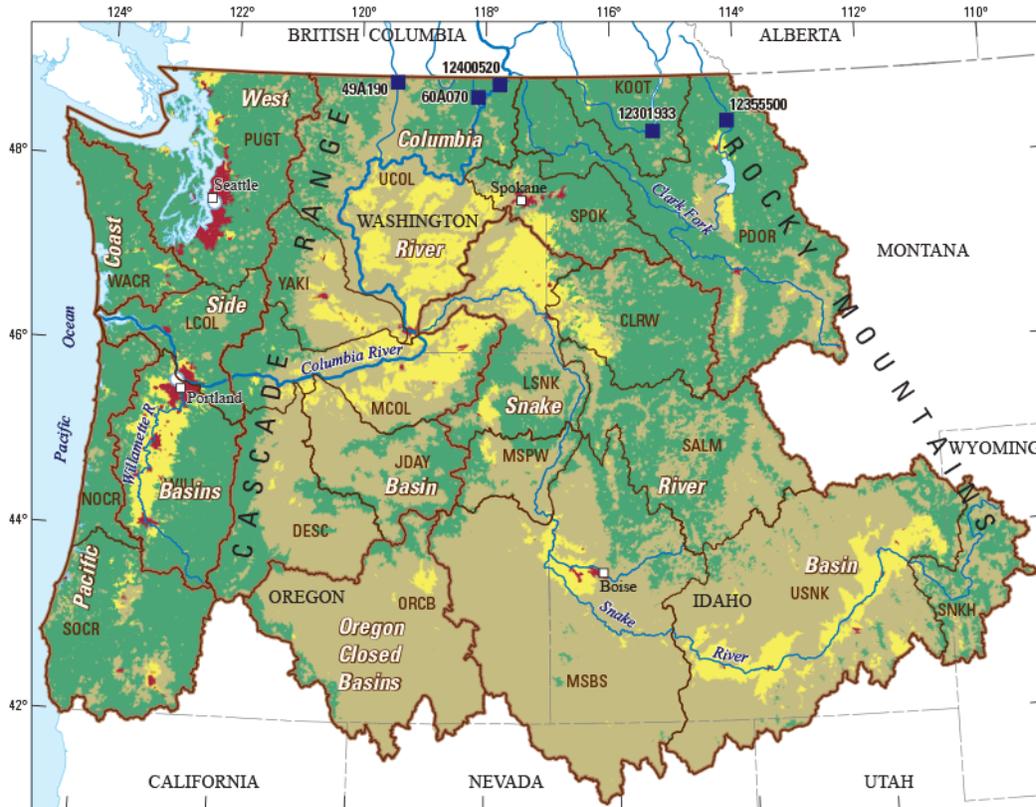


Section 3: Watershed Management

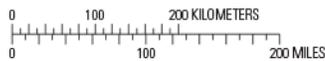
Section 3: Watershed Management

Bothell's Watershed Setting

Bothell is located in the Pacific Northwest area that drains to the Pacific Ocean, either directly or through the Columbia River system or Puget Sound.



Base map modified from USGS and other U.S. agency and Canadian national digital data sources at various scales. Projection: Albers, SP1: 29.5, SP2: 45.5, LO: 23.0, CM: -96.0, Datum: North American Datum of 1983.



EXPLANATION

- UCOL HUC Level 6 watershed and name—full name in table 1.
- Basin Major drainage
- Boundary calibration station
- Primary land cover type
- Scrub and grassland
- Forestland
- Agriculture
- Developed

Station No.	Station name	Agency
12301933	Kootenai River below Libby Dam near Libby, MT	USGS
12355500	N.F. Flathead River near Columbia Falls, MT	USGS
12400520	Columbia River at Northport, WA	USGS
60A070	Kettle River near Barstow, WA	WADOE
49A190	Okanogan River at Oroville, WA	WADOE

USGS = U.S. Geological Survey
WADOE = Washington Department of Ecology



Pacific Northwest

Bothell is located in the west side basins of the Pacific Northwest region, and is part of the Puget Sound watershed. This 2,138 square mile watershed contains unique marine and fresh water habitat. The Sound is also home to about 4.3 million people who rely on its resources for recreation, food, transportation, and other basic needs.

Basins in this watershed are part of the Western Washington stormwater management area, which has a distinctly different hydrology than basins on the Olympic Peninsula or east of the Cascade Range. This difference is evident in the Western Washington approach to drainage and stormwater management permitted by the Washington State Department of Ecology.

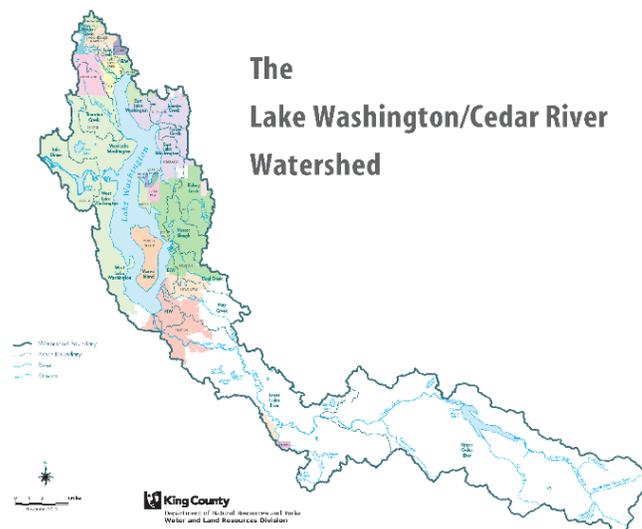
WRIA 8

The City of Bothell is fully contained in the Lake Washington/Cedar River (known as Watershed Resource Inventory Area or WRIA 8) of Puget Sound.

This WRIA is considered the most densely populated, developed, and degraded watershed within Puget Sound Basin, yet is also home to some native populations of salmon and other

migratory and resident fish. About 55 percent of the watershed is within Urban Growth Areas, including 28 different municipalities. WRIA 8 supports a population expected to grow to 1.6 million people by 2022.

Most of the watershed character was originally influenced by glacial activity which created the hillsides, topography, and soil characteristics. The glacial soils in Bothell include widespread fine-grained glacial tills that are relatively impermeable, easily erodible, and relatively unstable. In addition to the glacial till, there are some areas of organic soils, including peat, that may influence water quality and sometimes affect flood management.



Lake Washington/Cedar River Basin, developed by King County

Development in WRIA 8 for human uses has dramatically altered aquatic habitat conditions and the processes that form and maintain them. The factors that limit salmon habitat are similar for the lakes, rivers, and creeks in the watershed, although the magnitude of impact varies by type of water body and specific watershed area. It is important to understand that the limiting factors interact with one another to worsen the habitat problems seen in the aquatic systems. The factors that limit habitat, degrade water quality, and increase local flooding include:

- Altered hydrology (e.g., low base flows, higher peak flows following storms, and increased 'flashiness,' which means more frequent and rapid responses when it rains)
- Loss of floodplain connectivity (e.g., reduced access to side-channels or off-channel areas due to bank armoring and development close to shorelines)
- Lack of riparian vegetation (e.g., from clearing and development)
- Disrupted sediment processes (e.g., too much fine sediment deposited in urban stream)
- Loss of channel and shoreline complexity (e.g., lack of woody debris and pools)
- Barriers to fish passage (e.g., from road crossings, weirs, and dams)
- Degraded water and sediment quality (e.g., pollutants and high temperatures)
- Loss or degradation of fish habitat
- Reduced summer base flows due to changed infiltration and groundwater recharge

Bothell represents less than two percent of the total area within WRIA 8.

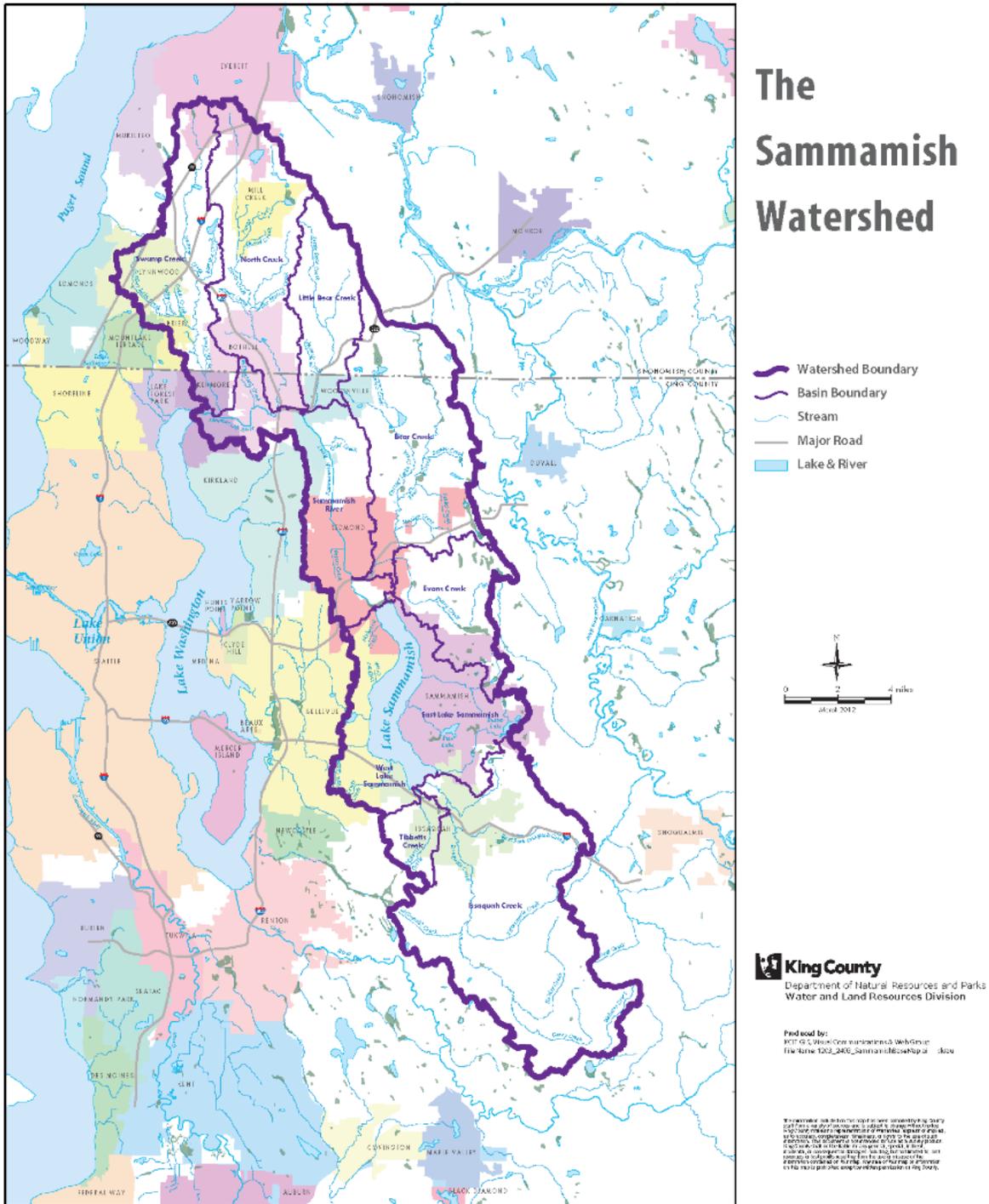
Sammamish River Basin

(Includes municipalities of Sammamish, Issaquah, Bellevue, Redmond, King County, Woodinville, Bothell, Lake Forest Park, Kenmore, Snohomish County)

The Sammamish watershed is part of the greater [Lake Washington - Cedar River drainage basin](#), encompassing the land area in which rainwater drains to [Lake Sammamish](#), the [Sammamish River](#) and out into [Lake Washington](#).

