ATTACHMENT A

WORKING DRAFT

CITY OF BELLEVUE
GRANT NO. G0800105

CUMULATIVE IMPACTS ANALYSIS

for City of Bellevue Shorelines: Lake Washington, Lake Sammamish, Phantom Lake, Kelsey Creek and Mercer Slough

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CUMULATIVE IMPACTS ANALYSIS

CITY OF BELLEVUE SHORELINES: LAKE WASHINGTON, LAKE SAMMAMISH, PHANTOM LAKE, KELSEY CREEK AND MERCER SLOUGH

1 INTRODUCTION

1.1 Preamble

The City of Bellevue (City) is currently in the process of updating its Shoreline Master Program (SMP). The updated SMP, once adopted, will regulate the development and use of the City's shorelines. City shorelines where the updated SMP will apply include those along Lake Washington, Lake Sammamish, Phantom Lake, Larson Lake, lower Kelsey Creek and Mercer Slough.

This working draft cumulative impacts analysis analyzes a snapshot of the current draft of the SMP. As the City's SMP evolves, the cumulative impacts analysis should be expected to evolve as well. This working draft does not include a final determation as to whether the Draft SMP meets the no net loss of ecological function standard. Rather, this working draft and the associated Draft Recommendations Memorandum highlights areas where the City Council should discuss the regulations contained in the Draft SMP and determine whether they are Bellevue-appropriate, taking into account the requirement that such regulations ensure no net loss of ecological functions.

The procedural and substantive requirements for updating an SMP are set forth in the Shoreline Management Act (SMA) and the Shoreline Master Program Guidelines (Guidelines). The SMA was passed by the Washington State Legislature in 1971 and adopted by voters in 1972. The Guidelines resulted from a negotiated settlement between business interests, ports, environmental groups, shoreline user groups, cities and counties, and the Washington State Department of Ecology (Ecology).

The SMA calls for the accommodation of "all reasonable and appropriate uses" consistent with "protecting against adverse effects to the public health, the land and its vegetation and wildlife, and the waters of the state and their aquatic life" and consistent with "public rights of navigation" (WAC 173-26-176(2)). And the SMA calls for "optimum implementation" of its policies in the case of "shorelines of statewide significance," which include Lake Washington and Lake Sammamish. The Guidelines, which direct the implementation of the SMA,

provide guiding parameters, standards, and review criteria for SMPs. The Guidelines allow local governments "reasonable discretion" to balance the goals set forth in the Guidelines and "substantial discretion" to adopt SMPs reflecting local circumstances.

A governing principle of the Guidelines is that an SMP must include policies and regulations designed to achieve "no net loss" of ecological functions (WAC 173-26-186(8)(b)). "Ecological functions" are defined as "the work performed or role played by the physical, chemical, and biological processes that contribute to the maintenance of the aquatic and terrestrial environments that constitute the shoreline's natural ecosystem" (WAC 173-26-020(13)). The Guidelines (in WAC 173-26-201(3)(d)(i)(C)) provide several examples of shoreline ecological functions. For instance, the ecological functions provided by shoreline vegetation along lakes include, but are not limited to: maintaining temperature; removing excessive nutrients and toxic compounds; attenuating wave energy; sediment removal and stabilization; and providing woody debris and other organic matter.

The Guidelines elaborate on the concept of no net loss as follows:

> *The concept of "net" as used herein, recognizes that any development has potential or actual, short-term or long-term impacts and that through application of appropriate development standards and employment of mitigation measures in accordance with the mitigation sequence, those impacts will be addressed in a manner necessary to assure that the end result will not diminish the shoreline resources and values as they currently exist (WAC 173-26-201(2)(c)).*

In short, an updated SMP must contain policies and regulations designed to direct development in a manner to prevent degradation of ecological functions relative to the existing conditions. For any projects that may result in the degradation of ecological functions, mitigation measures must ensure that no net loss of ecological functions occurs.

It is worth noting that the SMA features a very inclusive definition of development:

> *"Development" means a use consisting of the construction or exterior alteration of structures; dredging; drilling; dumping; filling; removal of any sand, gravel, or minerals; bulkheading; driving of piling; placing of obstructions; or any project of a permanent or temporary nature which interferes with the normal public use of the surface of the waters overlying lands subject to this chapter at any state of water level (RCW 90.58.030(3)(a)).*

Therefore, a wide variety of projects are subject to the no net loss standard. For example, not only must the construction of new single-family residences

cumulatively be considered in the evaluation of no net loss of ecological functions, but the cumulative effects of the reconstruction and expansion of existing homes must be considered as well.

The primary purpose of this cumulative impacts analysis is to evaluate whether the policies and regulations contained in the current draft of the SMP (Draft SMP) can be expected to achieve the no net loss standard. Per the Guidelines, this cumulative impacts analysis is a required element of the City's SMP update. WAC 173-26-186(8)(d) states that:

> *Local master programs shall evaluate and consider cumulative impacts of reasonably foreseeable future development on shoreline ecological functions and other shoreline functions fostered by the policy goals of the act. To ensure no net loss of ecological functions and protection of other shoreline functions and/or uses, master programs shall contain policies, programs, and regulations that address adverse cumulative impacts and fairly allocate the burden of addressing cumulative impacts among development opportunities.*

The Guidelines do not include a specific definition of "cumulative impacts" but the Shoreline Hearings Board in *May v. Pierce County*, SHB No. 06-031 (2007) stated that cumulative effects exist "where there is a clear risk of harmful impacts to high value habitat, loss of community uses, impacts to views or the loss of extraordinary aesthetic values." *May*, SHB No. 06-031 at 30; see also *Fladseth v. Mason County*, SHB Case No. 05-026, 21-23 (2007). Additionally, the Washington Supreme Court in *Hayes v. Yount*, 87 Wn.2d 280, 287, 552 P.2d 1038 (1976) noted with respect to cumulative impacts that "[l]ogic and common sense suggest that numerous projects, each having no significant effect individually, may well have very significant effects when taken together."

The Guidelines indicate that a cumulative impacts analysis need only evaluate whether "commonly occurring and planned development" may cause a net loss of shoreline ecological functions. For development projects that may have "unanticipatable or uncommon impacts" that cannot reasonably be identified at the time of SMP development, the Guidelines suggest that the permitting process be used to ensure that there is no net loss of ecological function.

WAC 173-26-186(8)(d) broadly states what a cumulative impacts analysis should consider:

> (i) *Current circumstances affecting the shorelines and relevant natural processes;*
> (ii) *Reasonably foreseeable future development and use of the shoreline; and*
> (iii) *Beneficial effects of any established regulatory programs under other local, state, and federal laws.*

The Guidelines provide some additional guidance on preparing a cumulative impacts analysis, particularly in WAC 173-26-201(3)(d)(iii). However, the Guidelines do not set forth a detailed methodology (though Chapter 17 of Ecology's SMP Handbook sets forth a "general method"). Therefore, the approach used for this cumulative impacts analysis represents just one potential approach.

WAC 173-26-186(8)(d) recognizes in particular "that methods of determining reasonably foreseeable future development may vary according to local circumstances." This cumulative impacts analysis primarily relies upon City data regarding past permit activity to evaluate potential future development. However, this analysis does not expect that past permitting activity will continue on at the exact same rate; rather, the data serve to inform the cumulative impacts analysis of the general types and frequency of potential future development in the City.

Consistent with Ecology guidance, the cumulative impacts addressed in this analysis only include those that will result from development and uses within the shoreline jurisdiction of the City of Bellevue and are subject to regulation under its SMP. Adverse cumulative impacts that may result from development outside of the City's shoreline jurisdiction are not considered in this analysis. This analysis does consider the beneficial effects of activities in the City occurring outside of shoreline jurisdiction.

This cumulative impacts analysis relies on an extensive body of scientific information, described and summarized in the City's Shoreline Analysis Report (The Watershed Company and Makers 2009). The available body of information remains generally consistent with what was described in the Shoreline Analysis Report and it is not again described in this document, although an updated list of key references is provided in Appendix B. WAC 173-26-201(2)(a) requires that SMPs be based on "the most current, accurate, and complete scientific and technical information." Although the body of scientific information concerning shorelines, including studies specific to lake shorelines and the shorelines of Lake Washington, is extensive, uncertainty and some gaps in the information and the relationship between the effects of development on shoreline functions still exist. In some cases, differences in study approach, timing, duration, or specific focus, may result in apparent or actual conflicts among different literature sources. Assumptions must often be made when applying scientific data to specific conditions, which may differ from the specific conditions studied. Therefore, while the available scientific data may allow for inferences related to the effect of shoreline development on shoreline functions, it is recognized that there is some level of inherent uncertainty in those inferences. Furthermore, available science does not generally direct a specific course of action, but it may be helpful in

guiding policy makers' decisions to understand the likely effect of a potential course of action.

To the extent that existing information was sufficiently detailed and assumptions could be made with reasonable certainty, the following analysis is quantitative. However, in many cases information was not available at a level that could be assessed quantitatively or the analysis would be unnecessarily complex to reach a conclusion that could be derived more simply. Further, effects to ecological functions are often not easily defined by a simple metric, particularly when acknowledging the potential for ecological tradeoffs (e.g. improvements in terrestrial vegetative functions may accompany a reduction in aquatic habitat functions). For these reasons, much of the following analysis is more qualitative. Accordingly, statements made in this document regarding changes in ecological function generally indicate the direction of change (i.e. increased or decreased), but do not attempt to indicate the magnitude of change.

1.2 Document Overview

The basic organization of this document is as follows.

Chapters 3, 4 and 5 are presented in accordance with the direction provided in WAC 173-26-186(8)(d). Chapter 3 reviews the current circumstances affecting the City's shorelines; Chapter 4 provides an assessment of reasonably foreseeable future development and use of the shoreline; and Chapter 5 reviews the beneficial effects of established regulations and programs under other local, state, and federal laws.

Building on the information presented in Chapters 3, 4 and 5, Chapter 6 evaluates whether the Draft SMP can be expected to achieve the no net loss standard. Section 6.1 primarily reviews the impacts of specific shoreline uses (e.g. utilities) and modifications (e.g. shoreline stabilization) and assesses whether the SMP contains regulations sufficient to address potential adverse impacts for each type of potential shoreline use or modification. Because the Draft SMP includes some environment designation-specific provisions and because a discussion structured around proposed environment designations allows for a synthesis of the information previously set forth in the document, Section 6.2 reviews the most probable types of development in each proposed environment designation and the potential for cumulative impacts. Chapter 7 summarizes the key findings of this analysis.

