**	
ATTN SEATTLE PUBLIC UTILITIES ADDRESS 700 5TH AVE # 4900 CITY SEATTLE STATE WA ZIP 98124	ATTN SEATTLE PUBLIC UTILITIES ADDRESS 700 5TH AVE # 4900 CITY SEATTLE STATE WA ZIP 98124	

9. 24 HOUR PRIMARY CONTACT INFORMATION	10. OWNER CONTACT INFORMATION
Primary Contact Daytime Phone: (206) 684-0221	Owner Daytime Phone: (206) 684-7414
Primary Contact Mobile/Cell Phone: (425) 241-5484	Owner Mobile/Cell Phone:
Primary Contact Evening Phone: (xxx) xxx-xxxx	Owner Evening Phone: (xxx) xxx-xxxx
Fax: | E-mail: XXXXXX	Owner Fax Phone: | E-mail: XXXXXX

WAC 246-290-420(9) requires that water systems provide 24-hour contact information for emergencies.

11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)

- [x] Not applicable (Skip to #12)
- [ ] Owned and Managed — SMA NAME: _____ SMA Number:
- [ ] Managed Only
- [ ] Owned Only

12. WATER SYSTEM CHARACTERISTICS (mark all that apply)

[ ] Agricultural	[x] Hospital/Clinic	[x] Residential
[x] Commercial / Business	[x] Industrial	[x] School
[x] Day Care	[x] Licensed Residential Facility	[ ] Temporary Farm Worker
[x] Food Service/Food Permit	[x] Lodging	[ ] Other (church, fire station, etc.): _____
[ ] 1,000 or more person event for 2 or more days per year	[x] Recreational / RV Park	

13. WATER SYSTEM OWNERSHIP (mark only one)				14. STORAGE CAPACITY (gallons)
[ ] Association	[ ] County	[ ] Investor	[ ] Special District	
[x] City / Town	[ ] Federal	[ ] Private	[ ] State	398,000,000

- SEE NEXT PAGE FOR A COMPLETE LIST OF SOURCES -

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
77050 Y	SEATTLE PUBLIC UTILITIES	KING	A	Comm

15	16	17	18										19			20	21						22	23	24			
	SOURCE NAME	INTERTIE	SOURCE CATEGORY										USE				TREATMENT						DEPTH		SOURCE LOCATION			
Source Number	LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456 IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	INTERTIE SYSTEM ID NUMBER	WELL	WELL FIELD	WELL IN A WELL	SPRING	SPRING FIELD	SPRING IN GRAVEL	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	PERMANEANT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN INTERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	CEDAR RIVER									X			X			Y		X		X	X	X		12500	SW SE	19	22N	07E
S02	TOLT RIVER									X			X			Y		X	X	X		X		83280	NW SW	32	26N	09E
S03	RIVERTON HTS #1				X									X		Y		X		X		X	275	3200	NE NW	21	23N	04E
S04	BOULEVARD		X											X		Y		X		X		X	293	2000	NW NW	16	23N	04E
S05	RIVERTON HTS #2				X									X		Y		X		X		X	280	1800	NE NW	21	23N	04E
S06	RIVERTON HTS WF			X										X		Y		X		X		X	275	5000	NE NW	21	23N	04E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
77050 Y	SEATTLE PUBLIC UTILITIES	KING	A	Comm

	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED CONNECTIONS
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)	0	157463	Unspecified
A. Full Time Single Family Residences (Occupied 180 days or more per year)	157463		
B. Part Time Single Family Residences (Occupied less than 180 days per year)	0		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	13330		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	0		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied less than 180 days/year	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units)	0	0	
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	13399	13399	
28. TOTAL SERVICE CONNECTIONS		170862	

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per [illegible] 668400

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?												
B. How many days per month are they present?												

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?												
B. How many days per month is water accessible to the public?												

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students daycare children and/or employees are present each month?												
B. How many days per month are they present?												

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
* Requirement is exception from WAC 246-290	189*	189*	189*	189*	189*	189*	189*	189*	189*	189*	189*	189*

35. Reason for Submitting WFI:

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other _____

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: _____

DATE: _____

PRINT NAME: _____

TITLE: _____

WS ID	WS Name
77050	SEATTLE PUBLIC UTILITIES

Total WFI Printed: 1

SEATTLE PUBLIC UTILITIES
2013 WATER SYSTEM PLAN

B. WATER SYSTEM INVENTORIES

APPENDIX B-2
WATER SYSTEM MANAGEMENT AND OPERATOR CERTIFICATION

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Water System Management and Operator Certification

December 2011

Seattle Public Utilities (SPU) reorganized its organizational structure since the *2007 Water System Plan*. An explanation of the management structure and personnel at SPU is provided here, followed by a description of SPU's current operator certifications and training programs.

Management and Organizational Structure

An organizational chart for SPU, which shows the current departmental structure, is provided as Exhibit 1. A brief explanation of the role of the Director's Office and each SPU branch is provided below.

Director's Office

The Director's Office includes the Director of Seattle Public Utilities and the Corporate Strategies and Communications (CS&C) Office. The Director is responsible for making sure the utility carries out the mission adopted for SPU. The Director has responsibilities typical of a water superintendent, such as developing budgetary requirements, assuring effective performance of the water system, and implementing City ordinances and utility policies regarding water service.

The CS&C Office assists the SPU Director to design and execute policy, strategy, analyses, internal and external communications, in order to maintain, improve, and explain service delivery, programs and projects, and to manage assets effectively and efficiently. The Office focuses on issues, initiatives, and agreements involving multiple disciplines, branches, departments, governments, and public constituencies. Groups comprising the Office consist of Community Relations Development, Corporate Policy and Performance, Asset Management and Economic Services and Communications Services.

Utility Systems Management Branch

Utility Systems Management (USM) provides overall management of each SPU utility system, including SPU's drinking water, sewer, drainage, solid waste programs and associated assets. USM also includes Watershed Services and Laboratory Services, which primarily support the drinking water system.

The Drinking Water Division Director serves as of the main contact for drinking water system-related issues. The Business Area Managers, who report to the Division Director, plan for projects and programs in their business area. For Drinking Water, these business areas are: Major Watersheds, Water Resources, Water Quality and Treatment, Transmission and Distribution.

Field Operations & Maintenance Branch
Field Operations and Maintenance strives daily to provide outstanding customer service by professionally operating, maintaining and improving SPU's drinking water, sewer, drainage, solid waste programs, and infrastructure investments which protect public safety, public health and the environment. The Branch includes the Water System Operational Planning and System Control section responsible for running day-to-day operations from the Control Center and includes certified water system operators.

Project Delivery Branch
The Project Delivery Branch (PDB) provides a variety of engineering and engineering support services to clients within and outside of SPU. PDB provides project management, engineering, design, survey, drafting, basemapping, construction specification and contract preparation, project cost estimating, geotechnical, materials testing, construction inspection, and contract payment services. Registered professional engineers and land surveyors reside in this Branch, as well as elsewhere in SPU. PDB executes SPU capital projects from start to completion, and provides specific services as appropriate on projects developed by other City departments, other agencies, and developers. PDB applies asset management principles and practices to achieve the triple bottom line goals of customer satisfaction, environmental protection/enhancement and cost efficiency.

Customer Service Branch
The Customer Service Branch is responsible for providing support and assistance to all residential, commercial and key SPU customers receiving water, sewer, drainage and solid waste services. The services this branch provides include: 1) Customer Billing Service, including meter reading; 2) Utility Service Teams, including water inspectors for new taps/lines, repairs, leaks, backflow assembly testing, cross connection control and water quality complaints; 3) Customer Response comprised of the Call Center; and 4) Customer Programs & Contracts Management, which includes water conservation program staff. This branch includes several water quality inspector positions which have Backflow Assembly Tester (BAT), and Cross Connection Control Specialist (CCS) certification requirements.

Finance and Administration Branch
The Finance and Administration Branch provides financial, accounting and information technology services to all sections and employees of SPU.

Human Resources & Service Equity Branch
The Human Resources Division provides the resources, consultation and assistance to enable SPU to recruit, develop and support a diverse workforce. Human Resource Operations & Data Management Division provides payroll support and employee records management for SPU. The Environmental Justice and Service Equity Division focuses on eliminating barriers to ensure all people of the City of Seattle receive equitable services and access to SPU's decision-making processes.

Operations Planning and Scheduling (OPS)

SPU's regional water supply system has multiple objectives that must be met and operational risks that must be actively managed:

- water resource management for people and for fish
- water quality source to tap
- pressure and flow in the transmission and distribution system
- system outages – called 'clearances' - for construction and major maintenance
- flood management and hydropower generation

In 2008, SPU established an Operations Planning and Scheduling (OPS) function that is supported by a core team. The OPS core team membership consists of:

- OPS Team Lead (as assigned)
- System Control Center Manager
- System Control Center Supervisor
- Clearance Work Order Process and Transmission and Distribution Operations representative
- Water Resources/River and Reservoir Operations representative
- Transmission and Distribution Business Areas representative(s)
- Water Quality and Treatment Business Area representative(s)

The OPS Team meets each week so establish a weekly web-based Water System Operating Plan (WSOP). OPS is responsible for developing, deconflicting and communicating (via the WSOP) the plan and schedule for operation of the water system to meet all of the objectives for the regional water system. OPS also reviews, approves, and schedules construction and major maintenance ('clearances') that affect system operations, as well as maintains a schedule of clearances (received, approved and scheduled, in-progress). The System Control Center, which operates 24/7, is responsible for operating the regional water system according to the WSOP, using best judgment where there are no specific instructions and responding to unusual and emergency situations. In addition, the System Control manages the configuration of the system, detects and directs response to water system emergencies, and coordinates and approves all construction and maintenance activities that require access to water system facilities (headworks, treatment, pump stations, gate houses, etc) or that may have an impact on water system.

Operator Certification

SPU is committed to meeting the requirements of the Water Works Operator Certification Program administered by the Washington State Department of Health (DOH) in conjunction with the Water and Wastewater Operator Certification Board of Examiners under the authority of Chapter 70.119 RCW and the comprehensive program regulations contained in Chapter 246-292 WAC. Under this program, water systems must employ certified operators to carry out various water system functions as part of treatment and distribution systems.

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Certification Requirements

SPU is classified as a "Group A" public water system. The Group A classification requires that SPU have certified operators in charge of all active, daily, and technical operations of the water system. In meeting this requirement, SPU maintains certified personnel throughout the utility for a variety of water system operations. This certification includes water treatment plant operators at the Tolt and Cedar Water Treatment Facilities, which are operated and maintained by private entities under contract by SPU. Required Classifications include Water Distribution Manager (WDM) Levels 3 and 4, Water Treatment Plant Operator (WTPO) Levels 3 and 4, and Cross Connection Control Specialists (CCS) depending on the requirements of specific positions. Table 1 shows the current listing of mandatory water works operator positions and required certification levels for SPU as they relate to the organizational structure of the utility. This list is updated on an annual basis for utility staff and submitted to DOH for their review. Additionally, SPU also has internal SPU certification requirements for lower level positions (involving level 1, and 2 certifications), that are not detailed out here.