The majority (about 98%) of Bothell drains to the Sammamish River, either directly or through North, Swamp, Waynita, or Little Bear Creeks. A small portion (about 2%) of the

southern part of Bothell drains into Juanita Creek through the city of Kirkland on its way to Lake Washington.

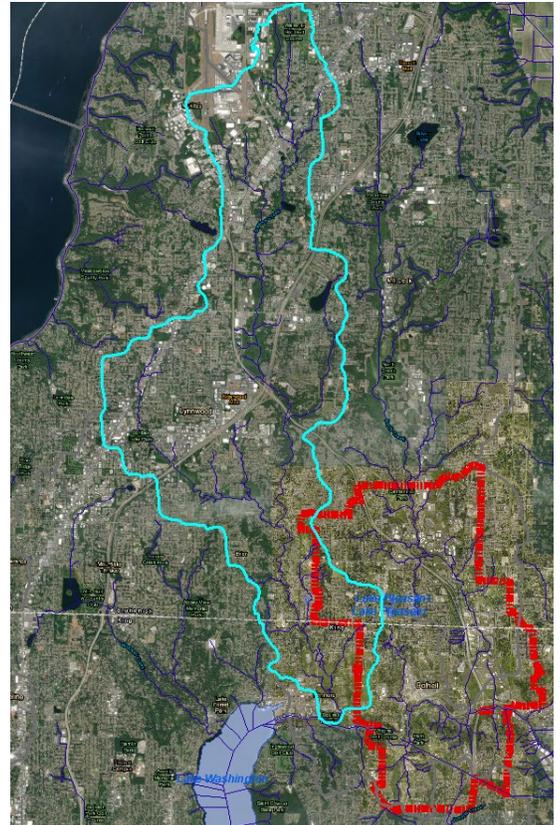


Sammamish River Basin, developed by King County

Swamp Creek Basin

(Includes municipalities of Everett, Lynnwood, Snohomish County, Brier, Bothell, and Kenmore)

About 1.4 square miles (10%) of Bothell drains toward Swamp Creek on its way to the Sammamish River and Lake Washington in Kenmore. This amount represents about 6% of the overall Swamp Creek Basin.



Swamp Creek Basin, developed in ArcGIS by Bothell staff.



Little Bear Creek Basin, developed by Snohomish County, WA

Little Bear Creek Basin

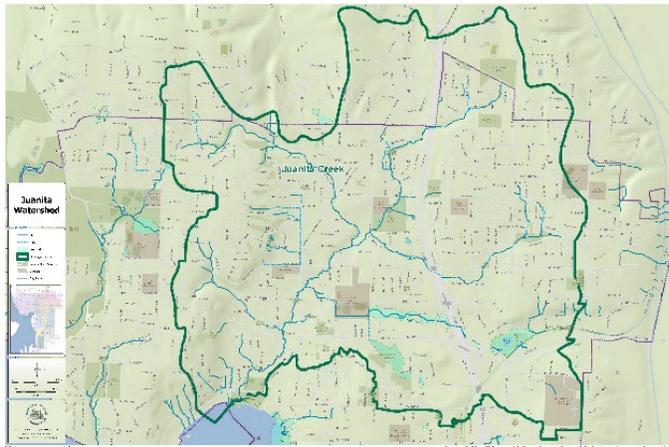
(Includes municipalities of Snohomish County, Woodinville, and Bothell)

About 0.2 square miles (1.4%) of Bothell drains to Little Bear Creek on its way to the Sammamish River in Woodinville. This represents about 1% of the total Little Bear Creek watershed.

Juanita Creek Basin

(Includes municipalities of Bothell and Kirkland)

About 0.7 square miles (5%) of Bothell drains to Juanita Creek in Kirkland on its way to Lake Washington. This represents about 10% of the 4224-acre Juanita Creek Watershed. A detailed analysis of the watershed was performed in August 2012 (Stormwater Retrofit Analysis and [Recommendations for Juanita Creek Basin in the Lake Washington Watershed](#) were developed by King County, the City of Kirkland, Ecology and WSDOT).



Juanita Creek Basin

Surface Water staff monitors the health of these basins and periodically produces a Stream Health Assessment Report to help inform the public and policy makers on the condition of Bothell's streams. The latest report can be found on the City's website at <http://www.bothellwa.gov/stormdocs>.

Watershed Management for Bothell: Utility-wide and Multi-Level Efforts

Surface watershed management in Bothell takes place at a wide range of levels, from individual inlets or catch basins to Utility-wide or regional management. Many design requirements, regulations, inspections, and education and outreach efforts are applied relatively equally throughout the Utility. Some situations call for a regional approach to watershed management, such as response to listing of Chinook salmon as endangered through the region's Watershed Resource Inventory Area or WRIA approach. Other situations call for a very specific response, such as the City's approach to managing and developing the Horse Creek basin.

This section of the Plan Update presents an added approach to managing storm and surface water efforts in Bothell. The approach includes dividing the city into Surface Water Management Areas (SWMAs), which are delineated watersheds to meet

Washington State Department of Ecology requirements under S5.C.1.d.i of the Western Washington Phase II Municipal Stormwater (MS4) Permit.

Some goals of the Utility's various watershed management approaches include:

- Protecting and improving health of the city's aquatic lands and surface waters
- Reducing stormwater impacts on developed properties by protecting and restoring natural surface water systems
- Meeting state and federal water quality requirements
- Efficiently deploying Utility resources

The Utility's watershed management planning includes:

1. Identifying watershed units to be managed

As mentioned, the city's watersheds are, and will continue to be, managed at a wide range of levels. This Plan Update introduces an intermediate management unit that subdivides the city into surface water management areas. This level of management can be used to focus much of the Utility's water quality, public outreach, and operations efforts.

2. Describing the conditions and attributed of watershed management units

Various watershed units in and surrounding the city have been described in past stormwater master plans, the City's Comprehensive Plan, and by several past reports, including:

- North Creek Watershed Management Plan, September 6, 1994, Snohomish County Public Works
- Surface Water Quality Plan, City of Bothell, 1996, CH2M-Hill
- North Creek Drainage Needs Study, December 2002, Snohomish County
- Sammamish River Corridor Action Plan, 2002, Tetra Tech
- Swamp Creek Drainage Needs Report, 2002, Snohomish County
- Restoration Plan for the City of Bothell Shorelines, May 2012, The Watershed Company
- Lake Washington/Cedar/Sammamish Watershed (WRIA 8) Chinook Salmon Conservation Plan, 2017, WRIA 8
- Stream Health Assessment Reports, City of Bothell Staff, 2010 through 2020



This Plan Update also describes the characteristics of each SWMA by compiling GIS-based land use data, natural environment information, and stream monitoring reporting.

3. Identifying goals, expectations, strategies, and action plans for watershed management units

Watershed goals and action plans have been developed at various levels for Bothell watershed units:

- As part of the region’s salmon recovery plan, Bothell is a participant in watershed planning for the Cedar-Sammamish Watershed Resource Inventory Area 8 (WRIA-8).
- The City has participated in regional efforts with Snohomish County and surrounding jurisdictions to address management of North Creek. Efforts have

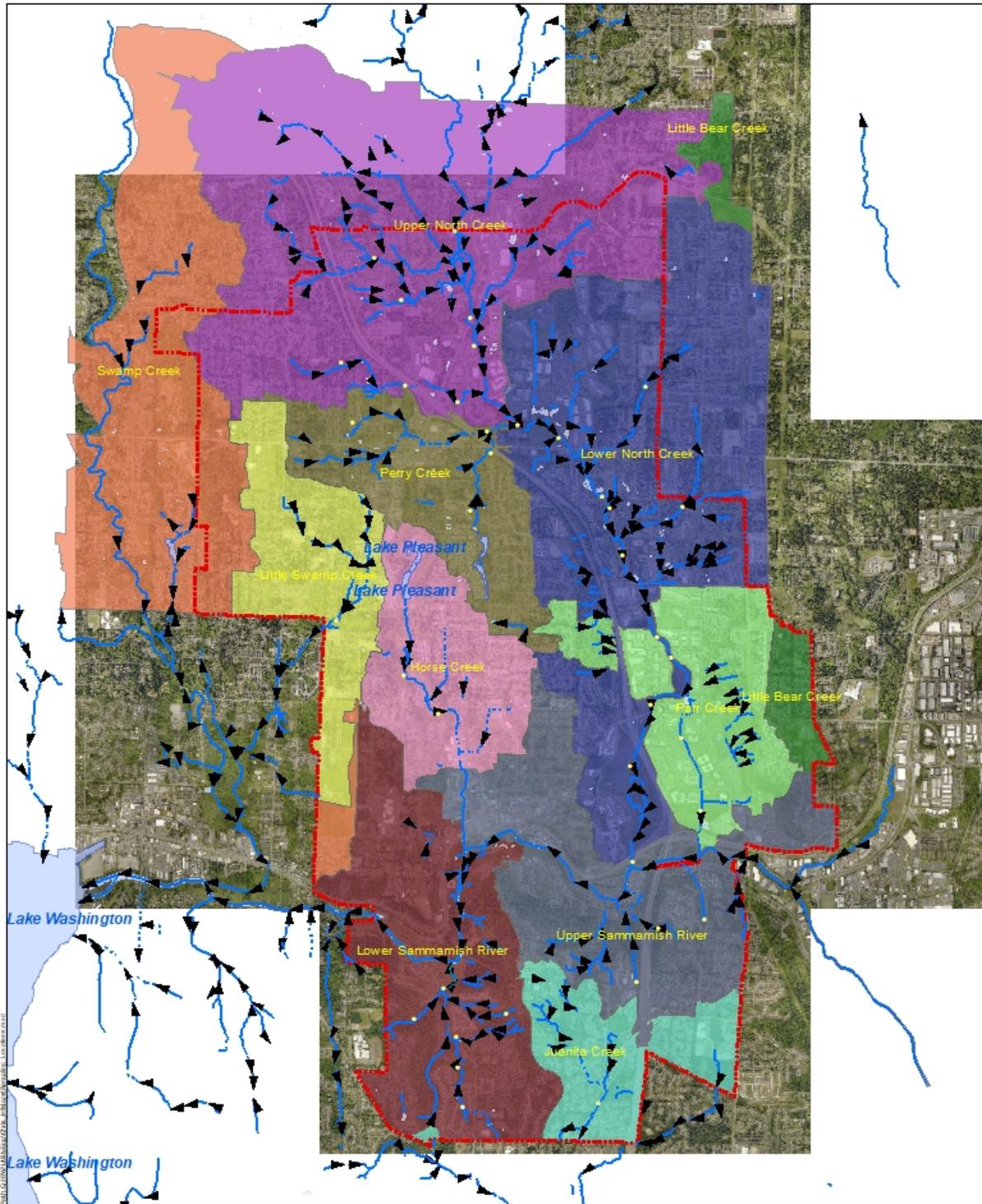
been made to identify goals and expectations for the Sammamish River, Juanita Creek, and Swamp Creek.

