CHAPTER 7 SUMMARY OF BASIN ISSUES AND NEEDS

The purpose of this chapter is to synthesize information from the existing conditions and state of the system, described in Chapter 6, and identify basin-scale strategies to address priority urban storm and surface water issues. Basins are grouped into similar conditions to facilitate a cohesive response for management actions to address common needs. This synthesis also clearly articulates different needs among basins; for example, there is greater need to have habitat information for salmon-bearing basins than for primarily piped basins.

Potential Actions to Address Basin Issues

Specific recommendations for solving basin problems are not provided in this system plan because additional studies would be required to fully identify the causes and potential solutions within a site-specific context. However, examples of existing tools and strategies that could be considered to meet stormwater management goals include:

- Stormwater regulations;
- Capital projects;
- Basin planning or targeted basin studies;
- Land and easement acquisitions;
- Operations and maintenance practices;
- Customer incentives for improved stormwater management;
- Education and outreach;
- Regional and public/private partnerships to achieve mutual goals; and
- tree canopy preservation (supported by Parks through opens space acquisitions and by DSD through tree preservation codes.

Individual tools are employed in different levels based on costs, impacts, and benefits, sometimes balancing competing priorities. Some regulations, such as stormwater detention volume, are required under state permits, while other regulations, such as land clearing limits, may be independently approved by the City Council. Bellevue Utilities Department utilizes regulatory, capital project, and maintenance programs to address storm and surface water goals by targeting the most critical issues, focusing programs to address those issues, measuring progress towards those goals, and adapting the goals to changes in priorities, environmental conditions, and community values. This process is discussed in detail in Chapter 12 Adaptive Management.

Examples of actions that can address various basin issues are summarized in Appendix C-1. Some of the actions can be implemented directly by the Utilities Department, while others must be implemented through land use actions or other programs.

A summary of existing basin plan information and recommendations can be found in Appendix C-2.

Introduction

As noted in Chapter 6, there are 26 storm and surface water drainage basins within the city. Each drainage basin has a unique combination of public and private ownership and natural and built characteristics affecting water quality, habitat functions, and stormwater conveyance system performance and operation. Some basins have long stretches of open streams that support salmon spawning; some consist largely of pipe networks that convey drainage; and others only have small streams or have predominantly steep gradients.

As discussed in Chapter 6, evaluation criteria are based on the Utilities Department stormwater mission statement, which forms the basis for identifying system issues and needs. A summary of the findings from Chapter 6 is presented below.

Summary of Basin Conditions

A summary table of basin evaluation results is available in Appendix C-3.

Flooding

There is limited structural or street flooding within the city. Increased detention regulations implemented in all basins in 2010 are expected to further reduce flooding issues as new development or redevelopment of properties occurs. Three measures were used to assess how well the system performs at reducing damage from storms: structural flooding claims, claims paid by the City for damages, and street closures. Structural flooding data are limited to information collected between 1996 and 2011. Road closures due to flooding are restricted to a few areas; some have been fixed. Most of the basins have only a few or moderate number of flooded structures reported during storms. Claims, paid and unpaid, for damages due to storm flooding are scattered across the city, but these claims are few; in many cases, the flooding is due to maintenance issues such as leaves blocking grates or private stormwater system issues.

Structural flooding is when homes, businesses, and public facilities are threatened, not the flooding of yards and landscaping. Incidents of structural flooding in the basins are as follows:

- Fifteen basins had little to no structural flooding;
- Eight basins had three or four problems; and
- Three basins had more than four structural flooding locations.

The City also has not paid many claims for stormwater damages during that time period, as indicated below:

- Nine basins had no paid claims;
- Eleven basins had one to two claims paid; and
- Six basins had more than two paid claims (up to eight).

There are 11 street locations that are commonly at risk of flooding during large storms, some of which are emergency routes. Alternative routes exist for each emergency route adversely affected by flooding. However, flooding of emergency routes does not jeopardize public safety.

Water Quality

Water quality is a concern in 8 out of 26 of the city's drainage basins according to the Washington State Department of Ecology (Ecology) list of impaired waters. The constituents of concern represent typical urban problems including fecal coliform bacteria, low dissolved oxygen, and elevated temperatures. Water quality risk areas that are based on percent of impervious surface areas, zoning, and other land use factors that affect water quality are of concern in 10 of the 26 drainage basins.