Certified operators are either on-site or on call for all critical water system operations. SPU also ensures that certified operators are in charge of all segments of the water system as appropriate. Certified operators staff the Control Center, and the two primary water treatment plants, 24 hours a day. Also, Water system operations and pipe district managers for the Water Transmission & Distribution Operations Division of SPU's Field Operations & Maintenance Branch maintain necessary Water Distribution Manager certifications.

Table 1
Mandatory Waterworks Personnel Certifications

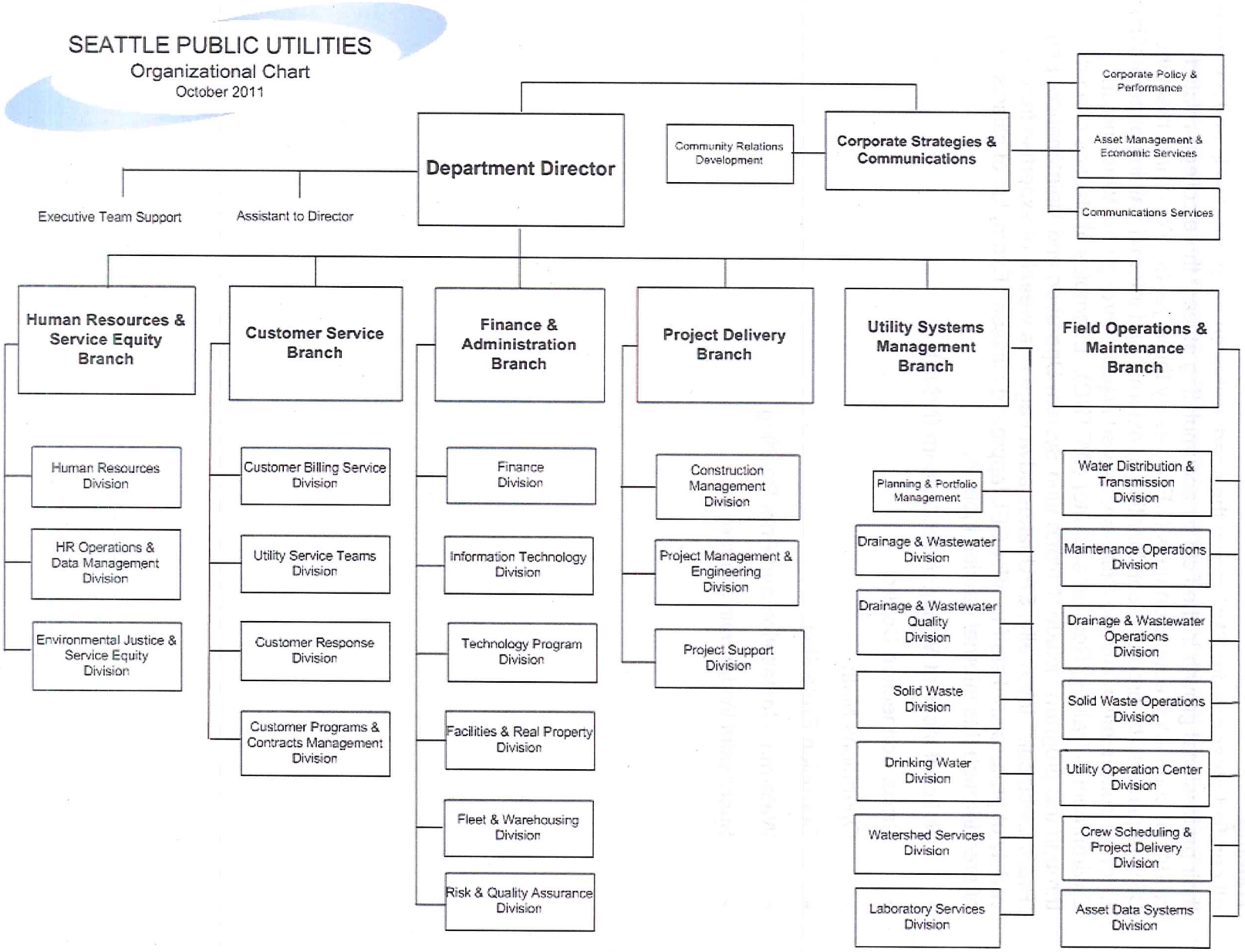
Branch	Division	Position	Required Certification
Utility Systems Management	Drinking Water	Drinking Water Director	WDM 4
	Contract Treatment Operations	Tolt Facility Manager	WTPO 4
		Tolt Chief Operator	WTPO 3
		Tolt Operator (multiple positions)	WTPO 3
		Cedar Project Manager	WTPO 4
		Cedar Operations Supervisor	WTPO 3
		Cedar Operator (multiple positions)	WTPO 3
Customer Service	Utility Service Teams	Utility Service Inspection Manager	WDM 3, CCS
Field Operations and Maintenance	Water Transmission & Distribution Operations	Water Transmission and Distribution Director	WDM 4
		Water Maintenance Manager	WDM 3
		Water Supply Operations Manager	WDM 3
		Water System Supervisor	WDM 3
		Water Transmission Manager	WDM 3
		Water Pipe Distribution Manager - North End	WDM 3
		Water Pipe Distribution Manager - South End	WDM 3
		Water Pipe Distribution Manager -All City	WDM 3

Training

All certified personnel for SPU renew their certificates on an annual basis and enhance their professional growth in the field by accumulating at least three college-related credits or continuing education units (CEUs) every three years. Personnel meet the CEU requirements through a combination of external and internal training opportunities. External opportunities include State-sponsored classes through the Washington Environmental Training Resource Center (WETRC). Examples of classes offered through this program include "Chlorination System Operation and Maintenance" and "Basic Electrical." Internally, SPU takes advantage of a wealth of expertise from a variety of professional staff to offer CEU approved classes. Examples of classes offered through this internal training include:

- National Incident Management System (NIMS)
- Cross Connection Control
- Operations Math
- Corrosion Protection
- Watermain Installation and Print Reading
- Successful Watermain Shutdowns

Exhibit 1


SEATTLE PUBLIC UTILITIES
Organizational Chart
October 2011
Department Director
Executive Team Support
Assistant to Director
Community Relations Development
Corporate Strategies & Communications
Corporate Policy & Performance
Asset Management & Economic Services
Communications Services
Human Resources & Service Equity Branch
Human Resources Division
HR Operations & Data Management Division
Environmental Justice & Service Equity Division
Customer Service Branch
Customer Billing Service Division
Utility Service Teams Division
Customer Response Division
Customer Programs & Contracts Management Division
Finance & Administration Branch
Finance Division
Information Technology Division
Technology Program Division
Facilities & Real Property Division
Fleet & Warehousing Division
Risk & Quality Assurance Division
Project Delivery Branch
Construction Management Division
Project Management & Engineering Division
Project Support Division
Utility Systems Management Branch
Planning & Portfolio Management
Drainage & Wastewater Division
Drainage & Wastewater Quality Division
Solid Waste Division
Drinking Water Division
Watershed Services Division
Laboratory Services Division
Field Operations & Maintenance Branch
Water Distribution & Transmission Division
Maintenance Operations Division
Drainage & Wastewater Operations Division
Solid Waste Operations Division
Utility Operation Center Division
Crew Scheduling & Project Delivery Division
Asset Data Systems Division

SEATTLE PUBLIC UTILITIES
2013 WATER SYSTEM PLAN

B. WATER SYSTEM INVENTORIES

APPENDIX B-3
WATER TREATMENT CHEMICALS

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Water Treatment Chemicals
February 2012

Facility	Chemical
Tolt Water Treatment Facility	Liquid Oxygen
	Carbon Dioxide
	Chlorine
	Ferric Chloride
	Hydrofluorosilicic Acid
	Lime
	Cationic Polymer
	Anionic Polymer
	Sodium Bisulfite (has not been used)
	Sodium Hydroxide
Cedar Water Treatment Facility	Liquid Oxygen
	Chlorine
	Lime
	Sodium Bisulfite
	Sodium Hydroxide
Landsburg Diversion & Pre-Treatment Facility	Chlorine
	Hydrofluorosilicic Acid
Seattle Wells*	Sodium Hypochlorite
	Sodium Hydroxide
	Hydrofluorosilicic Acid
In-Town Reservoir Treatment Facilities	Sodium Hypochlorite
	Salt (used for on-site hypochlorite generation)
	Chlorine

Notes:

* Indicates the facilities are only used seasonally during the high demand period. Chemicals may not be stored on site during the off season.

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SEATTLE PUBLIC UTILITIES
2013 WATER SYSTEM PLAN

B. WATER SYSTEM INVENTORIES

APPENDIX B-4
ASSET INVENTORIES

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Table 1 Tolt Water Treatment Facility Design Parameters	
Type:	Direct Filtration with Raw Water Ozonation
Capacity:	120 mgd
Ozone Generation	
Type:	LOX Feed
Number of units:	Two duty, one standby
Capacity:	2,388 lbs/day each
Applied dose:	2.9 mg/l (average)
	4.8 mg/l (maximum)
Production	1,651 lbs/day (average)
	4,775 lbs/day (maximum)
Ozone Contacting	
Type:	Fine bubble diffusion w/baffled contactor
Number of units:	Two parallel trains
Capacity:	60 mgd each
Contact time:	31.6 minutes (theoretical)
Flocculation	
Type:	Hydraulic flocculation w/baffled serpentine flow
	Pumped jet flash mix for chemical addition
Number of units:	Two parallel trains
Capacity:	60 mgd each
Detention time:	26.5 minutes (theoretical)
Filtration	
Type:	Anthracite mono-medium, with air/water backwash
Number of units:	Six (each with two bays)
Capacity:	24 mgd each
Rate:	12 gpm/sq ft
Bed depth:	72 inches
Clearwell	
Type:	Baffled concrete, cast-in-place
Number of units:	One (two equal halves)
Total volume:	7.4 MG
Washwater Recovery	
Type:	Settling/drying basins
Number of units:	Four
Capacity:	1.385 MG each
FTW/Equalization Basin	
Volume:	1.485 MG
Treatment Chemicals	
Ferric chloride:	Primary coagulant
Cationic polymer:	Primary coagulant/coagulant aid
Anionic/nonionic polymer:	Filter aid and washwater solids settling aid
Gaseous chlorine:	Disinfectant residual
Carbon dioxide:	pH and alkalinity adjustment
Lime:	pH and alkalinity adjustment
Hydrofluosilicic acid:	Fluoride addition
Sodium bisulfite:	Excess ozone quenching

Source: Process Design Criteria (February 2001), CDM PHILIP, SPU updated in 2006 and 2011

Notes:

FTW = Filter to Waste
gpm/sq ft = gallons per minute per square foot
lbs/day = pounds per day
LOX = Liquid Oxygen
mgd = million gallons per day
mg/L = milligrams per liter
MG = million gallons