- The State, as part of water quality regulations, has established water quality plans for Swamp Creek, North Creek, and the Sammamish River.
- The City has prepared citywide efforts for watershed management as part of its critical areas planning. In addition, the City has prepared a North Creek Fish and Wildlife Critical Habitat Protection Area to address, in part, watershed goals for a roughly 1,220-acre area of the city.
- This Plan Update presents initial draft goals and expectations by Surface Water Management Area (SWMA).

Individual named Stormwater Management Areas identified by the Utility include:

- Horse Creek
- Juanita Creek
- Little Bear Creek
- Little Swamp Creek
- Lower North Creek
- Lower Sammamish River
- Parr Creek
- Perry Creek
- Swamp Creek
- Upper North Creek
- Upper Sammamish River

These SWMAs can be seen in the following map.



0 3,100 6,200 9,300
Feet

Surface Water Management Areas

Legend

 **Bothell City Limit**

The City of Bothell delivers this data map in an AS-IS condition. GIS data maps are produced by the City of Bothell for internal purposes. No representation or guarantee is made concerning the accuracy, currency or completeness of the information provided.
Date: 02/7/2020



The characteristics of these SWMAs are described and potential management strategies are developed for each of the areas.

Stormwater Management Action Plan (SMAP)

The Washington State Department of Ecology National Pollutant Discharge Elimination System (NPDES) Western Washington Phase II Municipal Stormwater Permit (Permit)⁷ outlines requirements for a Comprehensive Stormwater Planning Process. This process includes development and implementation of a Stormwater Management Action Plan (SMAP) to address impacts on priority receiving waters from existing or planned development. As required by the Permit, the City has formed a SMAP interdisciplinary team across City departments. The mission of the interdisciplinary team is to coordinate permitting of the City's stormwater program and address water health through comprehensive planning. Also, as part of the SMAP, the City has evaluated all basins within Bothell and is developing an annual report for one high-priority basin that will identify tailored stormwater management actions, funding mechanisms, and adaptive management. Lower North Creek has been selected as the high-priority basin. The City will use the results of the SMAP process across all of Bothell to identify future Capital Improvement Projects, inform future Code, Standards, and Policy updates, and align with Growth-Management Comprehensive Plan updates.

Next Steps

Utility staff will prepare plans for each SWMA. Public engagement will be included in the development of each plan. The steps for developing the plans for the SWMAs include:

- A. **Identifying watershed goals within each SWMA.** Examples of goals might include:
 - Specific water quality levels and stream health for monitoring stations/streams in an SWMA
 - Targeted amount and quality of aquatic habitat within an SWMA
 - Desired reduction/limit of impervious surface coverage within the SWMA

⁷ Ecology (Washington State Department of Ecology). 2019a. Western Washington Phase II Municipal Stormwater Permit – National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for discharges from Small Municipal Separate Storm Sewers in Western Washington. State of Washington Department of Ecology. Olympia, Washington. Issuance Date: July 1, 2019; Effective Date: August 1, 2019; Expiration Date: July 31, 2024.

- B. **Establishing measurements/indicators for each goal.** Examples might include:
- Stream health and water quality testing and observations
 - Wetland and stream buffer assessments
 - GIS-based land cover assessments
- C. **Defining management activities that may achieve goals.** Examples might include:
- Education and outreach programs targeted to specific pollution-generating activities or problems within the SWMA
 - Maintenance activities, such as street sweeping, catch basin cleaning, and facilities maintenance, focused on specific areas or issues where problems are identified
 - Retrofitting facilities and reducing existing impervious areas to minimize storm runoff
 - Increased focus on stormwater code enforcement in problem areas, including illicit discharge elimination
 - Development or refinement of specific land planning and development efforts to address the goals of each SWMA
 - Specific restoration projects to address SWMA issues
- D. **Estimating technical and financial needs and available resources to implement the plan for each SWMA.**
- This effort will likely require revisiting the goals and management activities for each SWMA to align with the Utility's financial and technical capacity.
- E. **Describing and defining interim, measurable milestones, and schedules for these milestones.**
- F. **Developing a monitoring and reporting plan for each SWMA.**
- G. **Implementing the watershed actions for each SWMA.**

Surface Water Management Areas Descriptions

Introduction

Surface Water Management Areas (SWMAs) and relevant data were developed using internal GIS datasets using ArcGIS. SWMA boundary development information can be found in the summary section of this report. The following data dictionary provides an overview of the datasets and how they were developed. For more detailed information, see the workflow guide at www.bothellwa.gov/swmaworkflow. Also, feel free to visit the City Maps and GIS webpage at <http://www.ci.bothell.wa.us/233/Maps-GIS> for additional information and contacts.

Data Dictionary for the City of Bothell’s Watershed Analysis

This guide will describe the data values in the results spreadsheet of the City of Bothell’s watershed (monitoring basin) analysis. The goal is for this analysis to *assist in* prioritization of surface water infrastructure improvements among these monitoring basins. This guide briefly describes each value. For a more complete explanation of how each value was derived using ArcGIS Desktop 10.6.1 (advanced license), please refer to the workflow guide, which should accompany this guide.

It’s also important to note that this data dictionary is based on GIS data at coarse scale and is NOT intended to represent a scientific or survey-grade study of drainage or other phenomena and that:

GIS data (maps) are produced by the City of Bothell for internal purposes. No representation or guarantee is made concerning the accuracy, currency, or completeness of the information provided.

Data Value	Units	Description
Area		
Total Area	sqmi	The total area of the monitoring basin that is covered by the catchments of tributaries that intersect Bothell’s city limits (see PDF map).
Bothell City Portion	sqmi	The area of the monitoring basin that is within Bothell’s city limits.

Data Value	Units	Description
Bothell City Portion	%	The percentage of the monitoring basin that is within Bothell’s city limits.
Land Use		
Single Family Residential	%	The percentage of the monitoring basin within Bothell city limits that is covered by “Single Family Residential” land use. <u>Single Family Residential</u> : includes: houses, townhomes, mobile homes, & manufactured homes
Multi-Family Residential	%	The percentage of the monitoring basin within Bothell’s city limits that is covered by “Multi-Family Residential” land use. <u>Multifamily Residential</u> : includes apartments and condos where no commercial use on ground floor exists
Total Residential	%	Sum of the above two percentages.
High Use Commercial	%	The percentage of the monitoring basin within Bothell city limits that is covered by “High Use Commercial” land use. <u>High Use Commercial</u> : includes areas with oil water separators such as restaurants, gas stations, etc. Oil water separators are in storm site layers.
General Use Commercial	%	The percentage of the monitoring basin within Bothell city limits that is covered by “General Use Commercial” land use. <u>General Commercial</u> : includes office, retail, public facilities, schools, churches, etc.

Data Value	Units	Description
Industrial	%	The percentage of the monitoring basin within Bothell city limits that is covered by "Industrial" land use. <u>Industrial</u> : includes sites such as Romac, Philips Healthcare, Seattle Times Printing Plant, etc.
Total Commercial	%	Sum of the above three percentages.
Mixed Use (Residential and Commercial)	%	The percentage of the monitoring basin within Bothell city limits that is covered by "Mixed Use (Residential and Commercial)" land use. <u>Mixed Use</u> : Includes areas where residential buildings are on top of commercial such as SHAG.
Active Use Parks	%	The percentage of the monitoring basin within Bothell city limits that is covered by "Active Use Parks" land use. <u>Active Use</u> : Includes ballfields, areas with restrooms, playgrounds, etc.
Passive Use Parks	%	The percentage of the monitoring basin within Bothell city limits that is covered by "Passive Use Parks" land use. <u>Passive Use</u> : Areas of passive recreation
Total Parks and Open Space	%	Sum of the above two percentages.
Natural Areas (Streams, wetlands, and buffers)	%	The percentage of the monitoring basin within Bothell city limits that is covered by "Natural Areas (Streams, wetlands, and buffers)" land use. <u>Natural Areas</u> : Includes streams, wetlands, and buffers

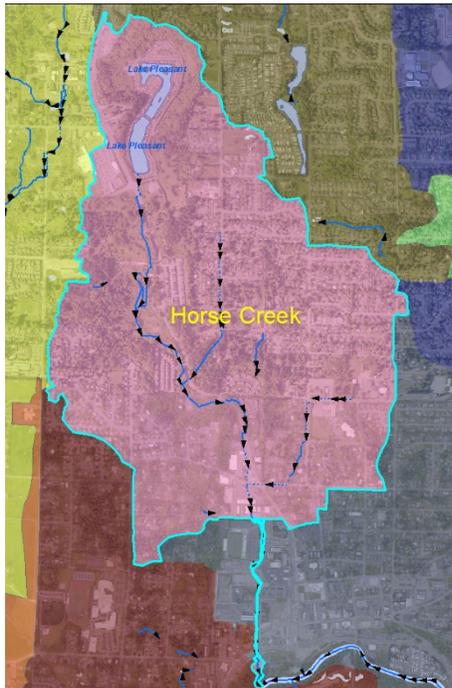
Data Value	Units	Description
Undeveloped	%	The percentage of the monitoring basin within Bothell city limits that is covered by "Undeveloped" land use. <u>Undeveloped</u> : Use the vacant layer for this category to find areas with potential of future development
Right-of-Way	%	The percentage of the monitoring basin within Bothell city limits that is covered by "Right-of-Way" land use. <u>Right-of-Way</u> : As land use was defined at the parcel level, the "right-of-way" land use fills in the gaps between parcels within the Bothell city limits.
Land Cover		
Impervious	%	The percentage of the monitoring basin within Bothell city limits that is covered by an impervious surface. This includes all impervious surfaces of roadways (below), buildings, parking lots, driveways, walkways, patios, decks, and miscellaneous.
Limited Access Roads	%	The percentage of the monitoring basin within Bothell city limits that is covered by <i>impervious</i> road surface that is part of a limited access highway. This includes I-405, the eastern portion of SR 522, and all associated on-ramps and off-ramps.
Arterial Roads	%	The percentage of the monitoring basin within Bothell city limits that is covered by <i>impervious</i> road surface that is part of an arterial roadway. This includes all major, minor, and collector arterials that aren't classified as limited access highways.