Five measures were used to evaluate whether the system was meeting water quality objectives: 1) compliance with the National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Stormwater Permit; 2) the number of fines for Clean Water Act violations; 3) the number of illicit discharge corrections; 4) basins with water quality impairments; and 5) basins with high risk for illicit discharges. The City has been in 100 percent compliance with the NPDES Permit since 2008 and has had no fines for Clean Water Act violations during the permit period. The City has only received one water

quality violation—a minimum fine for a construction failure that released muddy water into Valley Creek in 2004. One hundred and eighty-two illicit discharge corrections have been made to address pollutants entering the storm system. Illicit discharges range from permanent sources, such as illegal wastewater connections to the storm system, or episodic events, such as someone washing paint or commercial solvents into a storm drain. The illicit discharge correction program is new, so this number is anticipated to increase over the next few years as awareness of the issue increases.

There are currently eleven locations identified by Ecology as not meeting state water quality standards; thus, they are considered "impaired." Impaired water bodies are located in Coal, Kelsey, Lewis, Ardmore, and Yarrow Creeks; Mercer Slough; Lake Washington; Lake Sammamish; and Meydenbauer Bay.

The City has identified the basins believed to have the greatest potential for risk of pollution, by evaluating land use, density of stormwater outfalls, industrial permits, current water quality problems, septic system areas, and percentage of impervious surfaces. Based on that analysis, 10 basins were ranked as high risk, four basins were medium risk, eight basins were low risk, and four basins were not ranked because they had no streams.

Stream Habitat

Like other urban cities in the Puget Sound basin, Bellevue has large areas of impervious surfaces, reduced forest and vegetative cover, and pollutant loading to surface waters that affect ecosystem functions. Land use and stormwater regulations have helped to mitigate the impacts of urbanization. Even so, the state of the surface waters shows degradation in habitat quality and biota, similar to other urban areas across Puget Sound.

While there are no urban standards for aquatic habitat, three evaluation criteria were used to assess the condition of Bellevue streams: 1) the amount of wood in the stream channel; 2) the number and quality of pools; and 3) the Benthic Index of Biotic Integrity, B-IBI (which is a direct measure of the health of aquatic organisms and an indirect measure of the quality of aquatic habitat). Data to assess wood and pools were limited, but in the five basins where information was available, the streams did not meet standards set by NOAA Fisheries Service for protecting salmon. Similarly, of the 13 basins sampled for B-IBI, all showed impairment ranging from poor to very poor, consistent with other Puget Sound urban areas.

Basin Types

Storm drainage basins have varying key needs based on physical and biological characteristics (Figure 7-1). The drainage basins have been grouped for evaluation and planning according to characteristics that could be managed using similar strategies. Each basin has been grouped into one of three categories:

1. Basins with salmon spawning streams;
2. Basins with small streams and steep slopes; and
3. Basins with predominantly closed conveyance systems.

These groupings are generalized, so there may be sections of the basin that would fit in another classification; for instance, a basin that is primarily composed of steep slopes may have a small section of salmon spawning near the mouth of the stream.