2 METHODOLOGY

This cumulative impacts analysis was prepared consistent with the direction provided in the Guidelines (please see Section 1.1 for further discussion).

The information contained in this cumulative impacts analysis on "current circumstances affecting the shorelines and relevant natural processes" (Chapter 3, Existing Conditions) is in large part based on the material presented in the Shoreline Analysis Report. Additionally, Appendix B includes a list of some of the key documents that shape the current understanding of lake shoreline functions and the potential impacts to those shoreline functions from development. Most of these documents were referenced in the Shoreline Analysis Report; except that where new information sources are available since the completion of the Shoreline Analysis Report, they are also included in Appendix B.

To supplement the Shoreline Analysis Report, analyses of existing structure setback distances and existing vegetation in the proposed setback areas were conducted. Using City geographic information systems (GIS) data, for each waterfront parcel, the setback analysis evaluated the distance from the proposed ordinary high water mark (OHWM) [30.6 feet NAVD 88 for Lake Sammamish, 18.8 feet NAVD 88 on Lake Washington, 260.7 feet NAVD 88 for Phantom Lake] to the nearest structure over 800 square feet in area, which was assumed to represent a primary structure. To evaluate existing vegetation functions within the proposed setback areas, another analysis evaluated existing shrub and tree cover by parcel within both the nearest 25 and the nearest 50 feet of the proposed OHWM. This analysis used City land cover classification data from 2008 to identify trees and shrubs within the shoreline. The land cover classification data included eight categories of land cover. The categories "coniferous," "deciduous" and "shrub" were used to identify trees and shrubs (the categories "bare," "impervious," "non-woody," "unclassified" and "water" were excluded). Results were evaluated by proposed environment designation and waterbody.

For the assessment of "reasonably foreseeable future development and use of the shoreline" (Chapter 4, Anticipated Development), the information on likely changes in land use contained in the Shoreline Analysis Report was supplemented with an analysis of recent City permit history in order to better understand the extent, nature and general location of potential future impacts. The permit history analysis reviewed City permit activity in shoreline jurisdiction from 2003 to 2013. Permit activity was summarized by waterbody.

To incorporate the "beneficial effects of any established regulatory programs," even those which address lands outside of shoreline jurisdiction, Chapter 5

(Effect of Established Regulations and Programs) describes existing programs (e.g. stormwater management) and broadly assesses their potential beneficial impacts on shoreline uses and development.

The effects of the Draft SMP itself are mainly considered in Chapter 6 (Application of the Draft SMP Provisions). This analysis was performed on the Draft SMP dated January 16, 2013 (Final PC SMP Transmittal). For the purpose of evaluating impacts, consistent with the Guidelines, commonly anticipated uses and modifications were addressed in the most detail.

3 EXISTING CONDITIONS

This chapter begins (Section 3.1) with summaries of existing conditions by waterbody that are in large part based on the material presented in the Shoreline Analysis Report. As a supplement to the Shoreline Analysis Report, the results of GIS analyses of existing structure setback distances (Section 3.2) and existing vegetation in proposed setback areas (Section 3.3) are also presented.

3.1 Existing Conditions Summaries by Waterbody

The following summaries of existing conditions are based on the Shoreline Analysis Report. The Shoreline Analysis Report comprehensively inventoried existing conditions in the City's shorelines and assessed ecological functions and ecosystem-wide processes. The Shoreline Analysis Report was organized according to the four waterbodies listed immediately below. This section follows the same organization.

- Lake Washington
- Kelsey Creek/Mercer Slough
- Lake Sammamish
- Phantom Lake (including Larson Lake)

Please see the Shoreline Analysis Report for more detailed information about the existing conditions of the City's shorelines. Chapters 3 and 4 of the Shoreline Analysis Report include information on land use patterns; transportation; wastewater and stormwater utilities; impervious surfaces and vegetation; shoreline modifications; existing and potential public access sites; critical areas; floodplain and channel migration zone; historical and archaeological sites; other areas of special interest; and opportunities for protection and restoration. Chapter 5 includes an analysis of ecological functions and ecosystem-wide processes. Figures 16a through 16c, found in Appendix D of the Shoreline Analysis Report, map relative levels of ecological function. Further detail

regarding the methodology used in the preparation of the Shoreline Analysis Report can also be found in Appendix C of this document.

Ecological functions, as described in the Shoreline Analysis Report, are summarized in Table 3-1.

Table 3-1. Summary of ecological functions, as described in the Shoreline Analysis Report.

Ecological Functions	Stream Functions	Lake Functions
Hydrologic	• Storing water and sediment • Transport of water and sediment • Attenuating flow energy • Developing pools, riffles, and gravel bars • Removing excess nutrients and toxic compounds • Recruitment of large woody debris (LWD) and other organic material	• Storing water and sediment • Attenuating wave energy • Removing excess nutrients and toxic compounds • Recruitment of large woody debris (LWD) and other organic material
Vegetative	• Temperature regulation • Water quality improvement • Slowing riverbank erosion; bank stabilization • Attenuating of flow energy • Sediment removal • Provision of LWD and organic matter	• Temperature regulation • Water quality improvement • Attenuating wave energy • Sediment removal and bank stabilization • LWD and organic matter recruitment
Hyporheic	• Removing excess nutrients and toxic compounds • Water storage and maintenance of base flows • Support of vegetation • Sediment storage	• Removing excess nutrients and toxic compounds • Water storage • Support of vegetation • Sediment storage and maintenance of base flows
Habitat	• Physical space and conditions for life history • Food production and delivery	• Physical space and conditions for life history • Food production and delivery

3.1.1 Lake Washington

The City of Bellevue is bordered on its western boundary by approximately 9.12 miles of Lake Washington shoreline. For purposes of the Shoreline Analysis Report, this shoreline was broken into 28 reaches based on both land use and environmental factors.

Reaches were categorized as Residential, Water-Dependent Use or Parks. The Residential category contains land areas in shoreline jurisdiction generally dominated by single- and multi-family residential land uses. There are 18 reaches within the Residential land use area. The Water-Dependent Use category contains land areas in shoreline jurisdiction dominated by water-dependent uses (i.e. marinas, boat launching facilities). There are two reaches in this category: the first contains the marinas and yacht clubs within Meydenbauer Bay; the second contains the marinas, yacht club, and boat launch just south of

Mercer Slough. The Parks category contains land areas in shoreline jurisdiction generally dominated by parks and open space. There are eight reaches within this category.

Summary data for the entirety of the City's Lake Washington shoreline is provided below in Table 3-2. Summary data by reach category is provided below in Table 3-3.

Table 3-2. Lake Washington summary data.

Approximate Length	48,161 feet / 9.12 miles
Approximate Area	213 acres / 0.33 square miles
Roadways	13,752 feet
Impervious Surfaces	• 90.3 acres • 43%
Total Vegetative Cover in Shoreline Jurisdiction	• 121.4 acres • 57%
Total Armoring	• 38,789 feet • 81%
Overwater Structures	• 367 • 1,632,233 square feet • 40 per mile
Wetlands	• 22.3 acres • 10%

Table 3-3. Lake Washington summary data by reach category.

Reach Category	Reaches (Reach Numbers)	Existing Land Use	Comprehensive Plan Designation	Impervious Surfaces	Vegetative Cover	Total Armoring	Overwater Structures
Residential	• 18 (1, 3, 5, 7-9, 11, 13, 15, 16, 18, 21-23, 25-28)	• Single-family residential • Multi-family residential • Church/religious activity	• Single-Family Low Density = 35.8 acres / 21% • Single-Family Medium Density = 93.6 acres / 56% • Single-Family High Density = 33.1 acres / 20% • Multi-Family Low Density = 0.1 acres / <1% • Multi-Family Medium Density = 2.1 acres / 1% • Multi-Family High Density = 3.0 acres / 2%	• 74.5 acres • 44%	• 93.7 acres • 56%	• 33,610 feet • 87%	• 317 • 676,429 square feet • 43 per mile
Water-Dependent Use	• 2 (6, 20)	• Marina • Yacht club	• Single-Family Medium = 7.8 acres / 60% • Multi-Family High Density = 5.0 acres / 38% • Office = 0.2 acres / 2%	• 9.4 acres • 72%	• 3.8 acres • 29%	• 3,022 feet • 100%	• 28 • 581,565 square feet • 49 per mile
Parks	• 8 (2, 4, 10, 12, 14, 17, 19, 24)	• Parks	• Parks/Single-Family Low Density = 2.1 acres / 7% • Parks/Single-Family Medium Density = 26.4 acres / 83%	• 6.4 acres • 20%	• 23.8 acres • 75%	• 2,156 feet • 33%	• 22 • 374,239 square feet • 18 per mile

The Shoreline Analysis Report, in order to condense information as much as possible, grouped together reaches that have similar functional characteristics. The reach groups with their corresponding values for ecological function, as reported in the Shoreline Analysis Report, are shown below in Table 3-4.

Table 3-4. Lake Washington ecological function summary.

Reach Group	Ecological Function
Residential Groups	
R1 (reaches 1, 3, 5, and 8)	Low/Moderate
R2 (reaches 11, 13, and 15)	Low/Moderate
R3 (reaches 16, 18)	Low/Moderate
R4 (reaches 23, 25, and 27)	Low/Moderate
R5 (reaches 9, 26, and 28)	Low/Moderate
R6 (reach 7)	Moderate
R7 (reach 21)	Moderate
R8 (reach 22)	Low
Park Groups	
P1 (reaches 2, 4, 10, 12, 14, 17)	Low/Moderate
P2 (reach 19)	Moderate/High
P3 (reach 24)	Moderate/High
Water Dependent Groups	
WD1 (reach 6)	Low
WD2 (reach 20)	Low

Based on the above information, most of the City's Lake Washington shoreline can be characterized as having low/moderate ecological function. Three reaches are characterized as having low ecological function. These are Reach 6, which includes the Meydenbauer Bay marinas and yacht clubs; Reach 20, which also contains a marina and yacht club; and Reach 22, which contains Newport Keys within the Newport Shores community. Conversely, two Park reaches are characterized as having moderate/high ecological function. These are Reach 19 (mouth of Mercer Slough) and Reach 24 (Newcastle Beach Park).