Data Value	Units	Description
Local Roads	%	The percentage of the monitoring basin within Bothell city limits that is covered by <i>impervious</i> road surface that is part of a local roadway. This includes every road that is not classified as either a limited access highway or arterial roadway.
Total Road Surface	%	Sum of the above three percentages.
Tree Canopy	%	The percentage of the monitoring basin within Bothell city limits that is covered by tree canopy. This may overlap with impervious surface in some areas.
Physical Geography		
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	The percentage of the monitoring basin within Bothell city limits that is covered by "very severely erosive" soil (Class V) and is on a steep slope over 40%.
Natural Areas		
Wetland Area	%	The percentage of the monitoring basin within Bothell city limits that is covered by wetlands.
Wetland Area + Buffers	%	The percentage of the monitoring basin within Bothell city limits that is covered by wetlands or their associated buffers.
Rivers and Streams	mi/sqmi	The density of rivers and streams (including piped streams) within the portion of the monitoring basin within Bothell city limits.
Storm Infrastructure		

Data Value	Units	Description
Pipes and Culverts	mi/sqmi	The density of pipes and culverts (including piped streams and detention pipes, but not piped trenches) within the portion of the monitoring basin within Bothell city limits.
Ditches	mi/sqmi	The density of stormwater ditches (not bioswales) within the portion of the monitoring basin within Bothell city limits.
BioSwales	mi/sqmi	The density of bioswales within the portion of the monitoring basin within Bothell city limits.
Trenches	mi/sqmi	The density of trenches (including infiltration, dispersion, and interceptor trenches, and trenches with pipes) within the portion of the monitoring basin within Bothell city limits.
Total Conveyance	mi/sqmi	<i>Sum of the above four densities.</i>
Catch Basins	#/sqmi	The density of catch basins within the portion of the monitoring basin within Bothell city limits.
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	The density of control structures (including those in vaults, detention ponds, etc.) within the portion of the monitoring basin within Bothell city limits.
Detention Pipes	#/sqmi	The density of detention pipes within the portion of the monitoring basin within Bothell city limits.
Detention Ponds	#/sqmi	The density of detention ponds within the portion of the monitoring basin within Bothell city limits.
Vaults	#/sqmi	The density of vaults within the portion of the monitoring basin within Bothell city limits.

Data Value	Units	Description
Filters	#/sqmi	The density of filters (in catch basins, control structures, and vaults) within the portion of the monitoring basin within Bothell city limits. Filters include oil/water separators.
Total Number of Water Quality Treatment Facilities	#/sqmi	Sum of the above four densities.
Pervious Pavement	#/sqmi	The density of pervious pavement installations within the portion of the monitoring basin within Bothell city limits.
Bioretention	#/sqmi	The density of bioretention (or rain garden) installations within the portion of the monitoring basin within Bothell city limits.
Tree Boxes	#/sqmi	The density of tree box (or Filterra) installations within the portion of the monitoring basin within Bothell city limits.
Total Number of LID Facilities	#/sqmi	Sum of the above three densities.
Population		
Population Density	people/sqmi	An <i>estimate</i> of population density within the portion of the monitoring basin within Bothell city limits. Washington State Office of Financial Management estimates of average household size based on the number of units within a building were combined with the City of Bothell's building and address layers to estimate the population on each address point. Address points that were likely residences were then intersected with the monitoring basins.

Horse Creek Surface Water Management Area



General and Physical Character. The Horse Creek Surface Water Management Area encompasses 0.97 square miles and is 100% in City limits. The SWMA includes the downtown area in the west side of the city. General terrain is made up of moderate slopes from north to south.

Very severely erosive soils also classified on steep slopes (>40%) make up 6.48 percent of the SWMA. Compared to other SWMAs, 6.48 percent is the fifth highest.

Land use and Development. The prominent land use feature of this SWMA is residential with 63% of total parcel area with the second highest land use being commercial with 12% parcel area.

Thirty-two percent of the area is covered by impervious surfaces, making it one of the more developed SWMAs in the city. Of the impervious area, approximately one-fourth of the imperviousness is road surface.

Natural Environment. Horse Creek, the primary stream in the SWMA, flows for 3.3 miles from its headwaters at Lake Pleasant to its discharge point at the Sammamish River. Wetland and the associated buffers area is mapped as 9.88 percent of the basin.

The natural environment of Horse Creek is degraded. There are also two unnamed tributaries to horse creek entering on the East side of the stream. Though Horse Creek is not on Ecology's 303(d) list for water quality impairment, it is known to have low dissolved oxygen and high temperature. The benthic index of biotic integrity (B-IBI) score indicates extreme impairment and Horse Creek has the lowest B-IBI score among Bothell streams samples. Aquatic habitat diversity is also poor. The habitat, biological, and water quality data indicate Horse Creek is one of the most impaired water bodies in the city.

Stormwater Infrastructure. The amount of total conveyance (ditches, pipes, etc.) is 24.43 miles/square mile (23.7 miles total) with 1,018 total catch basins within the. The area has a significant number of detention pipes and bioswales relative to the impervious area in the western half of the SWMA. Residential areas to the east have inadequate stormwater conveyance capacity.

Surface Water Management Strategies. A large portion of this SWMA is redeveloping, but there is still significant area with older infrastructure. The majority of this area drains to the Sammamish River, so water quality treatment may be more important than flow control if conveyance systems are adequate.

Possible efforts include:

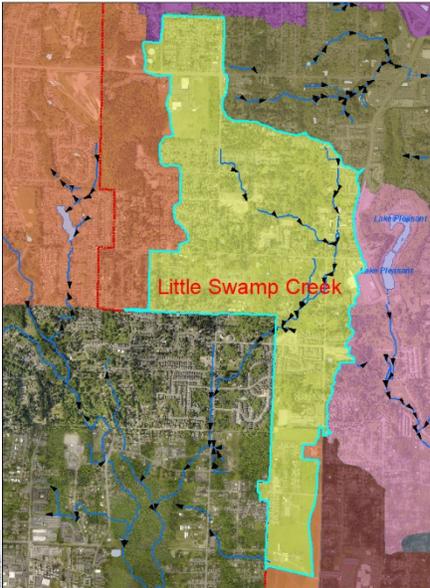
- Participating in design review of new systems as areas redevelop to address water quality
- Providing input into improved function of Horse Creek
- Assist the Capital group with downtown City street redevelopment
- IDDE focus on detecting possible cross-connections with sewer
- Outreach focus on IDDE, business operations, and protection of Horse Creek.

Horse Creek SWMA Data Table

SWMA Statistics		Horse Creek
Area		
Total Area	sqmi	0.97
Bothell City Portion	sqmi	0.97
Bothell City Portion	%	100.00
Land Use		
Single Family Residential	%	58.35
Multi-Family Residential	%	4.93
Total Residential	%	63.27
High Use Commercial	%	1.25
General Use Commercial	%	10.98
Industrial	%	0.00
Total Commercial	%	12.22
Mixed Use (Residential and Commercial)	%	0.00
Active Use Parks	%	0.92
Passive Use Parks	%	2.38
Total Parks and Open Space	%	3.30
Natural Areas (Streams, wetlands, and buffers)	%	5.46
Undeveloped	%	2.73
Right-of-Way	%	12.99
Land Cover		
Impervious	%	32.40
Limited Access Roads	%	0.00
Arterial Roads	%	3.21
Local Roads	%	4.96
Total Road Surface	%	8.18
Tree Canopy	%	49.05
Physical Geography		
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	6.48

SWMA Statistics		Horse Creek
Natural Areas		
Wetland Area	%	4.00
Wetland Area + Buffers	%	9.88
Rivers and Streams	mi/sqmi	3.44
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	22.98
Ditches	mi/sqmi	0.93
Bioswales	mi/sqmi	0.25
Trenches	mi/sqmi	0.28
Total Conveyance	mi/sqmi	24.43
Catch Basins	#/sqmi	1049.75
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	66.00
Detention Pipes	#/sqmi	68.06
Detention Ponds	#/sqmi	7.22
Vaults	#/sqmi	23.72
Filters	#/sqmi	7.22
Total Number of Water Quality Treatment Facilities	#/sqmi	106.21
Pervious Pavement	#/sqmi	2.06
Bioretention	#/sqmi	3.09
Tree Boxes	#/sqmi	0.00
Total Number of LID Facilities	#/sqmi	5.16
Population		
Population Density	people/sqmi	4226.24

Little Swamp Creek Surface Water Management Area



General and Physical Character. The Little Swamp Creek SWMA encompasses 1.68 square miles and a total of 59% (0.99 square miles) is in City limits.

Very severely erosive soils also classified on steep slopes (>40%) make up 0.08 percent of the SWMA. Compared to other SWMAs, 0.08 percent is the second lowest.

Land Use and Development. The prominent land use feature of this SWMA is residential with 64% of total parcel area with the second highest land use being commercial with 10% parcel area.

Thirty percent of the area is covered by impervious surfaces, making it one of the less developed SWMAs in the city. Of the impervious area, approximately one-fourth of the area is road surface (pollutant generating).

Natural Environment. The SWMA includes the upper reaches of Little Swamp Creek and smaller unnamed tributaries of Swamp Creek with a total combined length of 2.20 miles in City limits. Wetland and the associated buffers area is mapped as 6.48 percent of the basin.

Swamp Creek has high levels of fecal coliform bacteria and is on Ecology's 303(d) list for impaired water bodies. A Water Quality Improvement Report and Implementation Plan for Swamp Creek (Ecology) was produced in 2006 and includes actions each jurisdiction can take to reduce fecal coliform pollution. One possible source of bacteria is from the numerous septic systems in this area. Little Swamp Creek also has high in-stream temperatures and low dissolved oxygen during summer months failing to meet State Water Quality Standards.

Stormwater Infrastructure. The amount of total stormwater conveyance is 22.96 miles/square mile (22.73 miles total) with 885 total catch basins within the SWMA. The area has a limited number of flow control and water quality treatment facilities.

Surface Water Management Strategies. Since this mostly residential area drains out of the city to Swamp Creek, which is affected by high fecal coliform counts, management efforts focus on controlling water quality impacts due to septic systems, pet waste, and

animal attractants like waterfowl feeding. Management efforts will be coordinated with the City of Kenmore and other jurisdictions in the Swamp Creek basin.

Possible efforts include:

- Consider methods to reduce or eliminate impacts from septic systems, like possible regulations/enforcement, Local Improvement District, or other techniques
- IDDE might focus on sources of bacteria in this area
- Outreach might focus on septic system evaluation, maintenance, and conversion to sewer, pet waste management, and reducing concentrated waterfowl
- Inspections of drainage facilities in this area will be performed at the standard citywide baseline rate
- City Operations, including catch basin cleaning, street sweeping, vegetation control, and storm facility maintenance will be performed at the Utility's standard baseline rate.

Little Swamp Creek SWMA Data Table

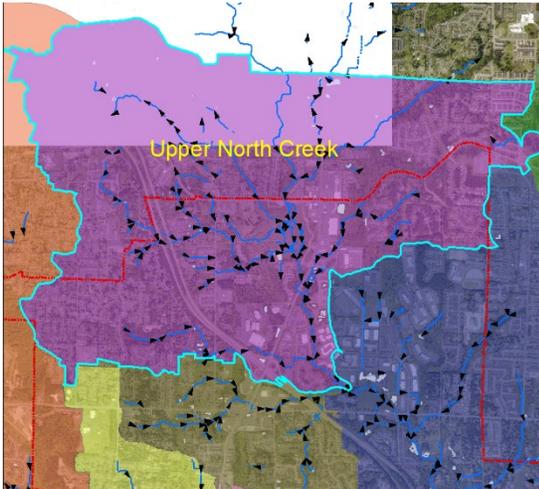
SWMA Statistics		Little Swamp Creek
Area		
Total Area	sqmi	1.68
Bothell City Portion	sqmi	0.99
Bothell City Portion	%	58.75
Land Use		
Single Family Residential	%	59.21
Multi-Family Residential	%	4.43
Total Residential	%	63.64
High Use Commercial	%	0.28
General Use Commercial	%	9.81
Industrial	%	0.00
Total Commercial	%	10.10
Mixed Use (Residential and Commercial)	%	0.00
Active Use Parks	%	1.28
Passive Use Parks	%	8.03
Total Parks and Open Space	%	9.31
Natural Areas (Streams, wetlands, and buffers)	%	3.28
Undeveloped	%	2.29
Right-of-Way	%	11.36
Land Cover		
Impervious	%	29.38
Limited Access Roads	%	0.00
Arterial Roads	%	2.00
Local Roads	%	5.33
Total Road Surface	%	7.33
Tree Canopy	%	39.93
Physical Geography		
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	0.08

SWMA Statistics

Little Swamp Creek

Natural Areas		
Wetland Area	%	3.80
Wetland Area + Buffers	%	6.48
Rivers and Streams	mi/sqmi	2.23
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	20.77
Ditches	mi/sqmi	1.62
Bioswales	mi/sqmi	0.14
Trenches	mi/sqmi	0.44
Total Conveyance	mi/sqmi	22.96
Catch Basins	#/sqmi	894.74
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	44.59
Detention Pipes	#/sqmi	17.23
Detention Ponds	#/sqmi	9.12
Vaults	#/sqmi	24.32
Filters	#/sqmi	15.20
Total Number of Water Quality Treatment Facilities	#/sqmi	65.86
Pervious Pavement	#/sqmi	0.00
Bioretention	#/sqmi	2.03
Tree Boxes	#/sqmi	0.00
Total Number of LID Facilities	#/sqmi	2.03
Population		
Population Density	people/sqmi	3495.50

Upper North Creek Surface Water Management Area



General and Physical Character. The Upper North Creek Surface Water Management Area encompasses 3.28 square miles with a total of 59.7 percent (1.96 square miles) in City limits.