Table 2 Cedar Water Treatment Facility Design Parameters	
Landsburg	
Chlorination	
System	Chorine Gas
Goal	Minimze entry of nuisance and invasive species at Lake Youngs
Fluoridation	
System	Hydrofluosilicic Acid
Target Residual	0.8 mg/L
Lake Youngs	
Plant	
Type:	Raw Water Ozonation and Ultra Violet Disinfection
Capacity:	180 mgd
Intake and Raw Water Pump Station	
Pump type	Submersible
Number of units:	7
Size	2 @ 20 mgd, 5 @ 40 mgd
Ozone Generation	
Type:	LOX Feed
Number of units:	2
Design concentration of ozone	6 - 12 %
Capacity:	825 lbs/day @ 12 % each (nomimal) 1250 lbs/day @ 6 % each (peak)
Applied ozone dose	0.3 - 0.6 mg/L (typical) 0.8 mg/L (peak)
Ozone Contacting	
Type:	Fine bubble diffusion
Flow direction	Counter-current
Contactor type	Pipeline
Number of units:	Two parallel trains
Volume	0.61 MG
Contact time:	9.8 min @ peak capacity
Ultra Violet Disinfection	
Design basis	3-log Cryptosporidium
Method	Medium pressure
Dosage	40 mJ/sq cm
Contactor type	Closed vessel
Number	13 total
Capacity:	18.4 MGD each
Clearwell	
Type:	Pre-stressed Concrete
Number of units:	2
Total volume:	20 MG
Treatment Chemicals	
Gaseous chlorine:	Disinfectant residual
Lime:	pH and alkalinity adjustment
Sodium Bisulfate	Excess ozone quenching

Source: Design Criteria (Updated July 12, 2004), CH2MHILL; SPU updated in 2006 and 2011

Notes:

lbs/day = pounds per day
mgd = million gallons per day
min = minutes
mg/L = milligrams per liter
LOX = Liquid Oxygen
MG = million gallons
mJ/sq cm = millijoules per square centimeter

Table 3 Seattle Well Fields Treatment Facilities		
Disinfection	System Target Dosage	Sodium Hypochlorite 1.0 to 1.4 mg/L
Fluoridation	System Target Dosage	Hydrofluosilicic Acid 0.8 mg/L fluoride*
Corrosion Control	System Target pH	NaOH Addition 8.2

* Historically, fluoride dose has been 1.0 mg/L. Reduction made in early 2011.

Source: Updated by SPU in October 2011

Table 4
Reservoir and Well Chlorination Facilities

	Year [1] Chlorination Facility Constructed	Type of Chlorination	Target Chlorine Residual (mg/l)	Redundancy	Condition
Outlet (Primary) Disinfection					
Roosevelt Reservoir	1996	Sodium Hypochlorite	1.1 - 1.3	One main storage tank, one day tank, and peristaltic pumps for sodium hypochlorite injection.	Treatment equipment is in good condition.
Volunteer Reservoir	1954	Chlorine gas 150-lb cylinders	1.2 - 1.3	Has one chlorinator and no sodium hypochlorite injection equipment or storage tanks.	Treatment equipment is in good condition.
Residual Maintenance (Secondary) Disinfection					
Beacon Reservoir	1987	Sodium Hypochlorite	1.0- 1.2	Two peristaltic pumps. Only one main storage tank.	Upgraded in 2000. Began operation as covered reservoir in 2009.
Bitter Lake Reservoir	2001	On-site Hypochlorite Generation	0.9	Backup pumps available. Can add sodium hypochlorite as a back up method.	Treatment equipment is in good condition.
Boulevard Park Well	1987	Sodium Hypochlorite	1.0 - 1.4	Backup pumps available. Well can be shut down if a disinfection equipment failure occurs.	Treatment equipment is in good condition.
Eastside Reservoir	1987	Sodium Hypochlorite	0.8	Backup pumps available. Can add sodium hypochlorite as a back up method of disinfection.	Treatment equipment is in good shape.
Lake Forest Park Reservoir	2002	On-site Hypochlorite Generation	0.9 - 1.1	Two peristaltic pumps. Can add sodium hypochlorite as a back up method of disinfection.	Treatment equipment is in good shape.
Lincoln Reservoir	2004	On-site Hypochlorite Generation	1.0 - 1.3	Two peristaltic pumps. Can add sodium hypochlorite as a back up method of disinfection.	Treatment equipment is in good condition.
Maple Leaf Reservoir	1996	Sodium Hypochlorite	1.0 - 1.3	One main storage tank, one day tank, and peristaltic pumps for sodium hypochlorite injection.	Reservoir is out of service for reconstruction (covering). Treatment equipment is in good condition.
Myrtle Reservoir	2007	On-site Hypochlorite Generation	0.9 - 1.0	Two peristaltic pumps. Can add sodium hypochlorite as a back up method of disinfection.	Treatment equipment is in good shape. Began operation as covered reservoir in 2008.
Magnolia Reservoir	1994	Sodium Hypochlorite	0.8 - 1.0	Two storage tanks and two metering pumps.	Condition of the equipment is good.
Riverton Well	1987	Sodium Hypochlorite	1.0 - 1.4	Backup pumps available. Well can be shut down if a disinfection equipment failure occurs.	Condition of the equipment is good.
West Seattle Reservoir: Inlet/Outlet and Trenton Outlet	1998	Sodium Hypochlorite	1.0 - 1.2	One main storage tank, one day tank, and peristaltic pumps for sodium hypochlorite injection.	Treatment equipment is in good condition.

Source: Reimer, 1999; Capron, 2011; Green, 2011; Nilson 2011

[1] In some cases, the year constructed is approximate. Some facilities have had equipment upgrades.

Table 5 Transmission Pipelines			
Pipeline Name	**Material Type**	**Largest Diameter (inches)**	**Length (feet)**
430 Pipeline	Cast Iron	30	178
	Concrete Cylinder	42	1,849
	Steel	42	22,643
550 Pipeline	Steel	72	41,006
8th Ave S Pipeline	Concrete Cylinder	24	4,462
Bel Red Road	Concrete Cylinder	24	2,718
	Steel	12	30
Cedar East Side Supply Line	Cast Iron	36	134
	Concrete Cylinder	36	53,499
	Steel	72	637
Cedar River Pipeline 1	Steel	72	85,796
Cedar River Pipeline 2	Concrete Cylinder	51	10,053
	Ductile Iron	52	11
	Steel	60	71,235
Cedar River Pipeline 3	Ductile Iron	48	38
	Steel	72	86,749
Cedar River Pipeline 4	Concrete Cylinder	60	3,428
	Reinforced Concrete	72	31,687
	Steel	72	18,530
Contactor Pipe Line 4	Steel	78	3,675
Contactor Pipe Line 5	Steel	78	3,730
Des Moines Pipeline	Cast Iron	20	14
	Concrete Cylinder	24	18,197
Finished Pipeline 4	Steel	78	13,720
Finished Pipeline 5	Cast Iron	24	17
	Concrete	84	333
	Steel	78	2,991
Lake Youngs Bypass 4	Steel	78	3,006
Lake Youngs Bypass 5	Steel	78	2,999
Lake Youngs Supply Line 4	Steel	92	35,712
Lake Youngs Supply Line 5	Steel	78	35,612
Lake Youngs Tunnel	Concrete	96	11,302
	Steel	96	6
Lake Youngs Tunnel Connection	Cast Iron	24	6
	Steel	72	233
Landsburg Tunnel	Concrete	96	10,129
Maple Leaf Pipeline	Steel	54	26,164
Mercer Island Pipeline	Cast Iron	20	1,384
	Concrete Cylinder	30	9,659
	Steel	30	5,094
	Unknown	20	21
NE 24th St	Cast Iron	16	2,273
NE 8th Pl	Concrete Cylinder	24	3,783
	Ductile Iron	24	174
	Steel	20	30
Olive St Pipeline	Cast Iron	30	2,055
	Concrete Cylinder	36	337
	Ductile Iron	30	374
Ozonation Overflow Line	Steel	54	875
Reg Basin Bypass	Concrete Cylinder	66	3,026
	Steel	66	6
S 146th St Pipeline	Concrete Cylinder	30	5,209
	Ductile Iron	30	32
	Steel	24	65
S 154th St Pipeline	Ductile Iron	36	6,203
	Steel	36	13
Soos Reservoirs 640 Zone	Cast Iron	14	5,470
	Ductile Iron	24	16,555
	Steel	48	1,785
South Fork Tolt Pipeline	Concrete	72	841
	Steel	72	25,820
Tolt East Side Supply Line	Concrete Cylinder	48	52,557
	Steel	54	1,221
	Unknown	16	8
Tolt East Side Supply Line Extension	Concrete Cylinder	48	7,657
	Ductile Iron	24	614
	Steel	48	5,441
Tolt Pipeline 1	Concrete Cylinder	66	56,300
	Ductile Iron	54	17,769
	Steel	81	54,379
Tolt Pipeline 2 Ph I	Steel	60	12,302
Tolt Pipeline 2 Ph II	Steel	60	21,498
Tolt Pipeline 2 Ph III	Steel	81	20,950
Tolt Pipeline 2 Ph IV	Steel	60	32,127
Tolt Pipeline 2 Ph VIa	Steel	87	8,598
Tolt Tieline	Steel	44	7,913
Tolt Treatment Facility Inlet	Steel	90	2,711
Transmission Connection	Steel	60	1
West Seattle Pipeline	Steel	54	25,591
Total		96	1,021,247

Source: Mantchev, 2012, based on SPU GIS

Pipeline lengths are from Arc_lngth field, and include both raw and treated water pipelines.
Excludes all pipelines in the Northwest Subregional System and some pipelines in the Southwest Subregional System which are also Seattle distribution mains.

Table 6 Treated Water Reservoirs						
Reservoir	**Year Constructed**	**Total Capacity (MG)**	**Number of Cells**	**Overflow Elev. (feet)[1]**	**Under- Drain**	**Construction Type**
Regional and Sub-Regional Reservoirs - Covered						
Eastside	1989/90	31.9	1	560	Yes	Reinforced concrete tank. Below grade.
Lake Forest Park	1961/62	60	2	550	Yes	Hyplon-lined, reinforced concrete slab. Floating cover added in 2003.
Maple Leaf	see note 2	60	2	430	Yes	Reinforced concrete tank. Below grade.
Riverton Heights	1979/80	20.1	1	460	Yes	Reinforced concrete tank. Part below grade.
Soos North	1989/90	6.5	1	640	Yes	Reinforced concrete tank. Above grade.
Soos South	1989/90	6.5	1	640	Yes	Reinforced concrete tank. Above grade.
West Seattle	2010	30	1	440	Yes	Reinforced concrete tank. Below grade.
Distribution System Reservoirs - Covered						
Bitter Lake	1956/57	21.3	1	509	Yes	Reinforced concrete slab. Hypolon liner and floating cover added in 2001.
Beacon	2009	50	1	326	Yes	Reinforced concrete reservoir. Below grade.
Lincoln	2006	12.7	1	326	Yes	Reinforced concrete reservoir. Below grade.
Magnolia	1993/94	5.5	1	330	Yes	Reinforced concrete tank. Part below grade.
Myrtle	2008	5	1	498	Yes	Reinforced concrete reservoir. Below grade.
View Ridge	1977/78	2.5	1	276	Yes	Reinforced concrete tank. Below grade.
Distribution System Reservoirs - Open						
Roosevelt[3]	1910	50.3	1	326	Yes	Unreinforced concrete slab. HDPE liner.
Volunteer[3]	1901	20.5	1	430	No	Unreinforced concrete slab.