3.1.2 Kelsey Creek/Mercer Slough

Kelsey Creek flows through the heart of Bellevue and is the primary component of the most productive and diverse stream network in the City. From its headwaters near Phantom Lake to its outflow into Mercer Slough and subsequently Lake Washington, Kelsey Creek and its tributaries pass through numerous parks, open spaces, school campuses, residential areas, commercial hubs, and a golf course. The majority of Kelsey Creek is not considered a Shoreline of the State (i.e. its mean annual flow is less than 20 cubic feet per second). However, per U.S. Geological Survey (USGS) calculations, a mean annual flow of 20 cubic feet per second is sustained at a point approximately 700 feet upstream of the confluence with Richards Creek. From this point until it empties into Lake Washington, Kelsey Creek, Mercer Slough, and their associated wetlands are considered Shorelines of the State.

For purposes of the Shoreline Analysis Report, the Kelsey Creek/Mercer Slough shoreline waterbody was divided into four distinct reaches, each containing associated wetlands: Reach 29 includes the Mercer Slough Nature Park (the area downstream of I-405, not including the Bellefield Office Complex or the Sturtevant Creek wetland north of SE 8th Street), Reach 30 includes the Bellefield Office Complex, Reach 31 includes lower Kelsey Creek (the area upstream of I-405 to the USGS 20 cubic feet per second cutoff), and Reach 32 includes the Sturtevent Creek wetland (associated wetland north of SE 8th Street and west of I-405).

Summary data for the entirety of the Kelsey Creek/Mercer Slough shoreline is provided below in Table 3-5. Summary data by reach is provided below in Table 3-6.

Table 3-5. Kelsey Creek/Mercer Slough summary data.

Approximate Length	19,741 feet / 3.74 miles
Approximate Area	455 acres / 0.71 square miles
Roadways	5,280 feet
Impervious Surfaces	• 79.6 acres • 17%
Total Vegetative Cover in Shoreline Jurisdiction	• 378.2 acres • 83%
Armoring	• Some shoreline armoring in Mercer Slough adjacent to the light industrial and office uses
Overwater Structures	• 3 within Mercer Slough • None in Kelsey Creek

Table 3-6. Kelsey Creek / Mercer Slough summary data by reach.

Reach	Comprehensive Plan Designation	Impervious Surfaces	Vegetative Cover
Reach 29 (Mercer Slough Nature Park)	• Light Industrial = 2.9 acres / 1% • Multi-family Medium Density = 100.6 acres / 31% • Office = 13.1 acres / 4% • Office Limited Business = 3.6 acres / 1% • Single-Family Low Density = 160.9 acres / 50% • Single-Family Medium Density = 45.4 acres / 14%	• 34.0 acres • 10%	• 294.4 acres • 90%
Reach 30 (Bellefield Office Complex)	• Office = 74.2 acres / 99% • Single-Family Low Density = 0.1 acres / <1% • Single-Family Medium Density = 0.5 acres / 1%	• 36.1 acres • 48%	• 39.9 acres • 53%
Reach 31 (Lower Kelsey Creek)	• Light Industrial = 3.0 acres / 7% • Multi-family Low Density = 4.5 acres /11% • Office Limited Business = 5.2 acres / 13% • Single-Family High Density = 5.2 acres / 13% • Single-Family Medium Density = 23.0 acres / 56%	• 8.7 acres • 21%	• 32.5 acres • 79%
Reach 32 (Sturtevant Creek Wetland)	• Office Limited Business = 12.2 acres / 100%	• .7 acre • 6%	• 11.5 acres • 94%

The reaches with their corresponding values for ecological function are shown below in Table 3-7. The Kelsey Creek/Mercer Slough shoreline is characterized as having moderate/high to high ecological function. Much of this is based upon the extensive wetland complex that is associated with this system along with the large amount of public open space and protected natural areas. Of note, Reach 30, which contains the Bellefield Office Complex, rated higher than one might expect of its commercial use (moderate/high). While this reach contains an extensive amount of impervious surface (48 percent) and commercial land uses (99 percent) compared to other areas in the City's shorelines, it is surrounded by higher value habitat within the Mercer Slough Nature Park and the slough itself, which completely encircles the office complex.

Table 3-7. Kelsey Creek/Mercer Slough ecological function summary.

Reach	Ecological Function
Reach 29 (Mercer Slough Nature Park)	High
Reach 30 (Bellefield Office Complex)	Moderate/High
Reach 31 (Lower Kelsey Creek)	Moderate/High
Reach 32 (Sturtevant Wetland)	Moderate/High

3.1.3 Lake Sammamish

The City is bordered on its eastern boundary by approximately 4.96 miles of Lake Sammamish shoreline. The shoreline is made up almost exclusively of single-family residences, with the exception of small pockets of multi-family residential, several small retail establishments, and private park facilities. The shoreline is nearly completely developed with a few scattered undeveloped properties in some areas. Shoreline armoring (71 percent of shoreline) and extensive amounts of docks and piers (326) also dominate the shoreline.

For purposes of the Shoreline Analysis Report, the Lake Sammamish shoreline was divided into five reaches: Reaches 33, 34 and 35 cover the area between the northern City limits and Vasa Park; Reach 36 covers Vasa Park; and Reach 37 covers the area between Vasa Park and the southern City limits.

Summary data for the entirety of the City's Lake Sammamish shoreline is provided below in Table 3-8. Summary data by reach is shown below in Table 3-9.

Table 3-8. Lake Sammamish summary data.

Approximate Length	26,193 feet / 4.96 miles
Approximate Area	119 acres / 0.19 square miles
Roadways	1,761 feet
Impervious Surfaces	• 46.2 acres • 39%
Total Vegetative Cover in Shoreline Jurisdiction	• 66 acres • 55%
Total Armoring	• 18,595 feet • 71%
Overwater Structures	• 326 • 331,940 square feet • 66 per mile
Wetlands	NA

Table 3-9. Lake Sammamish summary data by reach.

Reach	Comprehensive Plan Designation	Impervious Surfaces	Vegetative Cover
Residential (Reach 33)	• Single-Family Medium Density = 31.0 acres / 100%	• 14.1 acres • 43%	• 19.4 acres • 59%
Residential (Reach 34)	• Single-Family Medium Density = 16.1 acres / 100%	• 5.7 acres • 32 %	• 9.4 acres • 54%
Residential (Reach 35)	• Multi-family Medium Density = 1.6 acres / 3% • Neighborhood Business = 0.1 acres / <1% • Single-Family High Density = 11.7 acres / 25% • Single-Family Medium Density = 32.7 acres / 71%	• 18.1 acres • 38%	• 25.5 acres • 54%
Vasa Park (Reach 36)	• Single-Family High Density = 2.9 acres / 100%	• .5 acres • 18%	• 1.9 acres • 65%
Residential (Reach 37)	• Multi-family Medium Density = 0.4 acres / 2% • Neighborhood Business = <0.1 acres / <1% • Single-Family High Density = 17.2 acres / 97%	• 7.8 acres • 42%	• 9.8 acres • 53%

The reaches with their corresponding values for ecological function are shown below in Table 3-10. As the results indicate, most of these reaches can be characterized as having low/moderate ecological function.

Table 3-10. Lake Sammamish ecological function summary.

Reach Group	Ecological Function
Reach 33 (northern reach)	Low/Moderate
Reach 34	Low/Moderate
Reach 35	Low/Moderate
Reach 36	Moderate
Reach 37 (southern reach)	Low/Moderate

3.1.4 Phantom Lake

Phantom Lake is located in eastern Bellevue and is surrounded by public open space and single-family housing. The lake itself is approximately 65 acres, and drains near the northeast corner to Phantom Creek, which flows into Lake Sammamish. Historically, Phantom Lake drained into Kelsey Creek. However, near the turn of the century, a man-made outfall from Phantom Lake diverted flow into Lake Sammamish, creating Phantom Creek. The previous outlet to Kelsey Creek has since become an area of wetlands that stretches approximately one mile in a northwesterly direction to Larsen Lake. This area includes all of Phantom Lake, Larsen Lake and all their associated wetlands. Together this area is known as the Lake Hills Greenbelt, which encompasses over 150 acres of public open space and includes trails, shoreline access, fishing, produce stands, and wildlife viewing.

For purposes of the Shoreline Analysis Report, the shoreline jurisdiction surrounding Phantom Lake, including the Lake Hills Greenbelt, was divided into five distinct reaches. Four reaches surround Phantom Lake directly. Two of these reaches are single-family residential areas, one contains the Robinsglen Nature Park, and the last consists of the Lake Hills Greenbelt open space adjacent to Phantom Lake. The fifth reach consists of the Lake Hills Greenbelt north of SE 16th Street. As with the Lake Washington reach summary, the two residential reaches surrounding Phantom Lake were combined into one analysis unit due to their functional similarity. However, the park and open space reaches are each evaluated separately due the differences between both their land uses and landscape characteristics.

Summary data for the entirety of the Phantom Lake shoreline is provided below in Table 3-11. Summary data by reach is shown below in Table 3-12.

Table 3-11. Phantom Lake summary data.

Approximate Length	9,933 feet / 1.88 miles
Approximate Area	173 acres / 0.27 square miles
Impervious Surfaces	• 12.6 acres • 7.3%
Total Vegetative Cover in Shoreline Jurisdiction	• 162.4 acres • 93.9%
Roadways	• 163 Place SE • SE 16th Street • SE 17th Street
Armoring	• Approximately 2.4% of Phantom Lake • Not known to exist at Larson Lake
Overwater Structures	22
Wetlands	• 150.6 • 87%

Table 3-12. Phantom Lake summary data by reach.

Reach	Comprehensive Plan Designation	Impervious Surfaces	Vegetative Cover
Reaches 38 & 40 (Residential)	• Single-Family Low Density = 26.9 acres / 90% • Single-Family Medium Density = 3 acres / 10%	• 4.6 acres • 15.4%	• 25.2 acres • 84.0%
Reach 39 (Lake Hills Greenbelt at Phantom Lake)	• Single-Family Low Density = 21.4 acres / 100%	• .1 acre • 7.7 %	• 1.1 acres • 96.6%
Reach 41 (Robinsglen Nature Park)	• Single-Family Low Density = 1.1 acres / 100%	• .1 acre • .5%	• 21.2 acres • 98.7%
Reach 42 (Lake Hills Greenbelt north of SE 16th St., including agricultural use)	• Community Business = 2.3 acres / 2% • Multi-family Medium Density = 0.1 acres / <1% • Single-Family High Density = 5.4 acres / 4% • Single-Family Low Density = 112.9 acres / 94%	• 7.8 acres • 6.5%	• 115.0 acres • 95.3%

The reaches with their corresponding values for ecological function are shown below in Table 3-13. The Phantom Lake shoreline exhibits moderate/high to high shoreline ecological functions. This is primarily due to the extensive shoreline-associated wetland surrounding Phantom Lake. The lack of shoreline armoring in residential areas surrounding Phantom Lake also resulted in a moderate/high result.