Very severely erosive soils also classified on steep slopes (>40%) make up 2.94 percent of the SWMA. Compared to other SWMAs, 2.94 percent is the fifth lowest.

Land Use and Development. The prominent land use feature of this SWMA is residential

with 41.8% of total parcel area with the second highest land use being commercial with 17.4% parcel area.

Thirty-three percent of the area is covered by impervious surfaces. Of the impervious area, approximately one-third of the area is road surface (pollutant generating).

Natural Environment. The SWMA includes the upper reaches of North Creek including a total combined length of 17.2 miles (5.2 miles/square mile). This SWMA includes Queensborough Creek, Filbert Creek, Royal Anne Creek, Crystal Creek, and many unnamed tributaries. Wetland and the associated buffers area is mapped as 23.19 percent of the basin.

Upper North Creek includes multiple sampling sites on North Creek and Queensborough Creek. In those sampling sites, temperature, dissolved oxygen, and fecal coliform fail to meet State Water Quality standards consistently. Queensborough Creek also has very poor stream insect scores according to B-IBI analysis.

Stormwater Infrastructure. The amount of total stormwater conveyance is 77.6 miles (23.65 miles/square mile) with 3,074 catch basins within the SWMA. The SWMA has 26 control structures per square mile and 136 water quality treatment facilities per square mile.

Surface Water Management Strategies. Since this mostly residential area drains to North Creek, which is affected by high fecal coliform counts, low B-IBI scores, high temperatures, and low dissolved oxygen management efforts should focus on controlling water quality impacts due to septic systems, pet waste, and animal attractants and protecting or restoring natural areas.

Possible efforts include:

- Consider methods to reduce or eliminate impacts from septic systems, like possible regulations/enforcement, Local Improvement District, or other techniques
- IDDE might focus on sources of bacteria in this area
- Outreach might focus on septic system evaluation, maintenance, and conversion to sewer, pet waste management, and reducing concentrated waterfowl
- Inspections of drainage facilities in this area will be performed at the standard citywide baseline rate
- City Operations, including catch basin cleaning, street sweeping, vegetation control, and storm facility maintenance will be performed at the Utility's standard baseline rate.

Upper North Creek SWMA Data Table

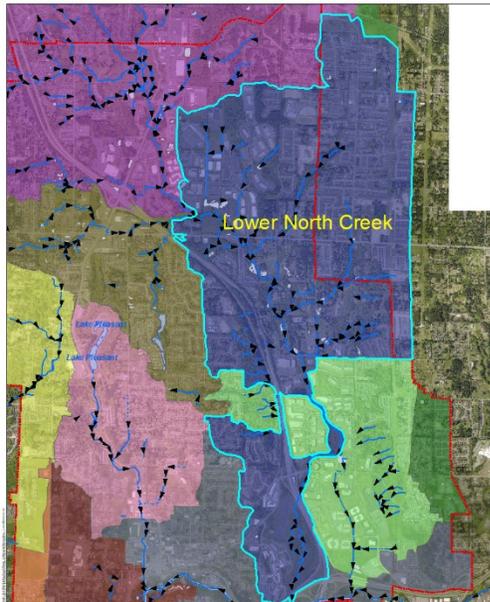
SWMA Statistics		Upper North Creek
Area		
Total Area	sqmi	3.28
Bothell City Portion	sqmi	1.96
Bothell City Portion	%	59.70
Land Use		
Single Family Residential	%	39.24
Multi-Family Residential	%	2.51
Total Residential	%	41.76
High Use Commercial	%	0.96
General Use Commercial	%	9.33
Industrial	%	7.06
Total Commercial	%	17.36
Mixed Use (Residential and Commercial)	%	0.00
Active Use Parks	%	0.00
Passive Use Parks	%	4.48
Total Parks and Open Space	%	4.48
Natural Areas (Streams, wetlands, and buffers)	%	14.79
Undeveloped	%	3.55
Right-of-Way	%	18.06
Land Cover		
Impervious	%	32.76
Limited Access Roads	%	2.11
Arterial Roads	%	3.21
Local Roads	%	4.70
Total Road Surface	%	10.01
Tree Canopy	%	48.12
Physical Geography		
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	2.94

SWMA Statistics

Upper North Creek

Natural Areas		
Wetland Area	%	12.76
Wetland Area + Buffers	%	23.19
Rivers and Streams	mi/sqmi	5.20
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	19.42
Ditches	mi/sqmi	3.71
Bioswales	mi/sqmi	0.33
Trenches	mi/sqmi	0.20
Total Conveyance	mi/sqmi	23.65
Catch Basins	#/sqmi	937.31
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	26.06
Detention Pipes	#/sqmi	9.71
Detention Ponds	#/sqmi	16.87
Vaults	#/sqmi	17.38
Filters	#/sqmi	91.99
Total Number of Water Quality Treatment Facilities	#/sqmi	135.95
Pervious Pavement	#/sqmi	0.51
Bioretention	#/sqmi	0.51
Tree Boxes	#/sqmi	2.56
Total Number of LID Facilities	#/sqmi	3.58
Population		
Population Density	people/sqmi	2734.05

Lower North Creek Surface Water Management Area



General and Physical Character. The Lower North Creek SWMA makes up 3.64 square miles with 65.79 percent (2.40 square miles) within City limits.

Very severely erosive soils also classified on steep slopes (>40%) make up 2.53 percent of the SWMA. Compared to other SWMAs, 2.53 percent is the fourth lowest.

The City had a detailed study of this area performed in 2006, titled the North Creek Fish and Wildlife Critical Habitat Protection Area Study. This study delineated and assessed the importance of wetlands, streams, and other

critical areas and their contribution to the quality of cool groundwater inputs to North, Palm, and Woods/Cole Creeks.

Land Use and Development. The prominent land use feature of this SWMA is residential with 36.7% of total parcel area with the second highest land use being commercial with 26.6% parcel area.

Thirty-three percent of the area is covered by impervious surfaces. Of the impervious area, approximately one-fourth of the area is road surface (pollutant generating).

Natural Environment. The area includes two streams (Palm Creek and Woods/Cole Creek) and an area that drains directly to North Creek. The total stream length within the SWMA is 16.96 miles. Twenty-two percent of the SWMA is mapped as wetlands and associated buffers.

The City has assessed habitat and biologic conditions for Lower North Creek at Palm Creek and found it to have the least impaired biological community of all streams in the city, though the creeks are still severely to moderately impaired. All streams in the SWMA are known to have low dissolved oxygen levels and high temperatures and are on Ecology's 303(d) list for impaired water bodies for fecal coliform.

Stormwater Infrastructure. The amount of total stormwater conveyance is 107 miles (29.39 miles/square mile) with 4,009 catch basins within the SWMA. The SWMA has 26.7

control structures per square mile and 114.4 water quality treatment facilities per square mile.

Surface Water Management Strategies. This SWMA has some of the higher quality basins that support North Creek in Bothell. Staff has selected Lower North Creek as its SMAP high-priority basin. Surface Water efforts will focus on protecting and preserving stream buffers and enhancing stormwater controls to the relatively higher quality creeks in this area.

Possible efforts include:

- Address any flooding or fish passable issues
- Focus on protecting the area through development and restoration efforts in buffer areas
- Focus on monitoring of creeks frequently to assure early detection of issues
- Focus outreach on residential activities including pet waste, low impact development installation, and stream buffers and management
- Prioritize IDDE in this area to protect streams.

Lower North Creek SWMA Data Table

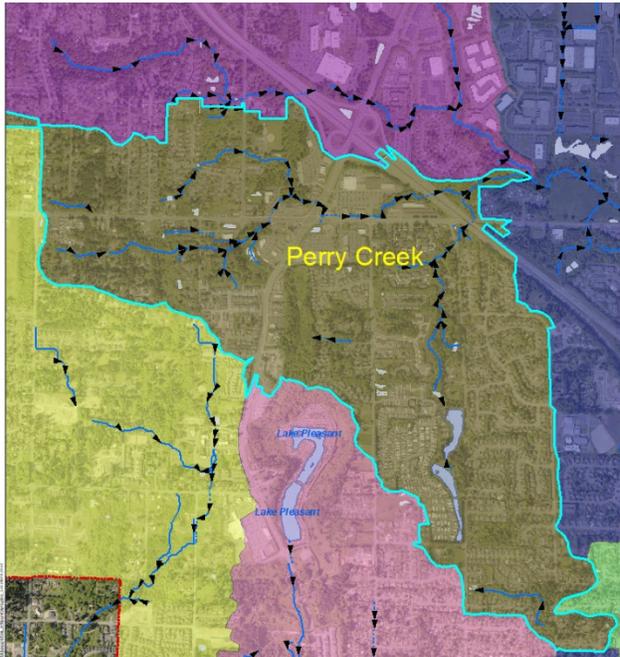
SWMA Statistics		Lower North Creek
Area		
Total Area	sqmi	3.64
Bothell City Portion	sqmi	2.40
Bothell City Portion	%	65.79
Land Use		
Single Family Residential	%	29.67
Multi-Family Residential	%	6.98
Total Residential	%	36.65
High Use Commercial	%	0.00
General Use Commercial	%	21.28
Industrial	%	5.32
Total Commercial	%	26.60
Mixed Use (Residential and Commercial)	%	0.23
Active Use Parks	%	0.00
Passive Use Parks	%	3.18
Total Parks and Open Space	%	3.18
Natural Areas (Streams, wetlands, and buffers)	%	16.13
Undeveloped	%	3.32
Right-of-Way	%	13.90
Land Cover		
Impervious	%	33.13
Limited Access Roads	%	3.16
Arterial Roads	%	1.99
Local Roads	%	3.66
Total Road Surface	%	8.81
Tree Canopy	%	46.53
Physical Geography		
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	2.53

SWMA Statistics

Lower North Creek

Natural Areas		
Wetland Area	%	12.51
Wetland Area + Buffers	%	22.39
Rivers and Streams	mi/sqmi	4.66
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	22.57
Ditches	mi/sqmi	5.80
Bioswales	mi/sqmi	0.49
Trenches	mi/sqmi	0.53
Total Conveyance	mi/sqmi	29.39
Catch Basins	#/sqmi	1101.38
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	26.71
Detention Pipes	#/sqmi	9.60
Detention Ponds	#/sqmi	13.36
Vaults	#/sqmi	25.04
Filters	#/sqmi	66.36
Total Number of Water Quality Treatment Facilities	#/sqmi	114.35
Pervious Pavement	#/sqmi	0.00
Bioretention	#/sqmi	1.25
Tree Boxes	#/sqmi	0.00
Total Number of LID Facilities	#/sqmi	1.25
Population		
Population Density	people/sqmi	2391.73

Perry Creek Surface Water Management Area



General and Physical Character. The Perry Creek SWMA includes 1.10 square miles with 100 percent of the basin in City limits.