Updated 2011

1. Nominal elevation based on North American Vertical Datum (NAVD 88).

2. Under construction; planned for completion in 2012.

3. Roosevelt and Volunteer Reservoirs are planned to be removed from service following the completion of Maple Leaf Reservoir. Roosevelt Reservoir is planned to be test-decommissioned between 2012 and 2014, when a final decision will be made about decommissioning. Although modeling shows that the emergency scenarios can be met without storage at Volunteer, a decision to decommission the reservoir site has not been finalized. The decision requires further operational experience to determine the importance of the reservoir to normal system operations. If a new, covered reservoir is constructed, the likely size would be 10 million gallons.

Table 7
Standpipes and Elevated Tanks

	Year Const.	Capacity (MG)	Base Elev. (feet)[1]	Overflow Elev. (feet)[2]	Diameter (feet)	Tank Height on Riser (feet)	Tank Material	Date of Last Inspection	Interior Coating		Exterior Coating		Seismic Upgrade (or Date Scheduled)
									Type[a]	Date Applied	Type[b]	Date Applied	
Regional and Sub-Regional System													
Elevated Tanks													
Beverly Park	1959	2.0	460	585	105	35	Welded Steel	Oct 98	CTE/epoxy	1985	Zn/Alkyd	1985	To be determined
Myrtle #2	1946	1.0	506.5	585	84.25	NA	Riveted Steel	Jan 99	CTE/epoxy	2010	Lead base[3]	2010	2003
Richmond Highlands #2	1958	2.0	488.5	590	86	35	Welded Steel	Nov 98	CTE	1958	Lead base[4]	1981	N/A
Others													
Control Works NE Tank	1925	0.3	437	512	NA	-	Riveted Steel	Oct 97	polyurethane	1994	epoxy/urethane[5]	1994	1994
Control Works SW Tank	1925	0.3	437	512	NA	-	Riveted Steel	Nov 97	polyurethane	1994	epoxy/urethane[5]	1994	1994
Distribution System													
Standpipes													
Charlestown	1996	1.3	424	498	58	-	Welded Steel	Feb 99	epoxy	1996	epoxy/urethane	1996	Not needed
Queen Anne	2008	1.9	460	530	75	-	Welded Steel	N/A	epoxy	2007	urethane / epoxy / acryclic polyurethane[6]	2007	N/A
North Trenton	1932	1.2	296	330	92	-	Riveted Steel	Jan 98	Vinyl	1979	Lead base[7]	1990	Not needed
South Trenton	1932	1.2	296	330	92	-	Riveted Steel	Oct 98	Vinyl	1979	Lead base[7]	1990	Not needed
Volunteer Park	1907	0.9	460	530	50	-	Masonry/Riveted Steel	Apr 99	Vinyl	1981	Lead base	1981	To be determined
Elevated Tanks													
Magnolia Bluff	1947	1.0	369	480	86	25	Welded Steel	Mar 99	epoxy	1988	Zn/Alkyd[8,9]	1988	1993

Updated 2011

a CTE = Coal Tar Enamel; p-urethane = Monolithic polyurethane lining

b epoxy = NSF epoxy primer and intermediate coats; and a polyurethane top coat; Zn/Alkyd = Zinc yellow primer and silicone alkyd enamel top coat

1. Top of concrete base, based on North American Vertical Datum (NAVD 88).
2. Nominal elevation based on North American Vertical Datum (NAVD 88).
3. Myrtle #2 has an intermediate layer of aluminum or SS flake alkyd paint.
4. 1993 seismic upgrade added all new steel to legs and riser, and coated legs and riser with a non-lead alkyd enamel paint system. The bowls still have the lead based primer as noted.
5. Base of tank in building. Above the roof: epoxy prime coat and polyurethane top coat (in 1994); Inside the bldg: moisture cured polyurethane primer and top coats (in 1998).
6. Exterior coating consists of zinc-rich urethane primer then epoxy followed by acrylic polyurethane top coat.
7. Trenton tanks were power tool cleaned and overcoated with an urethane/epoxy/urethane paint system in 1990.
8. Magnolia Bluff was commercially blasted and coated with a non-lead alkyd system. Some lead remains on the tank.
9. 1993 seismic upgrade added all new steel to legs and riser, and coated legs and riser with a non-lead alkyd enamel paint system. The bowls still have the lead based primer as noted.

Table 8

Decommissioned Standpipes and Elevated Tanks[d]

	Year Taken Off-Line	Year Const.	Capacity (MG)	Base Elev. (feet)[e]	Overflow Elev. (feet)[f]	Diameter (feet)	Tank Height on Riser (feet)	Tank Material	Date of Last Inspection	Interior Coating Type[a]	Interior Coating Date Applied	Exterior Coating Type	Exterior Coating Date Applied	Improvements Needed If Returned to Service	Current Uses
Regional and Sub-Regional System															
Standpipe															
Foy	2013[b]	1933	1.0	495	590	46	-	Riveted Steel	Feb 98	Vinyl	1980	Lead base	1980	Internal recoating, including coal tar removal, and installation of a mixing system.	Communications tower
Elevated Tanks															
Myrtle #1	2013[c]	1919	0.5	506.5	584.5	46	-	Riveted Steel	Feb 96	Vinyl	1982	Lead base Touch-up	1983 2009	Internal recoating.	
Richmond Highlands #1	2013[b]	1954	1.0	492.5	590	86	25	Welded Steel	Nov-99	CTE	1954	Lead base[g]	1981		
Distribution System															
Standpipes															
Barton	2012[b]	1927	1.4	277	326	80	-	Riveted Steel	Jan 98	CTE	1960	Lead base	1981	Internal recoating, roof repairs, drain improvements (air gap), and reconnection.	
Woodland Park	2003[h]	1925	1.0	356	430	50	-	Riveted Steel	Oct 98	Vinyl	1984	Lead base	1980	Reconnection	
Elevated Tanks															
Maple Leaf	2009	1949	1.0	431	530	84.25	25	Welded and Riveted	Jan 98	epoxy	1988/95	Lead base[i] Touch-up	 2011	Internal recoating and reconnection.	Communications tower

Source: Capron 2011, Mantchev 2012

a CTE = Coal Tar Enamel
b Per current schedule.
c WDOH approval pending.
d Decommissioned facilities have been disconnected from the water system, but not demolished, and can be returned to service after the improvements shown are made.
e Top of concrete base, based on North American Vertical Datum (NAVD 88).
f Nominal elevation based on North American Vertical Datum (NAVD 88).
g Richmond Highlands: 1993 seismic upgrade added all new steel to legs and riser, and coated legs and riser with a non-lead alkyd enamel paint system. The bowls still have the lead based primer as noted.
h Disconnected and decommissioned in 2009.
i Maple Leaf has some remaining red lead primer then coated with moisture cured urethane primer and top coats.

Table 9
Regional and Sub-Regional System Pump Stations

	Pump #	Manufacturer	Model	Design Flow (gpm)	Head (feet)	Speed (rpm)	Horse-Power	Comments
Augusta	1	Aurora	411 BF	300	102	1,750	15	Pumps 1 and 2 are continuous
	2	Aurora	411 BF	300	102	1,750	15	duty; alternating daily
	3	Aurora	411 BF	1,200	102	1,750	40	
	4	Aurora	411 BF	2,400	113	1,750	100	Fire flow only
Bothell Way	1	De Laval	T36/30	38,200	80	450	900	
Burien	1	Allis Chalmers	209-648-501	2,000	180	1,760	125	Emergency pump connections
	2	Allis Chalmers	209-732-501	3,000	180	1,760	200	for diesel pump.
	3	Worthington	10-LNHS-18	6,000	180	1,775	350	
Control Works	1	De Laval		1,200		1,760	25	Standby use only
Eastgate	1	Byron Jackson	18-KXH-1-STG	4,250	145	1,770	200	
	2	Byron Jackson	18-KXH-1-STG	4,250	145	1,770	200	
	3	Byron Jackson	18-KXH-1-STG	4,250	145	1,770	200	
Fairwood	1	Aurora	411 BF	750	220	1,750	75	Emergency pump connections for
	2	De Laval	A0615L	2,000	215	1,750	150	diesel pump.
Foy	1	Ingersoll Rand	10 LR 18A	6,000	165	1,785	300	
	2	Ingersoll Rand	8 LR-18S	4,440	165/290	1,778	400	165 ft. head with 15.43";
	3	Ingersoll Rand	8 LR-18S	4,440	165/290	1,778	400	290 ft. head with 18" impeller
Highland Park	1	Worthington	10 LNH 18	5,500	175	1,775	300	
	2	Worthington	10 LNH 18	5,500	175	1,775	300	
	3	Ingersoll Rand	6 AFV	1,400	140	1,770	60	Small pump can be powered by diesel generator
Lake Hills	1	Peerless	8AE17A	5,000	160	1,780	250	New 1999 Emergency pump connections
	2	Peerless	8AE17A	5,000	160	1,780	250	New 1999 for diesel pump
Lake Youngs	1	Fairbanks Morse	7000 AW	7,700	182	1,185	500	
	2	Fairbanks Morse	7000 AW	7,700	182	1,185	500	
Maple Leaf	1	Patterson	18X14 MAC	10,300	156	1,180	500	Can be powered by diesel generator
	2	Patterson	18X14 MAC	7,200	156	1,180	350	
Maplewood	1	Worthington	20 LN 28	17,750	108	720	600	Standby use only, low hours
North City	1	Worthington	12 LN 14	6,500	113	1,775	250	
	2	Worthington	12 LN 14	6,500	113	1,775	250	
Trenton	1	De Laval		1,000	225	1,845		Water Turbine Powered
	2	De Laval		3,000	225	1,200		Water Turbine Powered
TESS	1	Worthington	8 LP 13	1,600		1,770	100	
	2	Aurora		3,500	272		100	Diesel pump

Source: Capron 2011, Goodman 2011

Notes:

gpm = gallons per minute

rpm = revolutions per minute

Vert. = vertical

Table 10
Distribution System Pump Stations

	Pump #	Manufacturer	Model	Design Flow (gpm)	Head (feet)	Speed (rpm)	Horse-Power	Comments
Bitter Lake	1	Gould	3405	4,000	162	1,775	200	
	2	Gould	3405	4,000	162	1,775	365	Diesel standby use only
	3	Gould	3405	4,000	162	1,775	200	
Broadway	1	Fairbanks Morse	2844C	4,700	245	1,781	400	
	2	Fairbanks Morse	2844A	2,800	237	1,784	250	
	3	Fairbanks Morse	K65226	4,000		1,150	300	
Dayton Ave.	1	De Laval	56064	1,400	110	1,750	50	
	2	MP		100	100	3,450	5	
First Hill[1]	3	Fairbanks Morse	2824C	2,800	180	1,775	200	
	4	Fairbanks Morse	2824C	4,900	190	1,775	350	
Green Lake	1	De Laval	98851	900	331	1,750	93	Water Turbine Powered
Interbay	1	Worthington	10 LN 18	3,500	110	1,185	125	Low service
	2	Worthington	8 LA 4	3,500	230	1,785	300	High service
Lincoln	1	Worthington		3,900	117	1,540	125	Water turbine powered
Northgate	1	Allis Chalmers	205-603-502	5,500	182	1,760	300	
	2	Allis Chalmers	205-603-501	5,500	182	1,760	300	
Queen Anne	1	Berkeley	B2TPMS	170			5	Variable frequency drive
	2	Berkeley	B2TPMS	170			5	Variable frequency drive
	3	Berkeley		450			15	Variable frequency drive
	4	Berkeley		2,400			40	
Roosevelt	1	Allis Chalmers	201-052-501	3,000	110	1,760	100	
	2	Allis Chalmers	201-052-501	3,000	110	1,760	100	
Scenic Heights	1	Aurora	411 BF	450	95	1,750	20	
	2	Aurora	411 BF	450	95	1,750	20	
	3	Aurora	411 BF	1,100	100	1,750	40	
	4	Aurora	411 BF	1,100	100	1,750	40	
SW Spokane	1	Allis Chalmers	207-52-510	4,000	290	1,760	400	New starters and transfer switch in
	2	Allis Chalmers	207-52-510	4,000	290	1,760	400	1997; can be powered by diesel gen.
Viewridge	1	Layne		2,500		1,750	100	To 326 zone
	2	Layne		3,500		1,750	350	To 530 zone
Volunteer	1	Allis Chalmers	201-194-502	4,000	108	1,760	125	
	2	Allis Chalmers	201-194-501	4,000	108	1,760	125	
Warren Ave.	1	Allis Chalmers	207-521-510	4,000	265	1,770	350	Can be powered by diesel generator.
	2	Allis Chalmers	207-521-509	4,000	265	1,770	350	
West Seattle	1	Ingersol Rand	10 AFV	4,500	62.3	1,750	100	One pump can be powered by diesel
	2	Ingersol Rand	11 AFV	4,500	62.3	1,750	100	generator

Source: Capron 2011, Goodman 2011

Notes:

(1) First Hill pump station has two pumps, they are labeled 3 and 4. The pumps work in conjunction with pumps 1 and 2 and the Broadway pump station.