Table 3-13. Phantom Lake ecological function summary.

Reach	Ecological Function
Reaches 38 and 40 (residential)	Moderate/High
Reach 39 (Lake Hills Greenbelt at Phantom Lake)	High
Reach 41 (Robinsglen Nature Park)	Moderate/High
Reach 42 (Lake Hills Greenbelt north of Phantom Lake)	High

3.2 Existing Setbacks Analysis

This section presents the results of an analysis of existing structure setback distances. For waterfront parcels, the setback analysis evaluated the distance from the proposed OHWM to the nearest structure over 800 square feet in area, which was assumed to represent a primary structure. Results of the analysis are shown below in Table 3-14. The median is more representative of the typical setback condition than the mean because occasional wide setbacks skew the mean upward.

Table 3-14. Existing setbacks by environment designation and waterbody.

Environment Designation	Waterbody	Count	Median Setback (feet)	Minimum Setback (feet)	Maximum Setback (feet)	Mean Setback (feet)	Standard Deviation
Shoreline Residential	Lake Washington	308	47	0	378	62	52
	Mercer Slough / Kelsey Creek	1	--	206	206	--	--
	Lake Sammamish	348	53	0	357	65	48
	Phantom Lake	43	89	18	565	123	116
Shoreline Residential Canal	Lake Washington	79	33	0	107	39	22
Urban Conservancy	Lake Washington	4	75	24	147	95	53
	Mercer Slough / Kelsey Creek	10	67	43	237	83	56
	Lake Sammamish	2	--	104	118	--	--
Urban Conservancy-Open Space	Lake Washington	1	--	334	334	--	--
	Mercer Slough / Kelsey Creek	3	103	97	221	140	70
Recreational Boating	Lake Washington	4	2	0	75	19	37

For the two Shoreline Residential environments, the results show that the median existing setback distance is smallest in the Shoreline Residential Canal environment (33 feet) and largest in the Shoreline Residential environment on Phantom Lake (89 feet). The median setback in the Recreational Boating environment is the smallest (2 feet) given the water-oriented nature of structures in this environment designation.

3.3 Existing Vegetation Analysis

This section presents the results of a supplemental analysis of existing vegetation within the proposed and adjacent setback areas. The analysis evaluated existing shrub and tree cover by parcel within both the nearest 25 and the nearest 50 feet of the proposed OHWM. Results of the analysis are presented by environment designation and waterbody in Table 3-15.

Table 3-15. Existing shrub and tree coverage in shoreline area by environment designation and waterbody.

Environment Designation Waterbody	Count	0-25 feet		0-50 feet	
		Mean (percent)	Standard Deviation	Mean (percent)	Standard Deviation
Shoreline Residential					
Lake Sammamish	362	12	20	14	21
Lake Washington	324	26	27	28	27
Phantom Lake	50	54	34	54	33
Shoreline Residential Canal					
Lake Washington	80	25	24	24	22
Urban Conservancy					
Lake Sammamish	3	10	13	33	14
Lake Washington	10	23	19	27	21
Mercer Slough / Kelsey Creek	10	13	19	69	32
Urban Conservancy-Open Space					
Lake Washington	4	82	26	81	29
Mercer Slough / Kelsey Creek	4	48	55	46	53
Phantom Lake	5	71	27	65	28
Recreational Boating					
Lake Washington	5	5	7	4	5

Overall, the analysis shows that the percentage of shrub and tree cover is highest in the Urban Conservancy-Open Space environment and lowest in the Recreational Boating environment. In the Shoreline Residential environment, the percentage of shrub and tree cover is highest along Phantom Lake. Shoreline shrub and tree cover is lower along Lake Sammamish compared to Lake Washington in both the Shoreline Residential and Urban Conservancy designations. Finally, within the Shoreline Residential environment designation, the percentage of shrub and tree cover in the nearest 25 feet is generally similar to cover within the nearest 50 feet. This indicates that vegetative conditions are roughly similar in the first 50 feet waterward from the OHWM. In the Urban Conservancy environment designation, shrub and tree cover is lower in the first 25 feet, and tends to increase away from the water. This trend could be a result of higher intensity recreational uses close to the water (e.g. swim beaches) compared to more passive uses further away from the shoreline (e.g. picnic areas).

4 ANTICIPATED DEVELOPMENT

As discussed in Chapter 1, WAC 173-26-186(8)(d) says that a cumulative impacts analysis should evaluate the "reasonably foreseeable future development and use of the shoreline." This chapter presents the results of two analyses intended to help gauge future development. Section 4.1 below briefly summarizes the results of the land use analysis that was conducted as part of the Shoreline Analysis Report. Section 4.2 below presents the results of an analysis of City permits issued between 2003 and 2013 for projects in shoreline jurisdiction.

This cumulative impacts analysis primarily relies upon City data regarding past permit activity to evaluate potential future development. However, this analysis does not expect that past permitting activity will continue on at the exact same rate; rather, the data serve to inform the cumulative impacts analysis of the general types and frequency of potential future development in the City.

4.1 Shoreline Analysis Report Land Use Analysis

This section briefly summarizes the results of an analysis of likely changes in shoreline land use that was conducted as part of the previously prepared Shoreline Analysis Report. In reviewing likely changes in land use, the Shoreline Analysis Report addressed cases where the overall type of land use may change, such as from single-family residential to park (the analysis did not address the potential for development activities that would not affect the overall type of land use, such as structure remodels or expansions). For the complete analysis, please see Chapter 6 of that report.

In general, there is little likelihood of change in the type of land use in the City's shorelines. One exception to this is the area in the eastern portion of Meydenbauer Bay that is subject to the Meydenbauer Bay Park and Land Use Plan. Implementation of the plan is resulting in the conversion of multiple types of land use into a park. Another exception is along Lake Sammamish, where the City has acquired three single-family shoreline parcels with the intention of developing a future park site. Because there is little likelihood of land use change in the City's shorelines and because the majority of shoreline parcels feature some type of an existing structure, most shoreline development activities are expected to consist of the redevelopment of existing uses and minor development activities.

4.2 Permit History Analysis

The information on likely changes in land use contained in the Shoreline Analysis Report summarized above was recently supplemented with an analysis

of the City's permit history in order to better understand the extent, nature and general location of potential future impacts. The permit history analysis examined City permit activity in shoreline jurisdiction from 2003 through 2013. This permit history is summarized by shoreline waterbody in Table 4-1.

Table 4-1. Shoreline permit history 2003 to 2013.

	Number of Permits Issued 2003-2013				
Development Activity	**Lake Washington**	**Lake Sammamish**	**Mercer Slough / Kelsey Creek**	**Phantom Lake**	**Total**
Single-family residence - new[1]	35	37	0	0	72
Single-family residence - remodel	140	120	0	19	279
Pier - new or replacement	26	29	0	0	55
Pier - repair	58	49	0	0	107
Shoreline stabilization - repair/replacement	16	14	0	0	30
Shoreline stabilization - new	0	0	0	0	0
Boatlifts - new or replacement	37	24	0	0	61
Other shoreline permit[2]	57	22	26	5	110
Major commercial or multifamily project (BB)	1	2	1	0	4
Medium commercial or multifamily project (BM)	2	0	1	0	3
Minor commercial or multifamily project (BW)	13	1	7	0	21
Enforcement action[3]					458

[1] Of the new single-family residences permits, 10 were on vacant lots; the remainder included the demolition of an existing structure prior to construction of a new residence.
[2] Other shoreline permits includes development activities such as boathouse repair, infrastructure projects, park projects, marina or yacht club projects, among others.
[3] Enforcement actions includes actions to address unauthorized activities such as piers, bulkheads, or deck construction; tree removal; clearing and grading; among others.

The permit history analysis indicates that from 2003 through 2013 the development of single-family residences was the most common type of development in shoreline jurisdiction. Structure remodels far outpaced the development of completely new structures. The permit history analysis also shows that pier development activities (including new and replacement piers as well as pier repair) were relatively more common in comparison to other development activities during this time period. Approximately two-thirds of pier projects were to perform repairs; the remaining one-third were to construct new or replacement piers. The permit history analysis found that repair or replacement of shoreline stabilization was not all that common, occurring at an average rate of approximately three per year, and that the installation of completely new shoreline stabilization did not occur. Further, the permit history

analysis revealed that commercial or multifamily development occurred in the City's shorelines, and this development was primarily associated with minor (BW) projects. Finally, the City maintains a record of the number of enforcement actions undertaken in response to a variety of unauthorized activities.

4.3 Summary of Anticipated Development

While a limited number of changes in land use may occur, most development in shoreline jurisdiction is expected to consist of the redevelopment of existing uses and other minor development activities. Single-family residential development, including associated development such as piers, boatlifts and shoreline stabilization, is expected to continue as the most common category of future development. Some commercial or multifamily development, especially such development associated with minor (BW) projects, should also be expected. Finally, several recreational projects, particularly in association with park development, may occur in the future.

5 Effect of Established Regulations and Programs

As directed by WAC 173-26-186(8)(d), the intent of this chapter is to provide an overview of the beneficial effects of established regulations under other local, State, and federal laws. Please note that this chapter uses the term "regulations" broadly to include statutes, administrative codes, or other items that have may have regulatory effects.

5.1 City Regulations and Programs

A wide variety of City regulations may affect the City's shorelines and limit cumulative impacts. More pertinent regulations include the Land Use Code, Critical Areas Code, and Storm and Surface Water Utility Code. These are summarized below.

Bellevue Land Use Code: Title 20 of the Bellevue City Code, the Bellevue Land Use Code, contains the bulk of the City's development regulations. For each land use district in the City, the land use code identifies important information such as permitted and conditional uses, lot size requirements, building height allowances, and much more.

Critical Areas Overlay District: Activities outside of shoreline jurisdiction can impact conditions within shoreline jurisdiction through effects on water quality, freshwater inputs, and physical habitat conditions. Part 20.25H of the Bellevue

Land Use Code, the Critical Areas Overlay District, will apply outside of shoreline jurisdiction after adoption of the SMP and help limit the effects of development activities on critical areas.