Very severely erosive soils also classified on steep slopes (>40%) make up 2.09 percent of the SWMA. Compared to other SWMAs, 2.09 percent is the third lowest.

Land Use and Development. The prominent land use feature of this SWMA is residential with 59% of total parcel area with the second highest land use being right-of-way with 17%

parcel area.

Thirty-nine percent of the area is covered by impervious surfaces. Of the impervious area, approximately one-fourth of the area is road surface (pollutant generating).

Natural Environment. The area includes Perry Creek, with several unnamed tributaries, and drains directly to North Creek. The total stream length within the SWMA is 4.4 miles. Approximately thirteen percent of the SWMA is mapped as wetlands and associated buffers.

The City has assessed habitat and biologic conditions for Perry Creek and found it to have poor to very poor biological quality. All streams in the SWMA are known to have low dissolved oxygen levels and high temperatures and are on Ecology's 303(d) list of impaired water bodies for fecal coliform. Of the sampling sites around the City, Perry Creek was also found to have higher than average turbidity.

Stormwater Infrastructure. The amount of total stormwater conveyance is 32 miles (29.17 miles/square mile) with 1,276 catch basins within the SWMA. The SWMA has 64.7 control structures per square mile and 186.7 water quality treatment facilities per square mile.

Surface Water Management Strategies. During its SMAP analysis, staff identified Perry Creek as a secondary-priority basin. This area contains a large public forested open space. Efforts focus on reducing erosion and protecting the open space through stormwater controls.

Possible efforts include:

- Evaluating the need for addition of stormwater flow and treatment controls
- Coordinate with WSDOT on stormwater efforts
- Monitor erosion related to stormwater runoff
- Focus outreach on awareness of existing upland forests and the value they provide.

Perry Creek SWMA Data Table

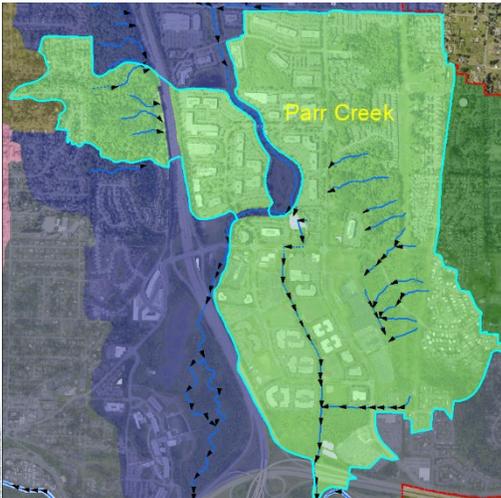
SWMA Statistics		Perry Creek
Area		
Total Area	sqmi	1.10
Bothell City Portion	sqmi	1.10
Bothell City Portion	%	100.00
Land Use		
Single Family Residential	%	55.64
Multi-Family Residential	%	3.77
Total Residential	%	59.40
High Use Commercial	%	3.67
General Use Commercial	%	6.35
Industrial	%	0.00
Total Commercial	%	10.02
Mixed Use (Residential and Commercial)	%	0.00
Active Use Parks	%	2.01
Passive Use Parks	%	0.11
Total Parks and Open Space	%	2.12
Natural Areas (Streams, wetlands, and buffers)	%	8.21
Undeveloped	%	2.83
Right-of-Way	%	17.41
Land Cover		
Impervious	%	39.02
Limited Access Roads	%	1.35
Arterial Roads	%	4.16
Local Roads	%	5.47
Total Road Surface	%	10.98
Tree Canopy	%	40.23
Physical Geography		
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	2.09

SWMA Statistics

Perry Creek

Natural Areas		
Wetland Area	%	8.02
Wetland Area + Buffers	%	13.18
Rivers and Streams	mi/sqmi	4.00
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	24.84
Ditches	mi/sqmi	3.52
Bioswales	mi/sqmi	0.44
Trenches	mi/sqmi	0.36
Total Conveyance	mi/sqmi	29.17
Catch Basins	#/sqmi	1160.45
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	64.67
Detention Pipes	#/sqmi	65.58
Detention Ponds	#/sqmi	20.95
Vaults	#/sqmi	29.15
Filters	#/sqmi	71.05
Total Number of Water Quality Treatment Facilities	#/sqmi	186.73
Pervious Pavement	#/sqmi	0.00
Bioretention	#/sqmi	0.00
Tree Boxes	#/sqmi	0.91
Total Number of LID Facilities	#/sqmi	0.91
Population		
Population Density	people/sqmi	4021.44

Parr Creek Surface Water Management Area



General and Physical Character. The Parr Creek Surface Water Management Area is 1.13 square miles with 99.7 percent of the basin in City limits.

Very severely erosive soils also classified on steep slopes (>40%) make up 7.26 percent of the SWMA. Compared to other SWMAs, 7.26 percent is the third highest.

Land Use and Development. The prominent land use feature of this SWMA is commercial with 43% of total parcel area with the second

highest land use being residential with 25.2% parcel area.

Forty-three percent of the area is covered by impervious surfaces. Of the impervious area, approximately one-fifth of the area is road surface (pollutant generating).

Natural Environment. The area includes Parr Creek and drains directly to North Creek. The total stream length within the SWMA is 3.7 miles. Approximately thirteen percent of the SWMA is mapped as wetlands and associated buffers.

The City has conducted ambient monitoring in the past for Parr Creek along with randomized sampling. In those sampling sites, temperature, dissolved oxygen, and fecal coliform fail to meet State Water Quality standards consistently. Parr Creek also has very poor stream insect scores according to B-IBI analysis. Of the sites sampled around the City, Parr Creek is more impaired than most other sites for temperature, dissolved oxygen, nutrients, fecal coliform, and stream insects.

Stormwater Infrastructure. The amount of total stormwater conveyance is 41.1 miles (36.4 miles/square mile) with 1,515 catch basins within the SWMA. The SWMA has 56.7 control structures per square mile and 83.3 water quality treatment facilities per square mile.

Surface Water Management Strategies. Efforts will focus on containing and restoring Parr Creek.

Possible efforts include:

- Restore Parr Creek riparian area through invasive species removal and native plantings

- Maintain drainage systems to reduce flooding potential
- Address sediment transfer/erosion that impacts Parr Creek
- Focus IDDE efforts on business park activities that might be sources of spills or illicit connections
- Coordinate with WSDOT on stormwater efforts associated with I-405
- Outreach might focus on property maintenance, vehicle maintenance, and facility operations that might affect water quality. Habitat awareness for Parr Creek could be emphasized.
- Local Source Control – Determine Small Quantity Generators status for sites in the business park, possibly through a GIS assessment, and provide LSC to qualifying businesses.

Parr Creek SWMA Data Table

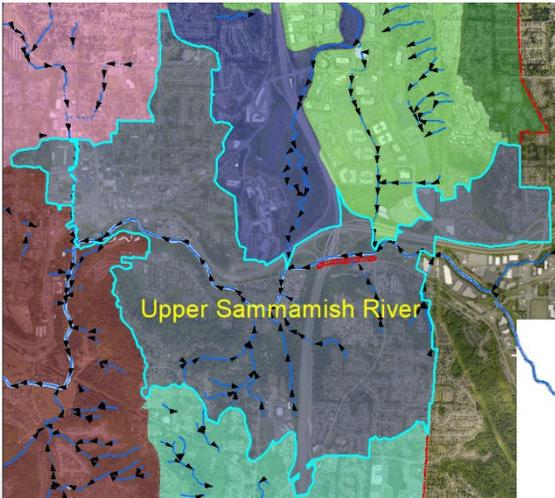
SWMA Statistics		Parr Creek
Area		
Total Area	sqmi	1.13
Bothell City Portion	sqmi	1.13
Bothell City Portion	%	99.65
Land Use		
Single Family Residential	%	19.29
Multi-Family Residential	%	5.86
Total Residential	%	25.15
High Use Commercial	%	0.00
General Use Commercial	%	37.30
Industrial	%	5.75
Total Commercial	%	43.05
Mixed Use (Residential and Commercial)	%	0.00
Active Use Parks	%	2.42
Passive Use Parks	%	7.60
Total Parks and Open Space	%	10.01
Natural Areas (Streams, wetlands, and buffers)	%	9.13
Undeveloped	%	1.14
Right-of-Way	%	11.50
Land Cover		
Impervious	%	42.50
Limited Access Roads	%	1.14
Arterial Roads	%	3.55
Local Roads	%	3.22
Total Road Surface	%	7.91
Tree Canopy	%	38.64
Physical Geography		
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	7.26

SWMA Statistics

Parr Creek

Natural Areas		
Wetland Area	%	5.52
Wetland Area + Buffers	%	12.89
Rivers and Streams	mi/sqmi	3.33
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	31.72
Ditches	mi/sqmi	3.99
Bioswales	mi/sqmi	0.56
Trenches	mi/sqmi	0.13
Total Conveyance	mi/sqmi	36.40
Catch Basins	#/sqmi	1340.95
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	56.68
Detention Pipes	#/sqmi	35.43
Detention Ponds	#/sqmi	11.51
Vaults	#/sqmi	13.29
Filters	#/sqmi	23.03
Total Number of Water Quality Treatment Facilities	#/sqmi	83.26
Pervious Pavement	#/sqmi	0.00
Bioretention	#/sqmi	0.00
Tree Boxes	#/sqmi	0.00
Total Number of LID Facilities	#/sqmi	0.00
Population		
Population Density	people/sqmi	1974.07

Upper Sammamish River Surface Water Management Area



General and Physical Character. The Upper Sammamish River Surface Water Management Area encompasses 1.96 square miles with 94.21 percent (1.85 square miles) within City limits. The area is characterized by numerous steep slopes and known landslides on the west, north, and east sides of Norway Hill.

Very severely erosive soils also classified on steep slopes (>40%) make up 8.93 percent of the SWMA. Compared to other SWMAs,

8.93 percent is the third highest.

Land Use and Development. The prominent land use feature of this SWMA is residential with 49.7% of total parcel area with the second highest land use being right-of-way with 23.3% parcel area.

Forty-one percent of the area is covered by impervious surfaces. Of the impervious area, approximately one-third of the area is road surface (pollutant generating).

Natural Environment. The area contains several unnamed tributaries and drains directly to the Sammamish River. The total stream length within the SWMA is 5.5 miles. Approximately two percent of the SWMA is mapped as wetlands and associated buffers.