Notes:

gpm = gallons per minute

rpm = revolutions per minute

Vert. = vertical

Table 11
Metered Connections by Classification and Size

CLASSIFICATION	CONNECTION SIZE (inches) 3/4	1	1-1/2	2	3	4	6	8	10	12	16	20	24	TOTAL
Residential [1]	143,514	16,751	1,263	439	1	1	1	1	-	-	-	-	-	161,971
Commercial [2]	6,902	5,244	3,634	4,578	497	725	334	115	36	6	-	2	-	22,073
Fire Service	83	1	2	610	29	1,526	1,262	728	28	9	-	-	-	4,278
RETAIL SERVICE TOTAL[3]	150,499	21,996	4,899	5,627	527	2,252	1,597	844	64	15	-	2	-	188,322

Source: City of Seattle, Consolidated Customer Service System, Meter Count By Connection Size Report, Run Date: 08-JAN-2011.

[1] Includes single-family residences, duplexes, and other residential services.

[2] Includes mulit-family residences, commercial properties and municipal services.

[3] Includes 10,871 services in Shoreline, 383 services in Lake Forest Park, and 4,780 other services outside the City of Seattle.

Table 12
Interties From Seattle Public Utilities to Other Purveyors
As of November 2011

Purveyor and SPU Meter No.	SPU Station	Meter Size (inches)	Service Location	Comments/Notes
CITY OF BELLEVUE				
2-533677-460238	47	8	128th Ave SE & SE 56th ST	
2-533677-460240	55	6	128th Ave SE & Newport Way	
2-533686-461091	56	8	128th Ave. SE & Newport Way	
2-533679-461120	58	12	145th Pl. SE & SE 28th Street	
2-533678-461098	59	8	132nd Ave. SE & SE 26th Street	
2-533900-460746	60	10	14509 SE Newport Way	
2-533880-461005	61	24	152nd Ave. NE & NE 8th Street	
2-533882-460302	62	12	132nd Ave. NE & Bel-Red Road	
2-533677-461245	63	10	132nd Ave. NE & NE 24th Street	
2-533675-461109	65	10	140th Ave. NE & 40th Street	
2-533680-460237	66	8	Mercer Is. Pipeline & 108th Ave. SE	
2-533677-461321	124	8	124th Ave SE & SE 38 PL	
2-533900-460746	182	10	14509 SE Newport Way	
CITY OF BOTHELL				
2-533588-461020	95	10	TRPL R/W - 104TH NE	
2-533591-460241	96	8	NE 180TH & 88TH NE	
2-533638-461029	99	6	TRPL & 96TH NE STA 1335	
CEDAR RIVER WATER AND SEWER DISTRICT				
2-533703-461103	30	8	141st Ave SE and SE 171st Way	
2-535998-460956	166	10	19201 SE Petrovitski Road	
2-533875-962982	187	10	FWPL4 at NE corner of Control Works property	
COAL CREEK UTILITY DISTRICT				
2-533690-461094	48	8	129th Ave SE & SE 73rd ST	
2-533689-461092	52	12	128th Ave SE & SE 70th ST	
2-533692-461099	54	4	132nd Ave SE & SE 96th ST	Meter not used, for backup only.
CITY OF DUVALL				
2-533661-461012	111	4	TOLT RIVER PIPELINE	
2-533885-461023	112	6	TRPL - STA 657 + 29	
CITY OF EDMONDS				
2-533584-460571	110	10	SE Corner N 205TH & Fremont AV	Emergency Intertie only

Table 12
Interties From Seattle Public Utilities to Other Purveyors
As of November 2011

Purveyor and SPU Meter No.	SPU Station	Meter Size (inches)	Service Location	Comments/Notes
HIGHLINE WATER DISTRICT				
2-534019-460587	41	12	Des Moines Way S & S 207th Street	
2-534079-460743	42	16	160th Ave S & Military Road S	
2-534018-460748	43	12	Des Moines Way S & S Normandy Road	
CITY OF KIRKLAND				
2-533676-460249	72	12	140th Ave. NE & NE 70th Street	
2-533668-460245	74	10	132nd Ave. NE & NE 113th Street	
2-533883-461006	75	16	132nd Ave. NE & NE 85th Street	
LAKE FOREST PARK WATER DISTRICT				
2-533597-971083	188	8	Tolt Pipeline ROW & NE 195th St	Emergency Intertie only
CITY OF MERCER ISLAND				
2-533669-461336	67	12	SE 43rd Street & 89th Ave SE	
2-533673-461333	68	6	SE 40th Street & 97th Ave SE	
2-539472-460740	171	10	E Mercer Way & Mercer Island Pipeline Right-Of-Way	Mercer Crest Water Association was taken over by City of Mercer Island.
CITY OF NORTH BEND				
2-1492723-971210	190	8	101 R @ SCL PP "RT 1-73"	
NORTHSHORE UTILITY DISTRICT				
2-533594-461018	81	6	Tolt Pipeline ROW & 119th Ave. NE	
2-533587-461026	83	10	Tolt Pipeline ROW & 112th Ave. NE	
2-533589-461024	85	6	Tolt Pipeline ROW & 104th Ave. NE	
2-533643-461014	86	20	88th Ave. NE & NE 180th Street	
2-533595-461205	89	6	64th Ave. NE & NE 185th Street	
2-533596-461206	90	6	64th Ave. NE & NE 185th Street	
2-533582-461004	92	6	40th Place NE & NE 195th Street	
2-533585-461013	93	12	Tolt Pipeline ROW & NE 195th Street	
2-533666-460246	94	10	132nd Ave. NE & NE 132nd Street	
OLYMPIC VIEW WATER AND SEWER DISTRICT				
2-533592-461242	107	8	8th Ave. NW & NW 205th St.	
2-533647-459418	108	8	Fremont N. & N. 205th St.	
2-533646-459419	109	8	Fremont N. & N. 205th St.	
2-533592-978166	192	6	24th Av NW & NW 205th St.	

Table 12
Interties From Seattle Public Utilities to Other Purveyors
As of November 2011

Purveyor and SPU Meter No.	SPU Station	Meter Size (inches)	Service Location	Comments/Notes
CITY OF REDMOND				
2-540865-460251	164	10	Trilogy Parkway NE & NE 125th Street	
2-533903-461057	165	10	160th Ave NE & NE 104th Street	
2-540865-951406	185	6	NE 172nd Street & Tolt Pipeline #2	
2-540865-460250	186	10	Trilogy Parkway NE & NE 125th Street	
CITY OF RENTON				
2-533998-460263	33	6	9602 S 160TH ST	
2-533707-460581	34	8	CRPL 4 - ST HWY 5 - C	
2-533708-460260	36	6	7TH - JONES ST - PL R/W	
2-533709-460281	37	3	PLAT RENTON	
2-533711-460578	38	6	CRPL & 84TH AV S	
2-533705-460573	39	10	CRPL RW & LK YOUNG WY	
2-533697-460257	179	10	Logan St & 2nd	Formerly SPU direct service to Boeing Renton plant
2-533698-460256	180	10	Logan St & 2nd	Formerly SPU direct service to Boeing Renton plant
2-533698-461130	196	8	7501-8001 S 153rd Pl	Serves Boeing/Longacres
SHORELINE WATER DISTRICT				
2-533579-480005	101	10	8th Ave NE & NE 160th Street	
2-533581-472896	102	10	16th Ave NE & NE 192nd Street	
2-533583-459353	103	6	32nd Ave NE & NE 195th Street	
2-533580-461207	104	8	8th Ave NE & NE 185th Street	
2-533580-975611	191	8	NE 195th St & 47th Pl NE	
2-533580-978151	193	8	NE 185th & 5th Ave NE	
2-533580-979000	194	8	NE 185th & 8th Ave NE	
SKYWAY WATER AND SEWER DISTRICT				
2-533712-471173	1	8	84th Ave. S & S 134th Street	
2-533720-457667	5	8	Beacon Ave S & S 124th Street	
2-533893-460571	172	6	Cornell Ave S & S 112th Street	
SOOS CREEK WATER AND SEWER DISTRICT				
2-533702-461124	27	10	148th Ave SE and SE 192nd Street	
2-533704-461155	28	10	SE 164TH Street and 132nd Ave SE	
2-533706-460576	29	8	SE 160TH Street and 114th Ave SE	
2-539118-461441	181	6	147th Ave SE and SE Petrovitski Road	

Table 12

Interties From Seattle Public Utilities to Other Purveyors

As of November 2011

Purveyor and SPU Meter No.	SPU Station	Meter Size (inches)	Service Location	Comments/Notes
2-539118-971209	189	10	SE 164th & 132nd SE (next to Sta.28)	
CITY OF TUKWILA				
2-534002-460582	13	10	South Center Parkway & Tukwila Parkway	
2-534001-461149	14	8	West Valley Hwy & S 162nd Street	
2-534004-457795	15	8	Christensen Rd. & Baker Rd	
2-534003-461363	16	6	53rd Ave S & S 160th Street	
2-536983-459031	183	12	E Marginal Way & S 112th Street	
2-536984-458373	168	12	7749 E Marginal Way S	
2-537357-460018	169	8	51st Ave S & S Leo Street	
2-539200-458356	170	12	W. Marginal Place & S 102nd St.	
2-537646-458802	173	6	47th Ave S & S Victor Street	
WOODINVILLE WATER DISTRICT				
2-533887-461022	53	8	TPL1 at pipeline station 1120	
2-533891-461021	57	6	TPL1 at pipeline station 1061	
2-533586-461027	76	4	TPL1 at 124th Ave NE	
2-533667-461096	77	6	132nd Ave NE & NE 140th Street	
2-533662-461019	78	8	TPL1 at Welcome Road Valve Station	
2-533904-461016	79	8	TPL1 at Avondale Road	
2-533665-461028	80	8	TPL1 at 168th Ave NE	
2-533663-461011	123	6	TPL1 at pipeline station 1197	
2-533870-460564	125	6	TPL1 at pipeline station 1049	
2-535993-461097	167	6	15002 132nd Ave NE	
TBD	195	6	132nd Ave NE & NE 144th Street	To be completed and operational in 2012.
KING COUNTY WATER DISTRICT #20				
2-534031-459065	19	16	12th Ave S & S 112th Street	
2-534044-461108	23	6	14th Ave SW & SW 149th Street	
2-534034-461419	126	8	8th Ave S & Aqua Way	
2-534030-461063	127	6	Des Moines Memorial Dr. & S 112th Street	
2-534029-460742	128	6	Military Road & S 125th Street	
2-534028-461093	129	6	Military Road & S 128th Street	
2-534032-461061	130	6	14th Ave S & S 112th Street	
2-534037-461329	132	8	4th Ave SW & SW 108th Street	