Storm and Surface Water Utility Code: Surface drainage and stormwater management are regulated under Chapter 24.06 of the Bellevue Land Use Code. A purpose of this code is to "protect receiving waters or waters of the state from pollution, mechanical damage, excessive flows and other conditions, which may increase erosion, turbidity, or other forms of pollution, which reduce flow or which degrade the environment."

Bellevue Utilities: The City's Utilities Department is responsible for ongoing maintenance and operation of the City's stormwater facilities, as well as inspection of private drainage systems associated with new development to ensure compliance with water quality mandates. The Utilities Department also sponsors several outreach and education programs, including the Stream Team Program, Natural Neighborhoods Program, Northwest Natural Yard Days, Residential Pollution Prevention Education, Closed Loop Oil Program, and the Waterwise Demonstration Program. These outreach and education activities are important for the City to fulfill its obligations under its Phase II Municipal Stormwater Permit.

Bellevue Parks: The City of Bellevue Parks Department manages City-owned lands for public access and ecological functions. Management activities to improve shoreline functions include forest management to achieve specific forest succession goals, public outreach through visitor centers and the Mercer Slough Environmental Education Center, and open space acquisition strategies that could help improve open space conditions and connectivity within the City (e.g. Wilburton acquisition, McTavish acquisition). Bellevue Parks also recently acquired Meydenbauer Bay Park and Marina, and it plans to redevelop the property for increased public access, as well as extensive shoreline ecological restoration. In 2011, Bellevue Parks invested in a closed loop equipment washing station to reduce storm drainage impacts from Parks equipment.

Capital Investment Program: The City of Bellevue makes capital investments in aquatic habitat and buffer restoration, stormwater management, and open space (parks). Recent ecological enhancement projects have been conducted at Phantom Creek, Mercer Slough, the West Tributary of Kelsey Creek, and Larson Lake. Likely future capital investment actions that would improve shoreline functions are identified in the Shoreline Restoration Plan (City of Bellevue 2013).

5.2 State Regulations

Under the Shoreline Management Act (SMA), Ecology must review and approve the City's SMP before it takes effect. Ecology also reviews all shoreline projects

that require a shoreline permit, and has specific regulatory authority over Shoreline Conditional Use Permits and Shoreline Variances.

Aside from the SMA, State regulations most pertinent to development in the City's shorelines include the Aquatic Lands Act, Hydraulic Code, and the State Environmental Policy Act. Other relevant State regulations include the Watershed Planning Act, Water Resources Act and Salmon Recovery Act.

A variety of State agencies (e.g. Ecology, Washington Department of Fish and Wildlife (WDFW), Washington Department of Natural Resources (WDNR)) are involved in implementing these regulations or own shoreline areas. State agency reviews of shoreline developments are typically triggered by in- or over-water work, discharges of fill or pollutants into the water, or substantial land clearing. Depending on the nature of the proposed development, State regulations can play an important role in the design and implementation of a shoreline project, ensuring that impacts to shoreline functions and values are avoided, minimized, and/or mitigated.

A summary of pertinent State regulations follows.

Aquatic Lands Act: In 1984, the Washington State Legislature passed what is commonly referred to as the Aquatic Lands Act (RCW 79.105 through 79.135) and delegated to the WDNR the responsibility to manage State-owned aquatic lands. The aquatic lands statutes (RCW 79.100 through 79.145) direct WDNR to manage aquatic lands to achieve a balance of public benefits, including public access, navigation and commerce, environmental protection, renewable resource use, and revenue generation when consistent with the other mandates. In addition, it also identifies water-dependent uses as priority uses for the transport of useful commerce.

If a proposed project requires the use of State-owned aquatic lands, the project may be required to obtain an Aquatic Use Authorization from WDNR and enter into a lease agreement. WDNR recommends that all proponents of a project waterward of the OHWM contact WDNR to determine whether the project will be located on State-owned aquatic lands, and, if so, to determine whether the land is available, whether the proposed use is appropriate, and how the project can be constructed to avoid or minimize impacts to aquatic resources.

Hydraulic Code: Chapter 77.55 RCW, the Hydraulic Code, gives the WDFW the authority to review, condition, and approve or deny "any construction activity that will use, divert, obstruct, or change the bed or flow of State waters." Practically speaking, these activities in the City of Bellevue include, but are not limited to, projects such as the installation or modification of shoreline stabilization measures, piers and accessory structures such as boatlifts, culverts,

and bridges and footbridges. These types of projects must obtain a Hydraulic Project Approval from WDFW, which will contain conditions intended to prevent damage to fish and other aquatic life, and their habitats. In some cases, the project may be denied if serious impacts would occur that could not be adequately mitigated.

State Environmental Policy Act (SEPA): SEPA provides a way to identify possible environmental impacts that may result from project and programmatic proposals. These decisions may be related to issuing permits for private projects, constructing public facilities, or adopting regulations, policies or plans. Information provided during the SEPA review process helps agency decision-makers, applicants, and the public understand how a proposal will affect the environment. This information can be used to change a proposal to reduce likely impacts, or to condition or deny a proposal when adverse environmental impacts are identified.

5.3 Federal Regulations

Federal regulations most pertinent to development in the City's shorelines include the Clean Water Act, the Endangered Species Act, and the Rivers and Harbors Act. Other relevant federal regulations include the Anadromous Fish Conservation Act, Clean Air Act, and the Migratory Bird Treaty Act, and the National Environmental Policy Act.

A variety of agencies (e.g. U.S. Army Corps of Engineers (Corps), National Marine Fisheries Service (NFMS), U.S. Fish and Wildlife Service (USFWS) are involved in implementing these regulations, with review of shoreline development typically triggered by in- or over-water work, or discharges of fill or pollutants into the water. Depending on the nature of the proposed development, federal regulations can play an important role in the design and implementation of a shoreline project, ensuring that impacts to shoreline functions and values are avoided, minimized, and/or mitigated.

A summary of pertinent regulations follows.

Clean Water Act, Section 402: Section 402 of the Clean Water Act required the Environmental Protection Agency (EPA) to develop and implement the National Pollutant Discharge Elimination System (NPDES) program. The NPDES program controls water pollution by regulating point sources that discharge pollutants into waters of the U.S. Point sources are discrete conveyances such as pipes or man-made ditches. Municipal, industrial, and other facilities must obtain permits if their discharges go directly to surface waters. In Washington, Ecology has been delegated the responsibility by the EPA for managing implementation of this program. The City of Bellevue operates under a Phase II Municipal Stormwater Permit.

Clean Water Act, Section 404: Section 404 of the federal Clean Water Act provides the Corps, under the oversight of the EPA, with the authority to regulate the discharge of dredged or fill material into waters of the U.S., including wetlands. Under Section 404, the extent of Corps jurisdiction in non-tidal waters typically extends to the OHWM. While the extent of the Corps' authority and the definition of fill have been the subject of considerable legal activity, it generally means that the Corps must review and approve many activities in the shoreline, including, but not limited to, depositing fill, dredged, or excavated material in waters and/or adjacent wetlands; shoreline and wetland restoration projects; and culvert installation or replacement.

Endangered Species Act (ESA): Section 9 of the ESA prohibits "take" of listed species. Take has been defined in Section 3 of the ESA as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The take prohibitions of the ESA apply to everyone, so any action of the City that results in a take of listed fish or wildlife would be a violation of the ESA and expose the City to risk of lawsuit. Per Section 7 of the ESA, the Corps must consult with the NMFS and/or the USFWS on any projects that fall within Corps jurisdiction (e.g. Section 404 or Section 10 permits) that could affect species listed under the ESA. These agencies ensure that the project includes impact minimization and compensation measures for protection of listed species and their habitats.

FEMA Biological Opinion: In 2008, NMFS issued a Biological Opinion, which found that the implementation of the National Flood Insurance Program in the Puget Sound region jeopardizes the continued existence of federally threatened salmonids and southern resident killer whales. As a result, NMFS established Reasonable and Prudent Alternatives to ensure that development within Special Flood Hazard Areas (100-year floodplains), floodways, channel migration zones, and riparian buffer zones (extending 250 feet waterward of the OHWM) does not adversely affect water quality, water quantity, flood volumes, flood velocities, spawning substrate, or floodplain refugia for listed salmonids. Because the National Flood Insurance Program is implemented by the Federal Emergency Management Agency (FEMA) through participation by local jurisdictions that adopt and enforce floodplain management ordinances, FEMA has delegated responsibility to local jurisdictions to ensure that development does not adversely affect listed species. Floodplain areas in the City include Lake Sammamish and Phantom Lake; however, only Lake Sammamish includes federally listed fish species. Development proposals in or near floodplain areas on Lake Sammamish will need to demonstrate that development does not adversely affect floodplain, floodway, or riparian vegetation relative to federally listed salmonids.

Rivers and Harbors Act: Section 10 of the Rivers and Harbors Act of 1899 provides the Corps with the authority to regulate activities that may affect "navigable" waters of the U.S. These are waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Lake Washington and Lake Sammamish are included in the list of federally designated navigable waters. Under Section 10, extent of Corps jurisdiction in non-tidal waters typically extends to the OHWM. Proposals to construct new or modify existing in-water structures (including, but not limited to, piers, marinas, bulkheads, and breakwaters), to excavate or dredge, or to "alter or modify the course, location, condition, or capacity of" navigable waters must be reviewed and approved by the Corps.

5.4 Shoreline Restoration Plan

As discussed in Chapter 1, one of the key objectives that the City's SMP must seek to achieve is "no net loss of ecological shoreline functions necessary to sustain shoreline natural resources" (WAC 173-26-201(2)(c)). However, SMP updates seek not only to maintain conditions, but to improve them. The Guidelines indicate that SMPs should include planning elements that, when implemented, serve to improve the overall condition of habitat and resources within the shoreline area (WAC 173-26-201(c)). The Guidelines state that "master programs shall include goals, policies and actions for restoration of impaired shoreline ecological functions," and that "these master program provisions should be designed to achieve overall improvements in shoreline ecological functions over time, when compared to the status upon adoption of the master program" (WAC 173-26-201(2)(f)). Pursuant to that direction, the City has prepared a Shoreline Restoration Plan (2013) as part of its SMP update.

Practically, it is not always feasible for shoreline developments and redevelopments to achieve no net loss at the site scale, particularly for those developments on previously undeveloped properties or developments featuring a new, non-replacement pier or bulkhead. Therefore, the Restoration Plan will be an important component in making up any reductions in ecological function that would result solely from implementation of the SMP. The Restoration Plan represents a long-term vision for restoration that will be implemented over time, resulting in incremental improvement over the existing conditions.