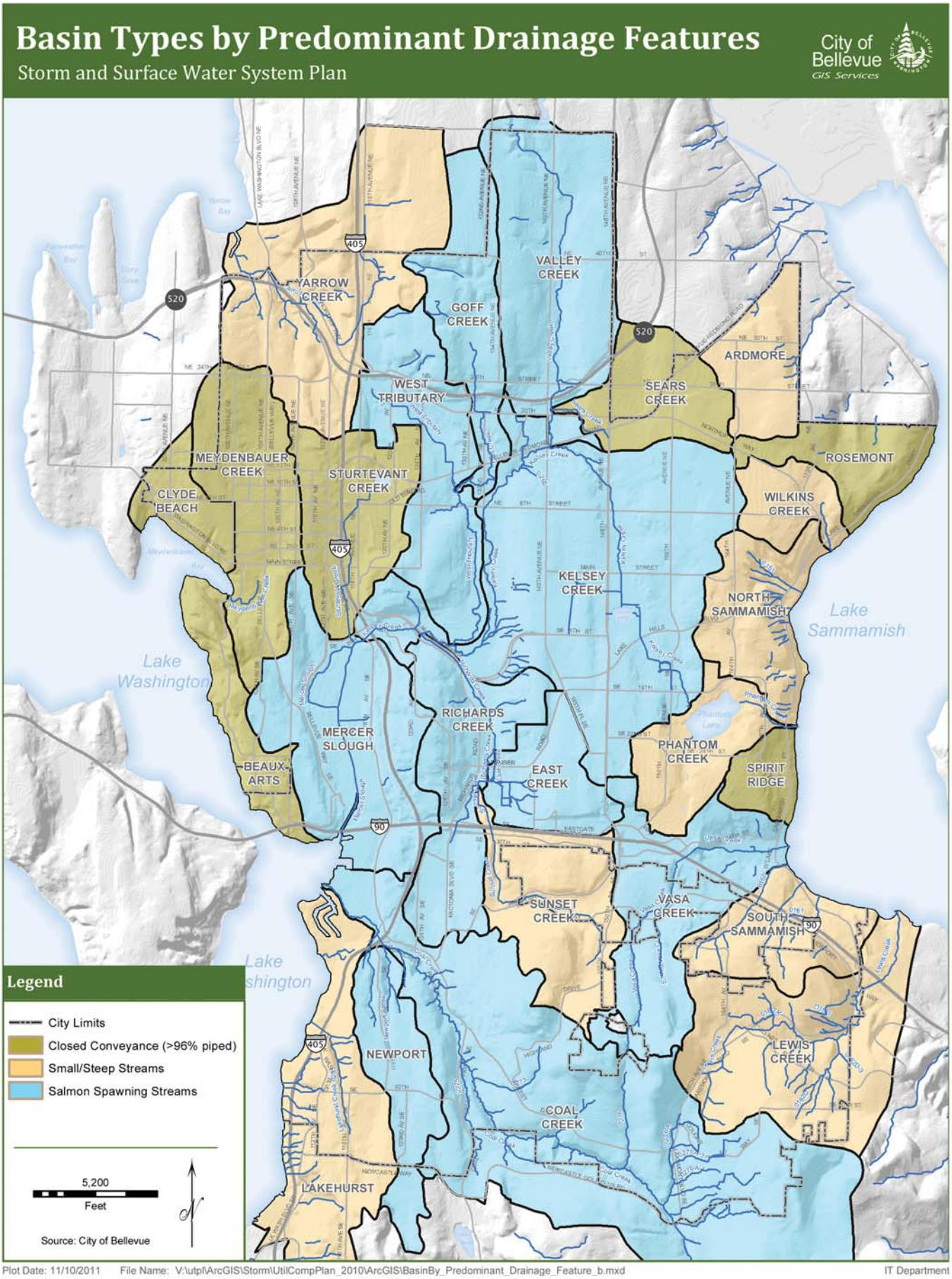

Figure 7-1. Drainage basin types organized by those with salmon spawning, small and/or steep streams, and predominantly piped conveyance systems.

Basins with Salmon-spawning Streams

These basins have predominantly open streams and support spawning salmon populations. Basins in this group include:

- Coal Creek;
- East Creek;
- Goff Creek;
- Kelsey Creek;
- Mercer Slough;
- Newport Area;
- Richards Creek;
- Valley Creek;
- Vasa Creek; and
- West Tributary.

Water quality, excessive flows, and aquatic habitat are especially important because these basins support spawning salmon. Salmon need clean water, stable stream gravels, habitat for salmon migration and rearing, and adequate food in the form of aquatic invertebrates. Aquatic habitat problems were identified in all of the basins except Mercer Slough. The B-IBI index score for Bellevue ranks in the impaired category, similar to all urban streams in the Puget Sound lowland. Water quality pollution is predominantly a medium to high-level risk, or is classified as impaired in all of these basins. The degree of water quality impairment in Bellevue is also similar to other urban streams in the Puget Sound lowland. Only two of the 11 basins in this group drain into a phosphorus-sensitive lake (Lewis Creek basin and Vasa Creek basin drain into Lake Sammamish). Land use (including percent impervious area) and the water quality risk assessment are the driving factors; four of the creeks have short segments that were found to be impaired according to the Clean Water Act Section 303(d). The total impervious area ranges from 20 to 46 percent in each of the basins, which affects stream flows, water quality, and habitat.