Table 12
Interties From Seattle Public Utilities to Other Purveyors
As of November 2011

Purveyor and SPU Meter No.	SPU Station	Meter Size (inches)	Service Location	Comments/Notes
2-534038-461330	133	10	4th Ave SW & SW 128th Street	
2-534039-460273	134	4	Ambaum Blvd SW & SW 132nd St.	
2-534011-460591	135	6	14th Ave S & S Director Steet	
2-534025-461422	136	10	8th Ave S & S 146th Street	
KING COUNTY WATER DISTRICT #45				
2-534036-461060	20	8	4th Ave SW & SW 108th Street	
2-534036-909301	176	6	12th Ave SW & SW 106th Street	
2-534036-479202	184	6	8th Ave SW & SW 99th Street	
KING COUNTY WATER DISTRICT #49				
2-541232-460590	25	8	16800 DesMoines Wy S	
2-534043-461052	139	10	10TH AV SW - SW 149TH	
2-536055-461420	140	12	DesMoines Way S. & 160th Ave S	
2-534042-461424	142	8	8TH AV SW - SW 146TH	
2-534017-460585	143	10	DESMOINES WY & AMBAUM	
KING COUNTY WATER DISTRICT #90				
2-533693-460274	45	10	132ND AV SE & SE 128TH	
KING COUNTY WATER DISTRICT #119				
2-533659-460940	116	4	ODELL STA 612 THRU 36 30	
2-533660-461010	117	6	34801 TOLT PL RW	
KING COUNTY WATER DISTRICT #125				
2-533717-460574	8	6	CRPLs 1,2 & 3 and S 131st Street	
2-534014-461335	9	6	42nd Ave S & S 160th Street	
2-534015-461148	10	8	Pacific Highway S & S 160th Street	
2-534024-461421	17	10	8th Ave S & S 146th Street	
2-533868-461089	119	6	CRPLs 1,2 & 3 and S 124th Street	
2-534006-466490	120	8	E Marginal Way & S 115th Street	
2-534027-461102	121	4	Military Road & S 135th Street	
2-535981-459141	174	10	2400 S 146th Street	Boeing Fire Service
2-535982-459140	175	10	2400 S 146th Street	Boeing Fire Service

SEATTLE PUBLIC UTILITIES
2013 WATER SYSTEM PLAN
APPENDIX C

POLICIES, PROCEDURES AND STANDARDS

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SEATTLE PUBLIC UTILITIES
2013 WATER SYSTEM PLAN

C. POLICIES, PROCEDURES AND STANDARDS

APPENDIX C-1
COMPREHENSIVE DRINKING WATER QUALITY MONITORING PLAN

COUNCIL CLERK

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Seattle Public Utilities
Comprehensive Drinking Water Quality Monitoring Plan
February 2012

1.0 Overview

Providing public health protection is a primary concern in the operation and maintenance of a public drinking water system. Determining the adequacy of this protection is accomplished with a comprehensive monitoring program that covers the source of supply, treatment systems, the distribution system, and customers' taps. Sampling requirements are established by federal regulations, such as the Safe Drinking Water Act (SDWA), which are in most cases adopted by the state. Seattle Public Utilities (SPU) conducts monitoring in accordance with the Safe Drinking Water Act and Washington State Department of Health requirements, Chapter 246-290 WAC.

This monitoring plan addresses the following:

- Monitoring requirements under state and federal drinking water regulations;
- Future regulations, which are currently under development at the federal level;
- Non-regulatory monitoring, which SPU conducts for informational purposes and to assist in operating the water system;
- Sampling procedures;
- Laboratory Information Management System (LIMS); and,
- All parameters, locations, and frequency of monitoring conducted by SPU. Monitoring locations include source, treatment, transmission and distribution system, and customer taps.

A summary of SPU's monitoring requirements is shown in Table 1. This table includes source water and distribution system monitoring required by regulation. Monitoring of treatment operations required by the Surface Water Treatment Rule or Lead and Copper Rule is not included in Table 1, but is discussed below, and is reflected in Table 2.

Table 2 is a summary of the monitoring currently conducted by SPU and is organized by sampling locations, frequencies, and parameters. This table includes monitoring required by regulations, and monitoring conducted for operational or informational purposes (non-regulatory). All monitoring shown is directly related to the drinking water supply. Monitoring related to special studies, customer inquiries, disinfection of new mains, construction of facilities, environmental compliance when dewatering facilities, wellhead protection, aquifer recharge, source development, treatment chemicals, or other monitoring conducted for purposes other than drinking water quality compliance is not included in this document.

DOH has the authority to grant waivers for certain parameters, depending on vulnerability and previous sampling results. If a system is considered to have low vulnerability to contamination from a certain chemical or group of chemicals, the State may waive the requirements for

sampling, or reduce the amount of samples required. The State issued waivers for SPU for Volatile Organic Chemicals (VOCs) and Synthetic Organic Chemicals (SOCs) for the 2008 to 2010 monitoring period. SPU will apply for waivers for the 2011 to 2013 monitoring period. There are also several area-wide waivers in effect for several of the SOCs. These waivers apply to all systems within the designated area.

SPU operates its own State-certified laboratory for a majority of the parameters monitored. This includes total coliform, fecal coliform, HPC, most inorganic chemicals, trihalomethanes, haloacetic acids, lead, copper, VOCs, and all SWTR parameters. Samples for SOCs, asbestos, some inorganics, and *Cryptosporidium* and *Giardia* are sent to other laboratories certified by the state or EPA for the analysis.

Adjustments to monitoring are often required based on operational considerations, detection of organic chemicals, construction projects, or as required by the state based on a public health concern. SPU will work with the State to determine appropriate changes to the monitoring program to address any concerns that may arise.

2.0 Monitoring Requirements

The following summarizes the monitoring requirements for existing and future regulations. Existing regulations include those finalized by EPA and published in the Federal Register under 40 CFR Part 141. Any regulation the state has adopted into Chapter 246-290 WAC with changes or additions are also discussed under existing regulations. Future regulations include those currently proposed by EPA.

2.1 Existing Regulations

The existing regulations discussed below are organized by their common name with a reference to the appropriate federal and state section numbers.

Total Coliform Rule (40 CFR 141.21 and WAC 246-290-300 (3))

SPU collects and analyzes coliform samples from representative points throughout the direct service area as outlined in SPU's Coliform Monitoring Plan (attached without appendices). These samples are collected at designated sample stands according to established routes assigned by the Senior Water Quality Analyst or designee. Routes are designed to cover both the Cedar and Tolt service areas each day; with most sample stands being sampled weekly. To meet regulatory requirements, SPU must collect at least 189 coliform samples from its direct service area each month. The chlorine residual is also analyzed in the field at the time of coliform sample collection as required by state regulations. Temperature is also measured, although not required.

For any sample found to be positive for total coliform, or invalidated, follow-up action is taken according to state and federal regulations, as described in SPU's Coliform Monitoring Plan. This follow-up action may include additional sample collection, additional analyses such as fecal

coliform, *E. Coli*, or HPC, and notification to the state. SPU's Coliform Monitoring Plan lists all sample locations, schedules, test methods used, follow-up sampling requirements, and notification requirements.

Surface Water Treatment Rule (40 CFR 141.70-75 and WAC 246-290 Part 6)

The Surface Water Treatment Rule (SWTR) requires a significant amount of monitoring for SPU's filtered surface water supply, the South Fork Tolt River. This includes raw water, treated water, and distribution system water monitoring as follows.

Raw Water Monitoring – Continuous monitoring of turbidity at the inlet to the Tolt Water Treatment Facility occurs as required by the SWTR. Samples analyzed for fecal coliform density are collected at the inlet to the Tolt Water Treatment Facility daily, for at least 19 days a month.

Treated Water Monitoring – Treated water monitoring for the SWTR consists of monitoring required to determine the effectiveness of the disinfection process. This includes monitoring to determine log reduction of *Giardia* cysts and viruses. To determine the log reduction for virus, the pH, chlorine residual, temperature, clearwell volume, and peak hourly flow rate must be recorded. For the Tolt system, this monitoring is continuous, but is reported once a day at peak hourly flow. To determine the log reduction for *Giardia*, the pH, ozone residual at multiple locations along the contact chamber, temperature, and peak hourly flow are recorded. CT is calculated for each section of the ozone contact chamber. Ct is reported to the state for both the peak hourly flow and at minimum daily CT.

In addition, continuous chlorine residual monitoring for water entering the distribution system occurs at the outlet of the Tolt Water Treatment Facility. Turbidity is also monitored continuously at each individual filter unit and from the combined filter effluent.

Additional monitoring is conducted at the treatment plant to meet the requirements of the Service Agreement with the DBO contractor. This monitoring is summarized in Table 3.

Distribution System Monitoring – Residual disinfectant concentration is measured at the same time and location that a routine or repeat coliform sample is collected within the distribution system.

Limited Alternative to Filtration (WAC 246-290-691)

Beginning in November 2004, the Cedar water supply system was designated a Limited Alternative to Filtration status. As such, the source and treated water monitoring requirements are slightly different than an unfiltered surface water source subject to the SWTR. This includes raw water, treated water, and distribution system water monitoring as follows.

Raw Water Monitoring – Continuous turbidity monitoring occurs at the Cedar Water Treatment Facility for the raw water coming from Lake Youngs (or Landsburg during by-pass operations).

Fecal coliform samples are also collected at this location once per day for a minimum of 19 days a month.

Treated Water Monitoring – Treated water monitoring consists of monitoring to determine inactivation of Giardia, Cryptosporidium, and viruses. This monitoring is conducted continuously for the ozonation system, UV treatment, and chlorination. For ozone inactivation of Giardia and viruses, monitoring includes temperature, initial ozone concentration, ozone decay, and flow rate. For inactivation of Giardia and Cryptosporidium with UV, monitoring consists of flow rate through each reactor, UV transmittance, UV dose, lamp power, and lamp hours. For inactivation of viruses with chlorine, monitoring includes flow rate, clearwell volume, pH, chlorine residual, and temperature.

Finished water entering the system is continuously monitored for chlorine residual, temperature and pH. Daily samples are also analyzed for coliform, although this is not required by regulation. Additional monitoring is required to meet the Service Agreement with the DBO contractor. Service Agreement monitoring is summarized in Table 3.