The City has conducted ambient monitoring in the past for one tributary (BY-1). In those sampling sites, temperature and dissolved oxygen fail to meet State Water Quality standards consistently. Upper Sammamish River has not had historical monitoring for other parameters.

Stormwater Infrastructure. The amount of total stormwater conveyance is 67.86 miles (34.6 miles/square mile) with 2,878 catch basins within the SWMA. The SWMA has 46.6 control structures per square mile and 169.4 water quality treatment facilities per square mile.

Surface Water Management Strategies. During its SMAP analysis, staff identified Upper Sammamish River as a secondary-priority basin. Efforts focus on sediment issues caused by stormwater. WSDOT and upstream developers should be engaged to address downstream sediment problems. Roadway flooding should be reduced.

Possible efforts include:

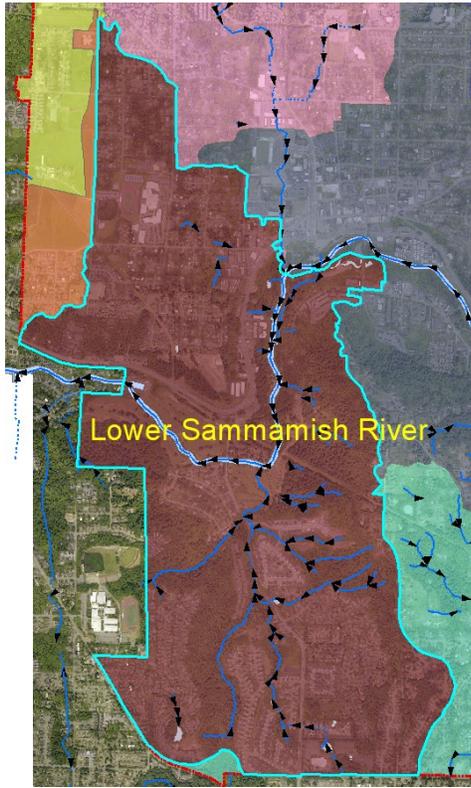
- Address sediment management with WSDOT and upstream properties
- Maintain storm system along East Riverside Drive to reduce flooding
- Outreach might focus on sediment and soils management, low impact development techniques appropriate for the area, and residential property management
- Inspections might be increased in the 160th area to address potential water quality impacts
- City Operations will continue to evaluate and improve or replace, if needed, its yard and decant facility on Brickyard Road
- Work with development review and Community Development to assess and develop, as needed, adequate stream protections on unstable hillsides

Upper Sammamish River SWMA Data Table

SWMA Statistics		Upper Sammamish River
Area		
Total Area	sqmi	1.96
Bothell City Portion	sqmi	1.85
Bothell City Portion	%	94.21
Land Use		
Single Family Residential	%	37.48
Multi-Family Residential	%	12.18
Total Residential	%	49.66
High Use Commercial	%	0.86
General Use Commercial	%	10.80
Industrial	%	0.42
Total Commercial	%	12.08
Mixed Use (Residential and Commercial)	%	0.44
Active Use Parks	%	0.50
Passive Use Parks	%	8.52
Total Parks and Open Space	%	9.02
Natural Areas (Streams, wetlands, and buffers)	%	1.44
Undeveloped	%	4.03
Right-of-Way	%	23.32
Land Cover		
Impervious	%	40.68
Limited Access Roads	%	4.01
Arterial Roads	%	3.86
Local Roads	%	6.08
Total Road Surface	%	13.95
Tree Canopy	%	38.86
Physical Geography		

SWMA Statistics		Upper Sammamish River
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	8.93
Natural Areas		
Wetland Area	%	1.26
Wetland Area + Buffers	%	2.23
Rivers and Streams	mi/sqmi	2.81
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	30.19
Ditches	mi/sqmi	3.41
Bioswales	mi/sqmi	0.71
Trenches	mi/sqmi	0.31
<i>Total Conveyance</i>	<i>mi/sqmi</i>	<i>34.62</i>
Catch Basins	#/sqmi	1468.56
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	46.55
Detention Pipes	#/sqmi	37.35
Detention Ponds	#/sqmi	9.20
Vaults	#/sqmi	30.31
Filters	#/sqmi	92.56
<i>Total Number of Water Quality Treatment Facilities</i>	<i>#/sqmi</i>	<i>169.43</i>
Pervious Pavement	#/sqmi	17.86
Bioretention	#/sqmi	9.74
Tree Boxes	#/sqmi	123.42
<i>Total Number of LID Facilities</i>	<i>#/sqmi</i>	<i>151.02</i>
Population		
Population Density	people/sqmi	5989.73

Lower Sammamish River Surface Water Management Area



General and Physical. The Lower Sammamish River Surface Water Management Area 2.08 square miles with 88.92 percent (1.85 square miles) within City limits. The area is characterized by numerous steep slopes and known landslides, but there are some moderately sloping areas to the south.

Very severely erosive soils also classified on steep slopes (>40%) make up 13.83 percent of the SWMA. Compared to other SWMAs, 13.83 percent is the highest.

Land Use and Development. The prominent land use feature of this SWMA is commercial with 49.7% of total parcel area with the second highest land use being right-of-way with 23.3% parcel area.

Forty-three percent of the area is covered by impervious surfaces. Of the impervious area, approximately one-fifth of the area is road surface (pollutant generating).

Natural Environment. Waynita Creek is the primary stream basin within the SWMA, with several unnamed tributaries, and includes approximately 8.34 miles of total stream length. The City has monitored the natural environment of Waynita Creek and found it to have one of the least impaired biological community of all streams in the city, though still considered in poor to very poor condition. Relative to other sites monitored around the City, Waynita Creek is less impaired for temperature, dissolved oxygen, stream insects, and fecal coliform. Waynita Creek does have relatively high turbidity when compared to other sites.

Approximately eight percent of the SWMA is covered by wetlands and associated buffers, most of which are in the Waynita Creek basin.

Stormwater Infrastructure. The amount of total stormwater conveyance is 56 miles (26.9 miles/square mile) with 2,181 catch basins within the SWMA. The SWMA has 40 control structures per square mile and 67.6 water quality treatment facilities per square mile.

Surface Water Management Strategies. Surface water efforts in this area will be focused on managing flow control for Waynita Creek and on working with the City and region in any efforts to preserve and protect the creek. Restoration of habitat and water quality features in the Sammamish River floodplain will also be pursued.

Possible efforts include:

- Evaluating the need for addition of stormwater flow and treatment controls
- Restore stream channel function and riparian habitat for salmon and water quality at the former Wayne Golf Course back nine.
- Monitor erosion related to stormwater runoff
- IDDE might be lower due to limited potential connections
- Outreach might focus on creek protection and sediment management, with new LID installation monitored and outreach provided to new property owners, and LID infiltration techniques will consider potential impacts on any landslide or liquefaction areas south of the Sammamish River
- Inspections will focus on working with property owners to develop proactive and effective facilities maintenance
- City Operations will focus on street sweeping and basin cleaning at a normal frequency
- Perform a sediment management plan in this area.

Lower Sammamish River SWMA Data Table

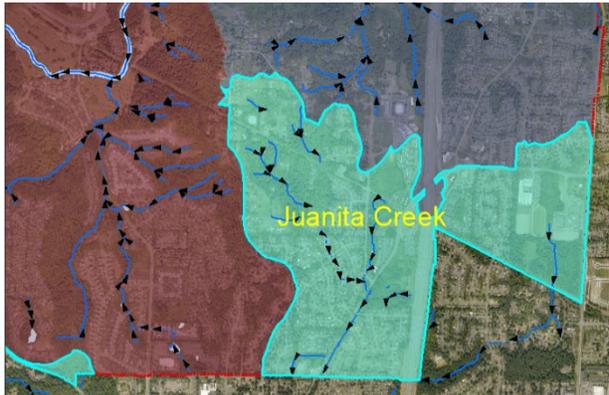
SWMA Statistics		Lower Sammamish River
Area		
Total Area	sqmi	2.08
Bothell City Portion	sqmi	1.85
Bothell City Portion	%	88.92
Land Use		
Single Family Residential	%	36.37
Multi-Family Residential	%	8.45
Total Residential	%	44.81
High Use Commercial	%	0.00
General Use Commercial	%	7.34
Industrial	%	0.00
Total Commercial	%	7.34
Mixed Use (Residential and Commercial)	%	0.00
Active Use Parks	%	1.05
Passive Use Parks	%	16.80
Total Parks and Open Space	%	17.85
Natural Areas (Streams, wetlands, and buffers)	%	13.00
Undeveloped	%	5.05
Right-of-Way	%	11.94
Land Cover		
Impervious	%	28.39
Limited Access Roads	%	0.00
Arterial Roads	%	2.39
Local Roads	%	4.96
Total Road Surface	%	7.35
Tree Canopy	%	52.35
Physical Geography		

SWMA Statistics

Lower Sammamish River

Very Severely Erosive Soils (Class V) on Slopes over 40%	%	13.83
Natural Areas		
Wetland Area	%	3.07
Wetland Area + Buffers	%	7.96
Rivers and Streams	mi/sqmi	4.01
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	24.01
Ditches	mi/sqmi	2.31
Bioswales	mi/sqmi	0.39
Trenches	mi/sqmi	0.19
Total Conveyance	mi/sqmi	26.90
Catch Basins	#/sqmi	1048.54
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	40.00
Detention Pipes	#/sqmi	22.16
Detention Ponds	#/sqmi	10.27
Vaults	#/sqmi	17.84
Filters	#/sqmi	17.30
Total Number of Water Quality Treatment Facilities	#/sqmi	67.56
Pervious Pavement	#/sqmi	1.62
Bioretention	#/sqmi	13.51
Tree Boxes	#/sqmi	7.57
Total Number of LID Facilities	#/sqmi	22.70
Population		
Population Density	people/sqmi	3783.33

Juanita Creek Surface Water Management Area



General and Physical Character. The Juanita Creek Surface Water Management Area is 6.67 square miles with 11.22 percent (0.75 square miles) within City limits. The SWMA is situated in the southeastern corner of the city and terrain slopes generally from east to west. The SWMA is divided roughly into thirds by I-405 (running from north to

south) and the Tolt Pipeline Trail (running from northwest to southeast). The entire watershed drains to Juanita Creek to the south in the city of Kirkland, and ultimately to Lake Washington.

Very severely erosive soils also classified on steep slopes (>40%) make up 4.02 percent of the SWMA. Compared to other SWMAs, 4.02 percent is the fifth highest.

Land Use and Development. The prominent land use feature of this SWMA is residential with 52% of total parcel area with the second highest land use being right of way with 17.3% parcel area.

Thirty-four percent of the area is covered by impervious surfaces. Of the impervious area, approximately one-third of the area is road surface (pollutant generating).

Natural Environment. The area contains several unnamed tributaries and drains directly to Juanita Creek to the south of the City limits. The total stream length within the SWMA is 23.5 miles with a majority of the streams outside City limits. Approximately twelve percent of the SWMA is mapped as wetlands and associated buffers.

The Juanita Creek SWMA has not had historical monitoring.

Stormwater Infrastructure. The amount of total stormwater conveyance is 148.2 miles (22.22 miles/square mile) with 6,495 catch basins within the SWMA. The SWMA has 45.4 control structures per square mile and 70.8 water quality treatment facilities per square mile. Most stormwater infrastructure for the SWMA is south of City limits.