The Shoreline Restoration Plan identifies a number of project-specific opportunities for restoration on both public and private properties inside and outside of shoreline jurisdiction, and also identifies ongoing City programs and activities, non-governmental organization programs and activities, and other recommended actions consistent with the *Final Lake Washington/Cedar/Sammamish Watershed (WRIA 8) Chinook Salmon Conservation Plan.*

The City's environmental protection and restoration goals include:

1) Balancing shoreline restoration with public access and recreation opportunities
2) Protecting watershed processes to achieve improved ecological functions over time
3) Protecting fish and wildlife habitat

These goals, as well as an understanding of existing constraints to restoration, were used to prioritize shoreline restoration projects. In addition to continuing ongoing programmatic actions, high-priority restoration projects were identified based on scientific recommendations, potential funding sources, the projected level of public benefit, and project feasibility. Six potential high-priority restoration projects were selected through the project prioritization and ranking process for further development of conceptual designs. These projects include:

- Chism Beach Park shoreline restoration
- Clyde Beach Park shoreline restoration
- Newcastle Beach Park shoreline restoration
- Mercer Slough-Bellefield Office Complex buffer enhancement
- West Lake Sammamish shoreline restoration
- Larsen Lake stream restoration, fish passage, and revegetation

Conceptual designs were developed with consideration to present condition, potential for improved ecological function, and public use interests at each site. Although project implementation is dependent on available funding and other factors, several of these projects are expected to be implemented in the foreseeable future. The 2013-2019 Capital Investment Plan (CIP) identifies stream daylighting and beach and shoreline improvements, as well as development of active uses within the park. The CIP also identifies funding for the Forest, Greenways, Trails and Nature Space Improvement Program, which restores, enhances, and renovates degraded natural areas including shorelines, streams, wetlands, forests, greenways, trails and nature space trees and landscaping within the 2,600 acre Parks and Open Space system.

The City's CIP also includes funding for fish passage correction and stream channel modifications, both generally and for specific projects on Kelsey Creek and Coal Creek. Typical projects addressing fish passage include culvert replacement or modification, debris removal, or installation of logs and boulders. Stream channel modification projects typically include projects to reduce stream upland sediment sources, bank stabilization with large woody debris or boulders, or re-vegetating the stream banks. Whether these project occur within shoreline jurisdiction or in smaller streams, they are expected to improve shoreline habitat by improving watershed conditions for anadromous fish.

6 Application of the Draft SMP Provisions

This chapter examines the potential for cumulative impacts on shoreline ecological processes and functions with application of the Draft SMP. The analysis integrates the understanding of existing conditions, anticipated development, the potential effects of shoreline activities on ecological functions, and the proposed SMP standards to manage and regulate shoreline uses and modifications. This analysis is based on information and analysis described in Chapters 3 and 4 of this report, the Shoreline Analysis Report, and the Draft SMP.

6.1 Draft SMP Provisions

6.1.1 General Requirements Applicable to all Shoreline Development and Uses (LUC 25.25E.060)

The Draft SMP contains numerous general policies and supporting regulations intended to protect the ecological functions of the shoreline and prevent adverse cumulative impacts (policies are not reviewed as part of this analysis based on the assumption that they are implemented by the regulations). Key general regulations are summarized in Table A-1 of Appendix A. Table A-1 also identifies the general functions that are directly affected by specific SMP provisions.

The most commonly anticipated changes in the City's shorelines involve single-family residential development. Single-family residential development is expected to play a significant role in determining the cumulative effects of the SMP since the majority of the City's shorelines are in single-family residential use. However, in regards to single-family residential development, is it worth noting that the SMA states that "alterations of the natural condition of the shorelines of the state, in those limited instances when authorized, shall be given priority for single-family residences and their appurtenant structures..." (RCW 90.58.020).

To a lesser extent, commercial, multifamily residential and recreational development are anticipated. Future development will also include other less common types of development, the location, timing and impacts of which are less predictable. The potential impacts from less common types of development must be adequately addressed during project review in order for such projects not to contribute to cumulative effects on a City-wide basis. On this issue WAC 173-26-201(3(d)(iii) states:

> *For those projects and uses with unanticipatable or uncommon impacts that cannot be reasonably identified at the time of master program development, the master program policies and regulations should use the permitting or conditional use permitting processes to ensure that all impacts are addressed and that there is not net loss of ecological function of the shoreline after mitigation.*

The Draft SMP includes a requirement for an analysis demonstrating no net loss of ecological function as part of applications for a Shoreline Conditional Use Permit, Shoreline Variance, and as part of a Shoreline Special Report, or as required for a site-specific mitigation plan. In contrast, this requirement does not apply to development requiring a Shoreline Substantial Development Permit or exemption. Because shoreline residential uses and associated appurtenant structures qualify for exemptions under the SMA, these common developments would not be required to demonstrate no net loss of functions. The Draft SMP includes a "rebuttable presumption," that development projects that comply with all applicable standards are assumed to satisfy the no net loss of ecological function standard (LUC 20.25E.060.B). Because the Draft SMP does not require a demonstration of no net loss for permitted and exempt development, in order to cumulatively meet the standard of no net loss, the Draft SMP would need to ensure that the prescriptive standards are sufficiently protective to meet the no net loss standard on a cumulative basis.

6.1.2 Residential Shoreline Regulations (LUC 25.25E.065)

As stated previously, single-family residential development is the most common category of development along Bellevue's shorelines. As presented above, from 2003 through 2013 there were 72 new single-family residences constructed in the City's shoreline jurisdiction. Only 10 of these new residences were constructed on vacant lots; the remaining 62 involved the demolition of an existing structure prior to construction of the new residence. In the same time period, 279 single-family residences in the shoreline were remodeled. Development trends also include the removal of vegetation (including significant trees) and increases in building footprint and impervious surfaces associated with redevelopment and remodeling of existing structures. Similar levels of development activity should be expected to continue for the foreseeable future.

Table 6-1 below summarizes the potential impacts of residential development.

Table A-2 of Appendix A identifies the Draft SMP provisions related to residential development that help maintain shoreline functions. Among these are provisions that aim to:

- Ensure that new development avoids the need for future new shoreline stabilization;

- Minimize contamination of surface waters by locating new parking and driveways outside of the shoreline setback and controlling runoff though natural drainage practices and low impact development where possible;

- Limit soil disturbance and potential for silt-laden runoff by limiting clearing, excavation and fill to the minimum necessary;

- Minimize overwater shading in the photosynthetic zone and in the area that provides the preferred habitat for threatened Chinook salmon by applying limits to the size and dimensions of new or reconfigured docks, limiting walkways to 4 feet within 30 feet of the OHWM, and restricting ells and boatlifts to the area beyond 30 feet from the OHWM or at least 9 feet of water depth;

- Improving light transmittal through docks by requiring grated decking on any new and reconfigured dock;

- Minimize overwater shading by prohibiting new boathouses and limiting the number of and material for boat lift canopies.

An analysis of how the application of the proposed residential setback provisions, residential overwater structure standards, and residential shoreline stabilization standards affect potential cumulative impacts to shoreline functions are discussed within the Shoreline Residential Environment Designation in Section 6.2.1.

Table 6-1. Summary of potential impacts from residential development and accessory uses.

Functions	Potential Impacts to Functions
Hydrologic	Increase in stormwater runoff and discharge in association with more impervious surfaces.
	Shoreline stabilization associated with residential development increases wave energy at the shoreline, resulting in erosion of the lakebed at the base of the bulkhead and adjacent properties, as well as the uprooting of aquatic vegetation.
Water Quality	Increase in contaminants (e.g. metals, petroleum hydrocarbons) and decrease in infiltration potential associated with the use and creation of new impervious surfaces, especially residential parking surfaces.
	Increase in pesticide and fertilizer use.
	Greater potential for increased erosion, bank instability, and turbidity associated with vegetation clearing.
	Water quality degradation associated with construction of docks and other in-water structures (e.g. spills, harmful materials use) and related uses of new docks (e.g. boat maintenance and operation).
Vegetative/Habitat	Reduced shoreline habitat complexity, increased water temperatures, and less large wood debris.
	Loss or disturbance of shoreline vegetation and associated functions.
	Increased shading in nearshore habitat areas resulting from dock and pier construction can limit growth of submerged aquatic vegetation and alter habitat for and behavior of aquatic organisms, including juvenile salmon.
	Disturbance of substrate and submerged aquatic vegetation from pilings or anchors.
	Nighttime lighting effects on fish behavior.
	Where shoreline stabilization is associated with residential development, increased slope reduces shallow nearshore habitat area.

6.1.3 Specific Use Regulations (LUC 25.25E.070)

The Draft SMP contains numerous regulations intended to address the potential impacts of specific shoreline uses. The potential impacts of specific shoreline uses, and the regulations intended to address them, are discussed in the following sections. Tables A-3 through A-6 in Appendix A summarize some of the key SMP provisions that help maintain shoreline functions.

Aquaculture (LUC 25.25E.070.B)

Under the Draft SMP, aquaculture uses would only be allowed when developed as part of a fish recovery program sponsored, developed, and overseen by a government entity or tribe. Therefore, applications for new aquaculture are likely to be rare to non-existent in the foreseeable future.

Aquaculture facilities have the potential to disrupt sediment processes and benthic habitat assemblages (Table 6-2).

The Draft SMP requires that aquaculture structures be designed to minimally interfere with water quality and flow, fish circulation, and aquatic plant life. The Draft SMP also prohibits aquaculture facilities in upland areas.

Table 6-2. Summary of potential impacts from aquaculture.

Functions	Potential Impacts to Functions
Hydrologic	Alteration in hydrologic and sediment processes associated with aquaculture structures.
Water Quality	Reduction in water quality from substrate modification, supplemental feeding practices, pesticides, herbicides, and antibiotic applications.
Vegetative/Habitat	Accidental introduction of non-native species or potential interactions between wild and artificially produced species.

Recreation (LUC 20.25E.070.C)

Bellevue's shorelines offer a variety of recreational opportunities, including several public parks, as well as privately owned recreational lands and facilities. Some recreational development, including at public parks, is expected in the future.

The potential impacts of recreational uses depend on the type and intensity of the use (Table 6-3). Active uses, which may require structural development such as boat ramps, boardwalks, and concession facilities, typically have a greater impact than passive uses, such as hiking trails.