Distribution System Monitoring – Residual disinfectant concentration is measured at the same time and location that a routine or repeat coliform sample is collected within the distribution system.

Disinfectants/Disinfection By-Products Rules (40 CFR 141.130-135, 141, 142) and WAC 246-290-300 (6)

Current regulations (Stage 1) require trihalomethane (THMs) and haloacetic acids (HAAs) monitoring in the distribution system. SPU is required to collect two samples each quarter at existing sample stands within the direct service area under an approved reduced monitoring schedule. One of these stands is generally served by Cedar water and one is generally served by Tolt water. These two samples are collected at sample stands that are considered to represent the maximum residence time in the system for each source. Currently, sample stands G2 and B4 are considered to represent the maximum residence time for the Cedar and Tolt, respectively. SPU elects to collect two additional THM and HAA samples each quarter for informational purposes. The other two sites used are J-3 and A-3. These are considered average residence time and generally represent higher HAA levels.

Monitoring for chlorine residual currently conducted at total coliform sample sites in the direct service area are reported under the Stage 1 rule. Bromate and bromide monitoring are conducted for the Tolt and Cedar supplies now that ozonation facilities for each supply are in operation. The monitoring for bromate is conducted monthly at the entry to the distribution system. The bromide monitoring was conducted monthly for the source water prior to any treatment during the first year of operation of the Tolt and Cedar Water Treatment Facilities.

Stage 2 DBP Rule was finalized in January 2006. This new rule will require increased monitoring for DBPs. Following the completion of the Initial Distribution System Evaluation in 2008, twelve sites were selected based on the criteria in the Stage 2 rule. Stage 2 DBP monitoring will begin at these 12 sites in the second quarter of 2012. Compliance under the

Stage 2 Rule will be based on locational running annual averages instead of system wide running annual averages.

Lead and Copper Rule (40 CFR 141.80-91)

SPU has conducted monitoring for lead and copper at customers' taps according to the regulations and a Bilateral Compliance Agreement with DOH. Two rounds of samples were collected at 375 homes in 2003 and 2004 after completion of a corrosion control optimization study for the Tolt. Two more rounds of samples were collected at 400 homes in 2005. These homes were selected based on criteria in the Lead and Copper Rule. For the last two rounds, the homes were divided into sub regions. One hundred samples were collected from the Seattle direct service area, 100 were collected from Bellevue, 100 were collected from the participating wholesale providers receiving water from the Cedar supply, and 100 were collected from the participating wholesale providers receiving water from the Tolt supply. Compliance was based on the 90th percentile for each sub-region. Based on previous rounds, each sub-region qualifies for reduced monitoring, which requires 50 samples per sub-region. Each sub-region is currently required to collect 50 samples once every three years. Monitoring requirements would change if the lead or copper action levels were exceeded. The Cedar wholesale provider group will collect samples in 2012, Seattle direct service area will collect samples in 2013, and the Tolt wholesale provider group will collect samples again in 2014.

Water quality parameter monitoring at the treatment plants and within the distribution system is also now required for the lead and copper rule. Monitoring of pH is required at the Cedar Water Treatment Facility and both pH and alkalinity is required at the Tolt Water Treatment Facility. The distribution system monitoring currently includes collecting 10 samples each month and analyzing the samples for pH and alkalinity. The 10 locations are distributed throughout the direct service area and Cedar and Tolt wholesale sub-regions that are part of the regional monitoring program.

Inorganic Contaminants, VOCs, SOCs (40 CFR 141.23-23, 40 and WAC 246-290-300 (4) and (7))

Primary and Secondary inorganic contaminants (IOCs), volatile organic chemicals (VOCs), and synthetic organic chemicals (SOCs) are monitored according to state and federal requirements. IOCs for the Cedar and Tolt supplies are monitored on an annual basis and VOCs are monitored once every three years, with the samples collected from the entry point to the distribution system, after treatment. This frequency assumes a state waiver has been granted for VOCs. The Riverton and Boulevard Park Wells are sampled once every three years (or when in operation) for IOCs and VOCs at the entry point to the distribution system prior to the first customer. SOCs are monitored as directed by the state, and the frequency is dependent on waiver status. SOCs were last collected in 2008. The year 2011 marks the beginning of a new three and nine year monitoring period. State waivers have not yet been issued for this monitoring period.

Radionuclides (40 CFR 141.26 and WAC 246-290-300 (8))

The new radionuclides rule (effective December 2003) requires monitoring for gross alpha, radium 226, radium 228, and uranium. This monitoring is conducted for each source at the entry point to the distribution system. Frequency is dependent on results. Two consecutive quarterly samples were collected before December 2007 for initial monitoring. After initial monitoring, samples will likely be required once every 9 years.

Fluoride (WAC 246-290-460)

As required by state regulations, fluoride is monitored daily at each point of fluoride addition and a report is submitted to the state monthly. For process control purposes, fluoride concentration is monitored continuously with an online instrument. In addition to fluoride monitoring at the treatment plants, a grab sample is collected daily and analyzed at SPU's Water Quality Laboratory as a check. Results for one monthly check sample are submitted to the state.

Unregulated Contaminants Monitoring Rule (40 CFR 141.35, 40)

The Unregulated Contaminants Monitoring Rule requires additional monitoring for SPU's source waters. For UCMR 2, four quarterly samples were collected at the entry point to the distribution system in 2009. The next projected UCMR monitoring (UCMR 3) is projected to occur between 2013 and 2015.

Groundwater Rule (40 CFR 141.400 - 405)

This regulation was finalized in late 2006, with an effective date of December 1, 2009. Only the Riverton and Boulevard Park Wells are subject to this regulation. SPU has decided to use triggered source water monitoring for the compliance strategy. This means a source water E. Coli sample will need to be collected from the wells any time the wells are in operation, and a TCR compliance sample from the area fed by the wells is positive. The sample must be collected within 24 hours notice.

Cryptosporidium Monitoring for LT2SWTR (40 CFR 141, Subpart W)

SPU currently conducts quarterly source water monitoring for *Giardia* and *Cryptosporidium* for the Cedar and Tolt supplies. This monitoring is currently voluntary. Monthly monitoring to determine compliance with LT2SWTR was completed in 2007. The results of *Cryptosporidium* monitoring are reported in the annual Drinking Water Quality Report sent to customers each year. Currently, samples are collected from two locations: Tolt Regulating Basin outlet (TPR-4), and Lake Youngs outlet (C1-Raw) prior to treatment. The next round of monthly monitoring for LT2SWTR compliance is required six years after completion of the previous round (possibly 2013 or 2014).

2.2. Future Regulations

The future regulations discussed below are organized by their currently accepted common name (may change in the future). *Federal Register* citations are provided for rules which have been published, either in draft or final form.

Revisions to Total Coliform Rule

Proposed RTCR regulations were published on July 14, 2010. Based on the proposed changes, there should not be any significant impact to the current coliform monitoring conducted in SPU's distribution system.

Fluoride Target

In January 2011, the U.S. Department of Health and Human Services (HHS) and the U.S. Environmental Protection Agency (EPA) announced a proposed recommended level of fluoride in drinking water of 0.7 part per million. A final recommendation on the fluoride level was expected in the late summer or early fall of 2011. The treatment target for Seattle supplies was lowered from 1.0 to 0.8 mg/L to match the minimum currently allowed by state regulation. SPU will continue to work with the Washington Department of Health and Public Health Seattle and King County in preparation for a final federal recommendation on fluoride levels.

2.3. Non-Regulatory Monitoring

Non-regulatory monitoring discussed below includes monitoring performed for informational purposes or to assist in making operational decisions. This monitoring is not required by regulation at this time, but may be required at some time in the future.

Limnology

Bi-weekly, monthly and quarterly monitoring of various limnological parameters is conducted at Lake Youngs, Chester Morse Lake, the Tolt Reservoir proper and reservoir tributary streams, and the Cedar River. In addition, samples are collected occasionally from the Tolt Regulating Basin. This data is collected for informational purposes, and is not required by state or federal regulations. Sample collection occurs at multiple locations and depths in Lake Youngs, Chester Morse Lake, and the Tolt Reservoir. The parameter list includes temperature, dissolved oxygen, transparency, turbidity, conductivity, alkalinity, calcium, pH, phosphorous, iron, manganese, ultra-violet light absorption, total organic carbon, phytoplankton, zooplankton, taste and odor, geosmin, MIB, and more.

Taste and Odor

Taste and Odor are analyzed on a weekly or bi-weekly basis for each of SPU's large in-town open reservoirs, the treated source waters, and other locations as needed. This monitoring is used to make operational decisions, but is not currently required by state or federal regulations. It

is anticipated that all of SPU's open reservoirs will be covered or removed from service in the near future. Once completed, taste and odor testing for those locations will discontinue.

Reservoir Protection

Each of SPU's in-town open reservoirs, and several closed reservoirs, currently have chlorination at the outlet or within a mixing system, prior to entry to the distribution system. The chlorine residual is monitored continuously to ensure adequate treatment occurs at all times. In addition, weekly check samples are collected and analyzed by laboratory staff for chlorine, total coliform, fecal coliform, *E. Coli*, pseudomonas, phytoplankton, pH, and HPC from the reservoir outlet and mid-reservoir. Treatment staff check each open reservoir treatment system daily. As required by WAC 246-290-470, SPU maintains and operates the open reservoirs according to a DOH approved Open Reservoir Protection Plan. In addition, DOH has approved SPU's Reservoir Covering Plan, which will replace, cover, or abandon all open reservoirs by 2018.

Treatment Processes

Existing source water treatment consists of ozonation, UV light, chlorination, fluoridation, and corrosion control on the Cedar supply. Treatment for the Tolt supply consists of ozonation, coagulation, flocculation, filtration, corrosion control, chlorination and fluoridation. Each of these processes is monitored continuously to ensure adequate treatment is maintained at all times. Portions of this monitoring are required by the regulations discussed above. Significantly more monitoring is required to meet the requirements of the Service Agreements for each DBO contractor operating the treatment plants. This monitoring is summarized in Table 3.

2.4 Sampling Procedures

Proper sample collection is important for accurate results. All laboratory assistants and other staff collecting samples in the field are trained in appropriate sample collection techniques based on parameter. Written sample collection procedures for bacteriological analyses such as total coliform are included in SPU's Coliform Monitoring Plan. Sample collection methods for all regulatory compliance samples follow standard procedures or methods listed in *Standard Methods*. In addition, training for laboratory staff conducting the analyses occurs on a regular basis.

2.5 Laboratory Information Management System (LIMS)

Beginning in 2006, SPU's Water Quality Laboratory implemented a new Laboratory Information Management System (LIMS). All water quality samples analyzed at the lab, or samples analyzed by outside laboratories for SPU's drinking water are entered into LIMS. This system provides the means to track sample status, record and validate results, and produce reports. Data from LIMS can then be extracted to other computer programs for long-term storage, analysis, or report formatting.