Surface Water Management Strategies. Storm and surface water efforts in this area will be coordinated with the City of Kirkland to assist with addressing basin issues for Juanita Creek.

Possible efforts include:

- Focus on ongoing sediment issues
- Coordinate with WSDOT on stormwater efforts
- Inspections of drainage facilities in this area will be performed at the standard citywide baseline rate
- City Operations, including catch basin cleaning, street sweeping, vegetation control, and storm facility maintenance will be performed at the Utility's standard baseline rate
- Outreach and education will focus on youth education programs, residential practices, and multifamily hazardous waste use, handling, and storage.

Juanita Creek SWMA Data Table

SWMA Statistics		Juanita Creek
Area		
Total Area	sqmi	6.67
Bothell City Portion	sqmi	0.75
Bothell City Portion	%	11.22
Land Use		
Single Family Residential	%	42.61
Multi-Family Residential	%	9.41
<i>Total Residential</i>	%	52.02
High Use Commercial	%	1.55
General Use Commercial	%	10.21
Industrial	%	0.00
<i>Total Commercial</i>	%	11.76
Mixed Use (Residential and Commercial)	%	0.00
Active Use Parks	%	0.00
Passive Use Parks	%	10.09
<i>Total Parks and Open Space</i>	%	10.09
Natural Areas (Streams, wetlands, and buffers)	%	7.16
Undeveloped	%	1.66
Right-of-Way	%	17.32
Land Cover		
Impervious	%	34.18
Limited Access Roads	%	3.10
Arterial Roads	%	2.34
Local Roads	%	6.69
<i>Total Road Surface</i>	%	12.13
Tree Canopy	%	47.71
Physical Geography		
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	4.02

SWMA Statistics		Juanita Creek
Natural Areas		
Wetland Area	%	6.65
Wetland Area + Buffers	%	12.37
Rivers and Streams	mi/sqmi	3.53
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	17.77
Ditches	mi/sqmi	3.32
Bioswales	mi/sqmi	0.98
Trenches	mi/sqmi	0.15
Total Conveyance	mi/sqmi	22.22
Catch Basins	#/sqmi	973.84
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	45.42
Detention Pipes	#/sqmi	30.72
Detention Ponds	#/sqmi	16.03
Vaults	#/sqmi	14.69
Filters	#/sqmi	9.35
Total Number of Water Quality Treatment Facilities	#/sqmi	70.80
Pervious Pavement	#/sqmi	1.34
Bioretention	#/sqmi	0.00
Tree Boxes	#/sqmi	0.00
Total Number of LID Facilities	#/sqmi	1.34
Population		
Population Density	people/sqmi	4213.45

Little Bear Creek Surface Water Management Area



General and Physical Character. The Little Bear Creek Surface Water Management Area encompasses 0.72 square miles with 27.92 percent (0.20 square miles) of the SWMA within City limits. The SWMA is located on the east side of the city, and comprises only one percent of the total Little Bear Creek watershed.

Very severely erosive soils also classified on steep slopes (>40%) make up 0 percent of the SWMA. Compared to other SWMAs, 0 percent is the lowest.

Land Use and Development. The prominent land use feature of this SWMA is residential with 56.8% of total parcel area with the second highest land use being right of way with 19.2% parcel area.

Fifty percent of the area is covered by impervious surfaces. Of the impervious area, approximately one-fourth of the area is road surface (pollutant generating).

Natural Environment. The SWMA does not include any mapped stream channels but drains to Little Bear Creek.

Little Bear Creek has high levels of fecal coliform bacteria and is on Ecology's 303(d) list for impaired water bodies. A Water Cleanup Plan for Little Bear Creek (Ecology) was produced in 2005 and includes actions for the City of Woodinville and Snohomish County, but does not address Bothell, likely because the city represents such a small percentage of the Little Bear Creek drainage basin.

Stormwater Infrastructure. The amount of total stormwater conveyance is 18.69 miles (25.96 miles/square mile) with 1,076 catch basins within the SWMA. The SWMA has 59.8 control structures per square mile and 69.8 water quality treatment facilities per square mile. Most stormwater infrastructure for the SWMA is outside of City limits.

Surface Water Management Strategies. This small area drains away from the city toward Little Bear Creek. Snohomish County is leading a watershed planning area for its portion of Little Bear Creek. The City will follow and inform this planning effort.

Possible efforts include:

- Assist Snohomish County with watershed planning efforts and consider actions identified in the completed plan
- Outreach will include standard residential property management issues and information to property owners about the County's planning efforts
- Inspections of drainage facilities in this area will be performed at the standard citywide baseline rate
- City Operations, including catch basin cleaning, street sweeping, vegetation control, and storm facility maintenance will be performed at the Utility's standard baseline rate.

Little Bear Creek SWMA Data Table

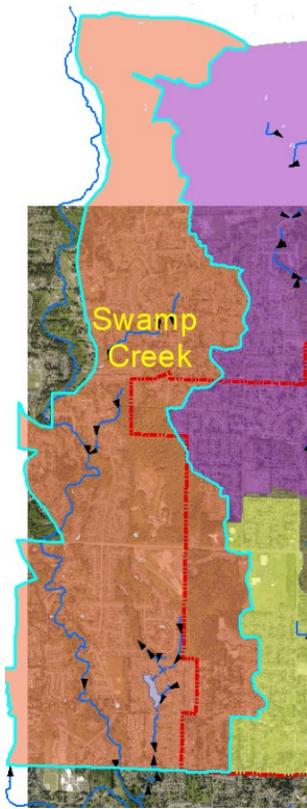
SWMA Statistics		Little Bear Creek
Area		
Total Area	sqmi	0.72
Bothell City Portion	sqmi	0.20
Bothell City Portion	%	27.92
Land Use		
Single Family Residential	%	56.77
Multi-Family Residential	%	0.00
Total Residential	%	56.77
High Use Commercial	%	0.00
General Use Commercial	%	9.56
Industrial	%	0.00
Total Commercial	%	9.56
Mixed Use (Residential and Commercial)	%	0.00
Active Use Parks	%	3.32
Passive Use Parks	%	9.02
Total Parks and Open Space	%	12.35
Natural Areas (Streams, wetlands, and buffers)	%	0.00
Undeveloped	%	2.06
Right-of-Way	%	19.24
Land Cover		
Impervious	%	49.87
Limited Access Roads	%	0.00
Arterial Roads	%	3.97
Local Roads	%	9.27
Total Road Surface	%	13.24
Tree Canopy	%	26.95
Physical Geography		
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	0.00

SWMA Statistics

Little Bear Creek

Natural Areas		
Wetland Area	%	0.00
Wetland Area + Buffers	%	0.00
Rivers and Streams	mi/sqmi	0.00
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	25.21
Ditches	mi/sqmi	0.74
Bioswales	mi/sqmi	0.00
Trenches	mi/sqmi	0.00
Total Conveyance	mi/sqmi	25.96
Catch Basins	#/sqmi	1495.14
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	59.81
Detention Pipes	#/sqmi	29.90
Detention Ponds	#/sqmi	14.95
Vaults	#/sqmi	19.94
Filters	#/sqmi	4.98
Total Number of Water Quality Treatment Facilities	#/sqmi	69.77
Pervious Pavement	#/sqmi	0.00
Bioretention	#/sqmi	0.00
Tree Boxes	#/sqmi	0.00
Total Number of LID Facilities	#/sqmi	0.00
Population		
Population Density	people/sqmi	6520.07

Swamp Creek Surface Water Management Area



General and Physical Character. The Swamp Creek Surface Water Management Area encompasses 1.37 square miles with 36.1 percent (0.50 square miles) within City limits.

Very severely erosive soils also classified on steep slopes (>40%) make up 11.22 percent of the SWMA. Compared to other SWMAs, 11.22 percent is the second highest.

Land Use and Development. The prominent land use feature of this SWMA is residential with 46.5% of total parcel area with the second highest land use being parks and open space with 21.7% parcel area.

Approximately twenty-four percent of the area is covered by impervious surfaces. Of the impervious area, approximately one-fifth of the area is road surface (pollutant generating).

Natural Environment. The area contains several unnamed tributaries and drains directly to Swamp Creek to the West of the City limits. The SWMA has no stream channels in City limits.

Stormwater Infrastructure. The amount of total stormwater conveyance is 21.14 miles (15.43 miles/square mile) with 867 catch basins within the SWMA. The SWMA has 28.2 control structures per square mile and 38.3 water quality treatment facilities per square mile. Most stormwater infrastructure for the SWMA is outside of City limits.

Surface Water Management Strategies. This small area drains away from the city toward Swamp Creek. Other jurisdictions are leading a watershed planning effort for this area. The City will participate and inform their planning effort.

Possible efforts include:

- Assist other jurisdictions with watershed planning efforts and consider actions identified in the completed plan
- Outreach will include standard residential property management issues and information to property owners about planning efforts
- Inspections of drainage facilities in this area will be performed at the standard citywide baseline rate

- City Operations, including catch basin cleaning, street sweeping, vegetation control, and storm facility maintenance will be performed at the Utility's standard baseline rate.

Swamp Creek SWMA Data Table

SWMA Statistics		Swamp Creek
Area		
Total Area	sqmi	1.37
Bothell City Portion	sqmi	0.50
Bothell City Portion	%	36.10
Land Use		
Single Family Residential	%	46.45
Multi-Family Residential	%	0.00
<i>Total Residential</i>	%	46.45
High Use Commercial	%	0.00
General Use Commercial	%	11.82
Industrial	%	0.00
<i>Total Commercial</i>	%	11.82
Mixed Use (Residential and Commercial)	%	0.00
Active Use Parks	%	0.17
Passive Use Parks	%	21.56
<i>Total Parks and Open Space</i>	%	21.73
Natural Areas (Streams, wetlands, and buffers)	%	0.04
Undeveloped	%	8.41
Right-of-Way	%	11.53
Land Cover		
Impervious	%	24.49
Limited Access Roads	%	0.00
Arterial Roads	%	1.12
Local Roads	%	4.85
<i>Total Road Surface</i>	%	5.97
Tree Canopy	%	47.97
Physical Geography		
Very Severely Erosive Soils (Class V) on Slopes over 40%	%	11.22

SWMA Statistics

Swamp Creek

Natural Areas		
Wetland Area	%	0.30
Wetland Area + Buffers	%	0.30
Rivers and Streams	mi/sqmi	0.00
Storm Infrastructure		
Pipes and Culverts	mi/sqmi	12.76
Ditches	mi/sqmi	2.53
Bioswales	mi/sqmi	0.11
Trenches	mi/sqmi	0.02
Total Conveyance	mi/sqmi	15.43
Catch Basins	#/sqmi	632.74
Control Structures (some in vaults, detention ponds, etc.)	#/sqmi	28.21
Detention Pipes	#/sqmi	12.09
Detention Ponds	#/sqmi	10.08
Vaults	#/sqmi	8.06
Filters	#/sqmi	8.06
Total Number of Water Quality Treatment Facilities	#/sqmi	38.29
Pervious Pavement	#/sqmi	0.00
Bioretention	#/sqmi	0.00
Tree Boxes	#/sqmi	0.00
Total Number of LID Facilities	#/sqmi	0.00
Population		
Population Density	people/sqmi	2856.77

For additional information City of Bothell's GIS data, please contact our GIS Division at www.bothellwa.gov/maps.