The Draft SMP limits the more intensive recreational uses to the Recreational Boating environment, where higher levels of development already exist. Table A-4 of Appendix A identifies the Draft SMP provisions that help maintain shoreline functions related to recreational uses. These provisions limit the area of pervious trails, impervious surfaces, and the clearing of vegetation to the minimum necessary for the proposed use. They also limit development within the shoreline setback or critical areas. Additionally, any areas of disturbance (either permanent or temporary) would be required to be mitigated. Where new or expanded recreational boating facilities are proposed, the Draft SMP provisions would require siting to avoid and minimize the need for excavation, filling, and dredging.

Table 6-3. Summary of potential impacts from recreational development.

Functions	Potential Impacts to Functions
Hydrologic	Increase in stormwater runoff and discharge in association with an increase in impervious surfaces.
Water Quality	Increase in contaminants associated with the creation of new impervious surfaces (e.g. metals, petroleum hydrocarbons).
	Increase in pesticide and fertilizer use.
	Greater potential for increased erosion, bank instability, and turbidity associated with vegetation clearing.
Vegetative/Habitat	Reduced shoreline habitat complexity, increased water temperatures, and less large woody debris.
	Loss of or disturbance to shoreline vegetation during upland development.
	Lighting effects on both fish and wildlife.

Transportation (LUC 20.25E.070.D)

Transportation features are very common in Bellevue's shorelines. The City's shorelines include 13,752 feet of public roads, as well as extensive private roads, driveways and parking areas. In general, most transportation development in shoreline areas is expected to consist of minor new development, minor expansions, or the reconfiguration of driveways and parking areas associated with redevelopment. Because development patterns in the City's shorelines are well established, new major transportation development is not generally expected to occur, with the exception of Sound Transit's East Link Extension, discussed below.

Roadways, parking areas, and their associated traffic tend to impair habitat and hydrologic connectivity, and stormwater runoff can have a substantial impact on water quality conditions (Table 6-4).

Some of the key standards in the Draft SMP related to transportation uses that help maintain shoreline functions are identified in Table A-5 of Appendix A. Draft SMP standards require that transportation facilities make joint use of rights-of-way and consolidate crossings of water bodies where feasible. Transportation facilities located in the shoreline jurisdiction must also be designed and maintained to prevent erosion and to permit the natural movement of surface water. The alignment and design of transportation facilities must result in the least environmental impact and permanent disturbance feasible. New and expanded transportation projects are also subject to mitigation standards identified in LUC 20.25E.060.D. Additionally, vegetation conservation standards and low impact development standards would apply to minimize impacts (See Section 6.1.1).

The Sound Transit East Link Extension represents a major potential new transportation use, scheduled to be under construction from 2015 to 2021. This project will cross Lake Washington and may extend into portions of shoreline

jurisdiction along Mercer Slough. Under the Draft SMP, if the City Council approves a facility, it would not be subject to a conditional use permit, nor would the requirement to demonstrate no other technically feasible alternative apply (LUC 20.25E.070.D.3.g). However, provisions in LUC 20.25E.060.C. a through e would apply, which require avoidance, minimization, and mitigation for temporary and permanent disturbance. Therefore, it is anticipated that any potential impacts of the East Link Expansion would be mitigated at a project level.

Table 6-4. Summary of potential impacts from transportation facilities.

Functions	Potential Impacts to Functions
Hydrologic	Increase in stormwater runoff and discharge in association with more impervious surfaces.
Water Quality	Increase in contaminants associated with the creation of new pollutant-generating impervious surfaces (e.g. metals, petroleum hydrocarbons).
Vegetative/Habitat	Greater potential for increased erosion, bank instability, and turbidity associated with vegetation clearing.
	Fish passage impacts associated with stream crossings.

Utilities (20.25E.070.E)

In the Draft SMP, utilities refer to utility systems and facilities identified in the Transportation and Utility Use Chart (see LUC 20.25E.030). Utilities provisions do not apply to ancillary residential utility connections.

All identified utility uses, with the exception of satellite dishes, may only be approved if there is no technically feasible alternative. As a result, future utilities should be expected to be rarely permitted. In contrast, connections to legally established utilities are allowed under the SMP; these connections should be expected to occur more frequently.

Connections to utilities can result in increased erosion, bank instability, and turbidity associated with vegetation clearing (Table 6-5).

Some of the key standards in the Draft SMP related to utilities uses that help maintain shoreline functions are identified in Table A-6 of Appendix A. The City's sewer main, or "Lake Line," runs just waterward of the shoreline in Lake Washington. The sewer main is deteriorating, and repair or replacement of the sewer line is planned. If the replacement is not identified in a Council-adopted Master Plan, it would require approval through the Shoreline Conditional Use process, in which case mitigation sequencing and demonstration of no net loss would be required. However, if the replacement is identified in a Council-adopted Master Plan, the project would need to comply with the Shoreline Substantial Development Permit requirements. Provisions in the Draft SMP require minimization and mitigation of temporary or permanent impacts from maintenance, repair or minor expansion of utilities. The Draft SMP also requires

minimization measures for the siting and design of new and expanded facilities, but it does not explicitly require mitigation for new or expanded facilities in LUC 20.25E.070.E. It is unclear whether mitigation would be required through the application of provisions in LUC 20.25E.060.C. If mitigation was not required for new and expanded utility facilities, unavoidable impacts to shoreline functions could occur. It is also unclear whether the "Lake Line" project would be classified as repair or as new or expanded facilities.

Table 6-5. Summary of potential impacts from utilities.

Functions	Potential Impacts to Functions
Hydrologic	Where utilities require shoreline armoring, associated hydrologic impacts are likely.
	Erosion at stormwater outfall locations can alter sediment transport processes.
Water Quality	Potential for contaminant spill or leakage.
Vegetative/Habitat	Greater potential for increased erosion, bank instability, and turbidity associated with vegetation clearing.
	Outfalls can transport pollutants to shoreline waterbodies.

6.1.4 Shoreline Modifications (LUC 25.25E.080)

The Draft SMP contains numerous regulations intended to address the potential impacts of specific shoreline modifications. The potential impacts of specific shoreline modifications, and the regulations intended to address them, are discussed in the following sections. Tables A-7 through A-11 in Appendix A identify some of the key provisions proposed in the Draft SMP and the functions that they directly affect.

Breakwaters, Jetties and Groins (LUC 25.23E.080.B)

Breakwaters, jetties and groins are usually intended to alter currents or to deflect or dissipate wave energy. Breakwaters, jetties and groins have the potential to cause intended and unintended impacts on natural bank erosion, sediment transport processes, and habitat.

Potential impacts from these structures are summarized below in Table 6-6.

The Draft SMP prohibits new jetties and groins, so these structures will not be installed on City shorelines in the future. The Draft SMP also prohibits solid landfill or rockery breakwaters, so any breakwaters constructed in the City would likely be less impactful floating structures.

Table 6-6. Summary of potential impacts from breakwaters, jetties and groins.

Functions	Potential Impacts to Functions
Hydrologic	Potential interference with movement of sediments, altering substrate composition.
Water Quality	Reduced circulation and associated changes in water quality.
Vegetative/Habitat	Migration barriers for aquatic species.
	Habitat alterations and shading.

Clearing, Grading and Fill in the Shoreline (LUC 20.25E.080.C)

Clearing, grading and fill frequently occur as part of development projects. Accordingly, these development activities should be expected to commonly occur along Bellevue's shorelines in the future.

Potential impacts from clearing, grading and fill are summarized below in Table 6-7.

Some of the key standards in the Draft SMP related to clearing, grading, and fill that help maintain shoreline functions are identified in Table A-8 of Appendix A. The Draft SMP limits the extent of clearing, grading and fill to the minimum necessary for the approved use. The Draft SMP also limits the activities for which fill and excavation below the OHWM are allowed. A provision related to the quality of fill also helps limit the potential that fill material will adversely affect water quality of aquatic habitat.

Table 6-7. Summary of potential impacts from clearing, grading and fill.

Functions	Potential Impacts to Functions
Hydrologic	Alteration of existing water runoff patterns due to topographical alterations.
	Alterations in the stormwater retention timing and infiltration due to the loss of vegetation.
Water Quality	Short-term and long-term increases in turbidity related to vegetation removal and soil disturbance.
	Reduced biofiltration of stormwater resulting from vegetation removal.
Vegetative/Habitat	Loss of functions due to removal or disturbance.

Dredging and Dredge Material Disposal (LUC 20.25E.080.D)

Dredging can have consequential effects on sediment transport, short-term effects on water quality, and by creating deep water, the act of dredging can eliminate valuable shallow, nearshore habitat (Table 6-8).

The Draft SMP establishes standards for new development to avoid the need for future maintenance dredging and includes strict limits on when dredging may be allowed. As a result, the most likely dredging applications are expected to be related to maintenance dredging of previously dredged channels where habitat functions are already altered. The Draft SMP also requires that dredging not cause long-term adverse impacts to water quality or aquatic habitat in adjacent

areas. Some of the key standards in the Draft SMP related to dredging and dredge disposal are identified in Table A-9 of Appendix A.

Table 6-8. Summary of potential impacts from dredging and dredge disposal.

Functions	Potential Impacts to Functions
Hydrologic	Alteration of hydrologic and sediment processes.
Water Quality	Reduction in water quality from turbidity and in-water dredge material disposal.
Vegetative/Habitat	Disruption of benthic community and submerged aquatic vegetation.
	Reduction in shallow-water habitat.

Non-Residential Moorage Facilities, Boat Ramps and Launches (LUC 20.25E.080.E)

Table 4-1 quantified the number of permits issued from 2003 through 2013 for new or replaced piers, as well as repaired piers. Because Bellevue's shorelines are predominantly residential, the numbers reported in Table 4-1 most likely reflect residential pier development activity. Given the limited extent of non-residential shorelines, combined with the built-out character of these shorelines, new non-residential moorage facilities, boat ramps and launches are expected to comprise few projects. Replacement or repair of such facilities is relatively more likely.

Overwater structures, boat ramps and launches can have a variety of impacts primarily stemming from the shading of nearshore areas, water quality degradation from associated uses, and disturbance of sediment transport (Table 6-9).

The SMP addresses potential impacts by applying specific dimensional standards, and including provisions that require avoidance, minimization and mitigation of effects on shoreline ecological function. Some of the key standards in the Draft SMP related to non-residential moorage facilities that help maintain shoreline functions are identified in Table A-10 of Appendix A.