Table 1
Summary of Drinking Water Quality Monitoring Requirements (Regulatory) - Seattle Public Utilities

Dated: November 18, 2011

Parameter	Locations	Frequency	Monitoring Year	Lab Used	Waivers	Comments
Inorganic Chemicals						
Antimony	SO1 at CLT-5	Annually for Cedar and Tolt	Every Year for SW	SPU		EPA and State allow waivers.
Arsenic	SO2 at TPT-3			SPU		SPU not likely to apply for IOC waivers.
Barium	SO4 at BPW-T	Once every three years for wells	2011 for GW or when	SPU		
Beryllium	SO6 at RHW-T		operating	SPU		
Cadmium				SPU		
Chromium				SPU		
Copper				SPU		No MCL, AL = 1.3 mg/L
Cyanide				Outside		
Fluoride				SPU		
Lead				SPU		No MCL, AI = 0.015 mg/L
Mercury				Outside		
Nickel				SPU		
Selenium				SPU		
Sodium				SPU		Health Advisory Level = 20 mg/L
Thallium				SPU		
Nitrate	CLT-5, TPT-3, RHW-T, BPW-T	Annually for SW and GW	Every Year, wells if operated	Outside		Sample during quarter with previous highest result (SW).
Nitrite						
Asbestos	B-2 for Tolt, M-1A for Cedar	Once every nine years	Once before end of 2018	Outside		Seattle no longer has AC pipe.
Radionuclides						
Gross Alpha Emitters	CLT-5, TPT-3, RHW-T, BPW-T	Took 2 initial samples in 2007 for Cedar and Tolt.	Once before end of 2019	Outside		
Radium 226		Once every 9 years thereafter.				
Radium 228						
Uranium			Next time Wells are used.			
Organic Chemicals						
VOCs	CLT-5, TPT-5, RHW-T, BPW-T	Wells once every three years. SW once a year without waiver.	Sampled S01 & S02 in 2011. Wells next time used.	Outside	Yes	State waivers for some
SOCs (Includes herbicides, general pesticides, & insecticides)	CLT-5, TPT-3, RHW-T, BPW-T	2 samples every 3 year monitoring period.	2011 to 2013	Outside	Yes	Waiting for waiver status from state
Dioxin, endothall, Diquat, Glyphosate, EDB & other Soil Fumigants						State waivers
Bacteriological						
Total Coliform Rule	64 distribution system sample stands	189 samples per month	sampling conducted daily	SPU		Reduced monitoring for SPU
Chlorine Residual	Same locations as coliform	189 samples per month	sampling conducted daily	SPU		
Lead and Copper						
Lead	At 50 customer taps in DSA	Once every three years	2013	SPU		Wholesale customers have 3 subregions: Cedar, Tolt, and Bellevue each take 50 samples once every 3 years
Copper						
Water Quality Parameters	T-FINISH, C1-FIN, C2-FIN, 10 dist sites	Treatment: daily; Distribution: weekly		DBO, SPU		Cedar TF: pH only. Tolt TF & Distribution: pH & alkalinity
Disinfection By-Products						
Trihalomethanes	G2, J3 for Cedar, A3, B4 for Tolt	Quarterly	Every Year	SPU		One sample is from extreme end of each source.
HAAs (future)	G2, J3 for Cedar, A3, B4 for Tolt	Quarterly	Every Year	SPU		Stage 2 monitoring begins in 2nd quarter 2012 at 12 sites.
Secondary Contaminants						
Chloride	CLT-5, TPT-3, RHW-T, BPW-T	Annually for Cedar and Tolt	Every Year for SW	Outside		
Color		Once every three years for wells	Next time Wells are used.	SPU		
Fluoride				SPU		
Hardness				SPU		
Iron				SPU		
Manganese				SPU		
Silver				SPU		
Specific Conductivity				SPU		
Sulfate				SPU		
Total Dissolved Solids				Outside		
Zinc				SPU		Only required if conductivity > 700 µmhos/cm
				SPU		
Surface Water Treatment Rule (Tolt)						
Turbidity	TPR-5S 5N, T-CFE, individual filters	Continuous				All Part of DBO Contract
Fecal coliform	TPR-5S 5N	Daily, at least 24 days per month		SPU		
Chlorine Residual	T-FINISH	Continuous				
CT Complaince	Ozone contactors and clearwell	Continuous				For Giardia and Virus inactivation
Limited Alternative to Filtration (Cedar) - LAF						
Turbidity	C1-RAW	Continuous				All Part of DBO Contract
Fecal coliform	C1-RAW	Daily, at least 24 days per month		SPU		
Chlorine Residual	C1-FIN, C2-FIN	Continuous				
CT Complaince	Ozone contactors, UV units, and clearwell	Continuous				For Crypto, Giardia, and Virus inactivation

Table 2
Seattle Public Utilities
Drinking Water Quality Monitoring Conducted – by Parameter
Required and Optional

Parameter	Source	Monitoring Frequency and Location					
		Continuous	Daily or M-F	Weekly or Biweekly	Monthly	Quarterly	Annually
Turbidity	Cedar	CPR-1, C1-RAW, C1-FIN, C2-FIN, security sites	CPR-1, CT-2	GL-1, GLR, VO-1, VOR, C1-Raw, CPT-05, WS-1, 2 sites on LY, Masonry Dam	4 sites on CMR, 3 sites on Lake Youngs	CLT-5, M-1A	
	Tolt	TPR-5S 5N, T-FINISH, T-CFE, each Filter at plant, reclaimed water, Reg Basin Inlet	TPR-4, TT-1, 2		5 sites Tolt Reservoir	TPT-3, B-2, 9 Tolt Streams	
pH	Cedar	C1-RAW, C1-CWI, C2-CWI, C1-FIN, C2-FIN	CPR-1, CLT-4, 5, CT-1, 2, 3,	GL-1, GLR, VO-1, VOR, RVR-1, 30 TCR sites, Masonry Dam, 2 sites on LY, C1-Raw, CPT-05, WS-1	CT-4, 4 sites on CMR, 3 sites on LY, 12 TCR sites, Soos Res.	4 DBP sites	
	Tolt	TPR-5S 5N, T-FINISH, T-CWI, TPL1 at Welcome Rd.	TT-1, 2, 11	TT-3, TT-22,	TPR-4, 5 sites Tolt Reservoir	9 Tolt Streams	
Conductivity	Cedar	Security sites	CPR-1, CLT-4, 5, CT-1, 2, 3,	GL-1, GLR, VO-1, VOR, RVR-1, 32 TCR sites, Masonry Dam, 2 sites on LY, C1-Raw, CPT-05, WS-1	CT-4, 4 sites on CMR, 3 sites on LYS, 13 TCR sites, LNR	CLT-5, M-1A	
	Tolt		TT-1, 2, 11	TT-3, TT-22,	TPR-4, 5 sites Tolt Reservoir	TPT-3, B-2, 9 Tolt Streams	
Fluoride	Cedar	CPT-00	CPT-00, CT-2	6 sample stands, T-FINISH, RVR-1	TT-3, A-4, J-3	8 QTR sites	
	Tolt	T-FINISH, T-CWI	TT-1, 2				
Chlorine Residual	Cedar	CPT-00, 4 locations at CTF, 8 reservoirs	CLT-4, 5, CT-1, 2, 3, CPT-04	Closed tanks, standpipes, and reservoirs, open reservoirs and checkpoints, TT-3, WSP-1, CT-4, all TCR sites DSA	10 PBCU sites	4 DBP sites, QTR sites	
	Tolt	T-FINISH, T-CWI, LFP, BLR	TT-1, 2, 11				
Total Coliform - PA	Cedar		CLT-4,5, CT-1, 2, 3, C1 and C2-FIN	Closed tanks, standpipes, and reservoirs, open reservoirs and checkpoints, CT-4, TT-3, WSP-1, all TCR sites DSA			
	Tolt		T-FINISH, TT-1, 2, 11				

Table 2
Seattle Public Utilities
Drinking Water Quality Monitoring Conducted – by Parameter
Required and Optional

Parameter	Source	Monitoring Frequency and Location					
		Continuous	Daily or M-F	Weekly or Biweekly	Monthly	Quarterly	Annually
Total Coliform – QT	both		CPR-1, C1-RAW, TPR-5S	Open Reservoirs, Masonry Dam	3 sites LYR, 4 sites CMR, TPR-4, TW-10, 2 sites Tolt Reservoir		
Fecal Coliform	Cedar		CPR-1, C1-RAW, C1-FIN, C2-FIN	Open Reservoirs			
	Tolt		TPR-5S				
HPC	Cedar		CPR-1, C1-RAW, CLT-4, 5, C1-FIN, C2-FIN, CT-2	Closed tanks, standpipes, and reservoirs, open reservoirs and checkpoints, WSP-1	5 Sites CMR, 3 sites LY, 4 sites Tolt, average of 10 TCR sites per month		
	Tolt		TPR-5S, TT-1, 2, 11, T-FINISH				
Temperature	Cedar	C1-RAW, Control Works	CPR-1, CLT-4, 5, CT-1, 2, 3, C1-FIN, C2-FIN, C1-RAW	Closed tanks, standpipes, and reservoirs, open reservoirs and checkpoints, CT-4, TT-3, T-CFE, WSP-1, CPT-04 05, TPR-4, all TCR sites	10 Pb/Cu sites, TT-22	DBP sites, 8 quarterly sites, 9 Tolt streams	
	Tolt	TPR-5S, 5N	TT-1, 2, 11, TPR-5S 5N, T-FINISH				
UVA	Both	CPR-1	CPR-1	TPR-5S, T-CFE, CPT-05, C1-RAW, Masonry Dam, 2 LY sites	5 CMR sites, 5 Tolt Res sites, 3 LY sites, TPR-4	9 Tolt streams, 8 quarterly sites	
TOC	Both			CPR-1, TPR-5S, T-CFE, CPT-05, C1-RAW, 2 LY sites, Masonry Dam	5 sites CMR, 4 sites Tolt Res, 3 sites LY, TPR-4	9 Tolt streams	
Taste and Odor	Both			CPT-05, CT-2, C1-RAW, C1-FIN, C2-FIN, T-FINISH, open reservoirs			
Giardia/Crypto	Both					C1-RAW, TPR-4	
Alkalinity	Both		T-FINISH	CPT-05, CPR-1, C1-RAW, 2 LY sites, T-FINISH	10 Pb/Cu sites, TT-3, TPR-4, TW-10, LY7-B, 5 CMR sites	8 QTR sites, 9 Tolt streams	

Note: Sampling for Riverton and Boulevard Park Wells is not included in this table.

Table 3
Seattle Public Utilities
Drinking Water Quality Monitoring Conducted by DBO Contractors
Continuous Monitoring

Parameter	Tolt Water Treatment Facility					
	Reclaimed Water	Raw Water	Ozone Contactors	Filter Effluents	Combined Filter Effluent	Clearwell Effluent
Turbidity	X	X		X	X	X
Temperature		X				X
pH		X			X	X
Particle Count		X		X(1)	X	
Ozone Concentration			X			
Chlorine Residual					X	X
Fluoride					X	X

Parameter	Cedar Water Treatment Facility					
	Raw Water	Ozone Contactors	UV Reactors	Clearwell Influent	Clearwell Effluent	Finished Water
Turbidity	X					X
Temperature	X				X	
pH	X			X	X	X
Ozone Concentration		X				
UV Transmittance, UV Dose			X			
Chlorine Residual				X	X	X

Tolt grab sample parameters include coliform, alkalinity, bromate, iron, sodium, taste and odor, TTHMs and HAAs SDS, Color, TOC, and UVA.
Cedar grab sample parameters include coliform, bromate, iron, chlorophyll, sodium, and taste and odor.