Flood protection is an issue in all of the salmon-spawning basins except East Creek and Goff Creek. Coal Creek and Kelsey Creek had the most flooding claims and flooded structures of all the salmon-spawning basins; these are also the largest basins in the city. Kelsey Creek, Lewis Creek, Richards Creek, and Coal Creek basins all experienced at least one road closure during a major storm event. Capital project and routine maintenance efforts to reduce structural and street flooding have been implemented in Kelsey, Richards, and Coal Creeks. Two of these recurring road closure areas have been resolved by Capital Investment Program (CIP) projects. Flood protection should be addressed first where there are recurring structural and road closures due to storm events that affect emergency routes. Other streets that flood should be addressed only after public safety issues are resolved and only when the benefit justifies the cost. Basins with many claims and flooded structures may benefit from a targeted analysis to determine which areas may need additional drainage system capacity.

Basins in this classification should employ strategies to address all three mission objectives: flooding, water quality, and habitat. Tools include regulations, capital projects, public education, and additional studies. The 2010 detention regulations are expected to help reduce high flows over time as properties are redeveloped or developed. Capital efforts for habitat should be focused on these basins. Public education programs and illicit discharge detection efforts for reducing non-point pollution is also important for protecting salmon populations. Basins within this category with flooding or other conveyance issues may benefit from new or updated hydrologic and/or hydraulic modeling to better understand the causes and potential solutions that would balance all objectives (Table 7-1). The status of projects and summary recommendations of major plans and studies as listed in Table 7-1 are provided in Appendix C-4. Fish passage barriers, although not specifically addressed here, are also a

priority in these basins (see Chapter 6 for fish passage barrier information). These basins should have priority for assessment of basin evaluation criteria for stream habitat.

Basins with Small Streams and/or Steep Relief

These basins have small streams, often located in steep ravines, and are prone to erosion processes that require specific stormwater management strategies. The basins with small streams and/or steep relief include:

- Ardmore;
- Lakehurst;
- Lewis Creek ;
- North Sammamish;
- Phantom Creek;
- Sunset Creek;
- South Sammamish;
- Wilkins Creek ; and
- Yarrow Creek.

Table 7-1. Summary of major plans and studies, and status of recommendations

Date	Plan Name	Focus Area	Scope of Study							Plans or Studies with Identified Projects and Recommendations (See Appendix C-4 for more information on the status of associated projects and recommendations)
			Conveyance Capacity	Flooding	Erosion	Sedimentation	Geology/Soil Infiltration Rates	Water Quality	Habitat/Fish	
1976	Drainage Master Plan	Entire city, except Lewis Creek, Lakehurst Area, and South Sammamish Area basins	√	√	√	√	√			√
1979	Draft Environmental Impact Statement for the 1976 Drainage Master Plan	Same as above	√	√	√	√	√			
1980	Meydenbauer Basin Study	Meydenbauer Creek basin	√							√
1984	Bellevue Urban Runoff Program Summary Report	Surrey Downs and Lake Hills neighborhoods						√		
1987	Coal Creek Basin Plan and Environmental Impact Statement	Coal Creek basin		√	√	√	√		√	√
1987-1993	Phantom and Larsen Lakes Restoration Reports	Phantom Lake and Larsen Lake					√	√		√
1988	Comprehensive Drainage Plan	City-wide	√	√	√	√		√		√
1988	Meydenbauer Creek Basin Study	Meydenbauer Creek basin				√				√

Table 7-1. Summary of major plans and studies, and status of recommendations

Date	Plan Name	Focus Area	Scope of Study							Plans or Studies with Identified Projects and Recommendations (See Appendix C-4 for more information on the status of associated projects and recommendations)
			Conveyance Capacity	Flooding	Erosion	Sedimentation	Geology/Soil Infiltration Rates	Water Quality	Habitat/Fish	
1990	Lewis Creek Basin Drainage Report	Lewis Creek basin	√	√	√	√		√		
1994	Comprehensive Drainage Plan	City-wide	√	√	√	√		√		√
1995	Characterization and Source Control of Urban Stormwater Quality	City-wide						√		√
1996	Lake Sammamish Water Quality Management Plan-1996	Lake Sammamish basins						√		√
1999	Richards Creek Basin Plan	Richards Creek basin	√			√				√
2001	City of Bellevue Stream Typing Inventory	Stream typing inventory of Bellevue streams							√	
2003	Hydrologic Study of Kelsey Creek	Kelsey Creek basin and tributaries		√	√				√	
2005	Coal Creek Environmental Impact Statement	Coal Creek basin		√	√	√			√	√
2006	Lake Bellevue Water Quality Study and Management Recommendations	Sturtevant Creek basin						√		√

These streams are variable in their ability to support fish use. Lewis Creek, while identified as primarily a steep relief basin within Bellevue downstream of I-90, is the primary spawning stream for a critically declining population of late-run kokanee salmon. Some basins, such as Phantom Creek, have fish passage barriers that significantly limit the extent of salmon usage. Others, like South Sammamish, have small streams that intermittently go dry during the summer.

The structural and street flooding review indicates that flood protection is a key issue for seven of the nine basins (all but Ardmore and South Sammamish). The one recurring road closure area at Kamber Road in the East Creek basin was addressed through a CIP project in 2003. Storm-related claims and calls regarding flooded structures were common in basins with flooding issues. Many of the flooding issues were related to maintenance issues, such as leaves blocking storm drains or roots reducing the conveyance capacity of the pipes. Problem areas are incorporated into routine maintenance

surveillance routes unless a structural solution, through a capital project, can correct the maintenance issue.

Aquatic habitat is an issue in six of the eight basins, but is not considered as high priority as in salmon-spawning basins. Water quality is identified as an issue in Ardmore, Sunset, and Yarrow Creek basins based primarily on the water quality risk assessment and Ecology's list of impaired waters. Most of these basins drain to phosphorus-sensitive lakes and have increased regulations limiting land clearing during the rainy season to reduce soil erosion, which is one of the largest sources of phosphorus.

Generally, basins with steep relief have retained vegetated riparian corridors because building on steep slopes is difficult or prohibited. Still, these basins are affected by stormwater runoff and typically experience erosion and sedimentation problems. Increased flows from development can result in greater channel instability in these basins than in lower gradient streams. Basins experiencing increased flows or instability would benefit from targeted studies that focus on both upland and in-stream conditions to determine causes and solutions for the symptoms. For small-stream basins with flooding or conveyance issues, new or updated hydrologic and/or hydraulic modeling may be beneficial to determine the most effective approaches to stabilize stream channels.

Basins in this category can benefit from tools that reduce stormwater runoff, including the 2010 detention regulations, capital projects that either increase storage or bypass steep slopes, and additional studies to determine whether other strategies may work to address issues within individual basins.

Basins with Predominantly Closed Conveyance Systems

These basins are largely piped and are most likely to have issues associated with conveyance capacity and flooding rather than habitat. Basins with predominantly closed conveyance systems are:

- Beaux Arts Area;
- Clyde Beach;
- Meydenbauer Creek;
- Rosemont Area;
- Sears Creek;
- Spirit Ridge; and
- Sturtevant Creek.

Seven basins have closed (or piped) conveyance systems that comprise most of the drainage system rather than streams or open ditches. Flood protection is a key issue for all of the closed conveyance basins except for Sears Creek. Sears Creek basin has a neighborhood street that regularly floods during storm events, but does not affect emergency routes. A capital project has addressed flooding concerns from undersized culverts in the Sturtevant Creek basin and a capital project is in design for Sears Creek. As in other basins, the increased detention regulations are expected to reduce flooding problems over time.

Water quality is identified as a key issue in four of the seven basins: Meydenbauer, Sears, Spirit Ridge, and Sturtevant. This is primarily due to high to moderate water quality risk level, but in Spirit Ridge, this is due to high impervious area and a phosphorus-sensitive lake.

In spite of being primarily closed systems, three of these basins still have open stream channels that have resident fish and limited salmon access, including Meydenbauer, Sturtevant, and Sears Creek basins. Aquatic habitat data were not available for any of these basins.

Efforts within these basins should focus on water quality and flooding. Tools include education programs to reduce non-point pollution; illicit discharge investigations and corrections; operations and maintenance activities; private system inspection and education; and capital projects to address flooding concerns.