Table 6-9. Summary of potential impacts from non-residential moorage facilities, boat ramps, and launches.

Functions	Potential Impacts to Functions
Hydrologic	Potential interference with movement of sediments, altering substrate composition.
	Sediment disturbance associated with periodic maintenance dredging.
Water Quality	Water quality degradation associated with construction of docks and other in-water structures (e.g. spills, harmful materials use) and related uses of new docks (e.g. boat maintenance and operation).
Vegetative/Habitat	Increased shading in nearshore habitat areas resulting from dock and pier construction can limit growth of aquatic vegetation and alter habitat for and behavior of aquatic organisms, including juvenile salmon.
	Disturbance of substrate and submerged aquatic vegetation from pilings, anchors, or periodic maintenance dredging.
	Nighttime lighting effects on fish behavior.
	Loss of habitat for benthic community, less LWD for habitat complexity.

Shoreline Stabilization (LUC 20.25E.080.F)

Shoreline stabilization structures are common features on the City's shorelines, particularly on Lake Washington (81percent armored) and Lake Sammamish (71 percent armored). New shoreline stabilization measures are expected to be rare, as the City has not permitted any new shoreline stabilization projects in the past 10 years, although some new stabilization measures have been tied to resolving enforcement actions. Repair and replacement of existing structures can be expected to occur more commonly (the City permitted 30 such projects in the last decade).

Shoreline stabilization measures can impact sediment transport processes, which in turn affect submerged aquatic vegetation and nearshore habitat functions (Table 6-10).

Some of the key standards in the Draft SMP related to shoreline stabilization measures that help maintain shoreline functions are identified in Table A-11 of Appendix A. The Draft SMP substantially limits the development of new shoreline stabilization structures by establishing strict permitting criteria. The Draft SMP further ensures that new structures evaluate and implement the stabilization approach with the least potential for impacts to shoreline functions. Replacement of stabilization measures would generally be allowed so long as they occurred in the same location, size, and design. Unless the Director concludes there is no practical alternative, a vertical bulkhead could not be replaced in-kind, but replacement with a riprap revetment with a maximum slope of 1:1 would be permissible (replacement of vertical bulkheads is allowed in the Shoreline Residential-Canal environment designation). Based on an inventory of shoreline stabilization measures completed as a part of the Shoreline Analysis Report, approximately 30 and 56 percent of the residential shorelines along Lake Washington and Lake Sammamish, respectively, have existing

vertical bulkheads. A very modest reduction in the effect of stabilization on sediment transport processes may be anticipated as these vertical bulkheads are replaced with sloped revetments, since vertical bulkheads will tend to reflect wave energy more and create a more abrupt shoreline transition compared to sloped stabilization. On the other hand, rip rap revetments at a 1:1 slope still affect shoreline processes, and scour at the base of the revetment would be expected to continue. The continued effect of this scour could mean that the shoreline is deepened over time adjacent to the bulkhead. In this case, shoreline functions could continue to degrade despite the minor reduction in the effect on shoreline processes.

Table 6-10. Summary of potential impacts from shoreline stabilization.

Functions	Potential Impacts to Functions
Hydrologic	Increase in wave energy at the shoreline resulting in erosion of the lakebed at the base of the bulkhead and to adjacent properties, as well as uprooting of aquatic vegetation.
	Disruption of shoreline wetlands (where they exist presently).
Water Quality	Water quality impacts associated with construction.
	Removal of shoreline vegetation increases erosion and water temperatures.
Vegetative/Habitat	Reduction in shoreline vegetation.
	Increased slope reduces shallow nearshore habitat area.

6.1.5 Shoreline Environment Designations

The Draft SMP includes five upland environment designations, as well as an Aquatic environment designation to address in-water areas. Maps of the environment designations can be seen at the following webpage: http://www.ci.bellevue.wa.us/pdf/Land%20Use/Environment_Designation_04-08-11_LR.pdf).

The five upland environment designations were assigned based on the existing use pattern, the biological and physical character of the shoreline as identified in the Shoreline Analysis Report, and community goals as expressed in the Bellevue Comprehensive Plan. According to the environment designation purpose and designation criteria contained in the Draft SMP (LUC 20.25E.010.D), the upland environment designations are generally intended to allow less intensive uses in less altered areas, and more intensive uses in more altered areas. This strategy helps minimize cumulative impacts by concentrating development activity in lower functioning areas that are not likely to experience function degradation with incremental increases in new development. The City's upland environment designations, generally ordered from higher ecological function/less intensive development to lower ecological function/more intensive development, are as follows:

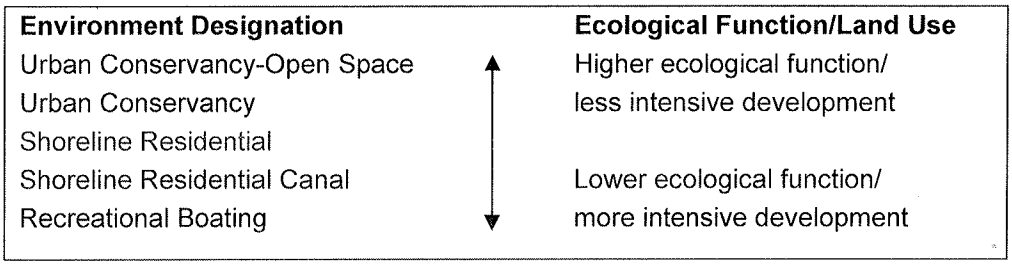

Figure 6-1. Upland environment designations generally ordered from higher ecological function/less intensive development to lower ecological function/more intensive development.

Table 6-11, below, identifies prohibited and allowed land use classifications for each of the shoreline environment designations. Consistent with the environment designation purpose and designation criteria, the Draft SMP shows a pattern of allowing less intensive uses in less altered areas, and more intensive uses in more altered areas (the table has been colorized to help illustrate this pattern). The Urban Conservancy-Open Space environment is generally the most restrictive with respect to allowed development, while the Urban Conservancy environment allows a limited amount of additional development options. The Shoreline Residential and Shoreline Residential Canal environments are generally very similar with respect to allowed development. The Recreational Boating environment accommodates the most intensive types of shoreline development, such as marinas and fueling stations.

Table 6-11. Shoreline use chart.[1]

KEY[2]

SSDP - Permitted Use subject to Shoreline Substantial Development Permit or Exemption requirements

(#) - Allowed as accessory use

C - Shoreline Conditional Use subject also to SSDP requirements

X - Use not allowed

	Aquatic	Urban Conservancy-Open Space	Urban Conservancy	Shoreline Residential	Shoreline Residential Canal	Recreational Boating
RESIDENTIAL						
Single-Family Dwelling	X	SSDP (1)	SSDP (1)	SSDP	SSDP	SSDP (2)
Multifamily Dwellings (Two or more units per structure)	X	X	SSDP (3)	SSDP (4)(5)	X	X
Congregate Care Senior Housing	X	X	X	SSDP (5)(6)(7)	X	X
Nursing Home	X	X	X	SSDP/C (5)(7)(8)	X	X
Assisted Living	X	X	X	SSDP/C (5)(7)(8)	X	X
Accessory Dwelling Unit (9)	X	SSDP	SSDP	SSDP	SSDP	X
TRANSPORTATION AND UTILITIES						
Water-dependent transportation: Commercial float plane and ferry terminal	(1)	X	X	X	X	C (11)
Highway and Street Rights-of-Way (2)	C/SSDP (3)	C/SSDP (3)	C/SSDP (3)	SSDP	SSDP	SSDP
Railroads (2)	C	C	C	C	C	C
Pedestrian and bicycle, facilities (2)	SSDP	SSDP	SSDP	SSDP	SSDP	SSDP
Accessory Parking, Loading and Maintenance Access	X	(4)	(4)	(4)	(4)	(4)
Regional light rail alignment including bridges, stations and associated structures	TBD	TBD	TBD	TBD	TBD	TBD
Park and Ride (2)	X	C	C	C	C	C
Utility Facility, excluding Electrical Utility Facility (2)(3)(5)	C/SSDP	C/SSDP	C/SSDP	C/SSDP	C/SSDP	C/SSDP
Local Utility System (2)	SSDP	SSDP	SSDP	SSDP	SSDP	SSDP
Regional Utility System, except Electrical Utility Facility (2)(3)(5)(6)	C/SSDP	C/SSDP	C/SSDP	C/SSDP	C/SSDP	C/SSDP
Essential Public Facility (2)(7)	C	C	C	C	C	C
Wireless Communication Facility (WCF): (without WCF Support Structures) (2)(8)	X	C	C	C	C	C

KEY[2]

SSDP - Permitted Use subject to Shoreline Substantial Development Permit or Exemption requirements

(#) - Allowed as accessory use

C - Shoreline Conditional Use subject also to SSDP requirements

X - Use not allowed

	Aquatic	Urban Conservancy-Open Space	Urban Conservancy	Shoreline Residential	Shoreline Residential Canal	Recreational Boating
Communication, Broadcast and Relay Towers including WCF Support Structures (Freestanding) (2)(8)	X	C	C	C	C	C
Satellite Dishes (9)	X	SSDP	SSDP	SSDP	SSDP	SSDP
Electrical Utility Facility (2) (10)	C	C	C	C	C	C
WHOLESALE AND RETAIL						
Water-dependent commercial, wholesale, retail	X	X	(1)(2)	X	X	(1)(2)
Water-related, water-enjoyment commercial, wholesale, retail	X	X	(1)(2)	X	X	(1)(2)
Retail Boat Sales	X	X	X	X	X	(1)(2)
Marina Fueling Stations	X	X	X	X	X	(1)(2)
Eating and Drinking Establishments	X	X	(1)(2)	X	X	(1)(2)
SERVICES						
Environmental Education, and Interpretive Centers	(1)	(1)(2)	(1)(2)	X	X	(1)(2)
Religious Activities	X	X	C	C	C	C
Administrative Office – General	X	X	X	X	X	(3)
RECREATION						
Public Marinas	(1)	X	X	X	X	C/SSDP (2)(3)
Private Marinas	(1)	X	X	X	X	SSDP/C (4)
Yacht Clubs	(1)	X	X	X	X	SSDP/C (4)
Community Club	(1)	X	X	X	X	SSDP/C (4)
Boat Moorage (5)	(1)	X	(1)	X	X	(1)
Boat Storage (cradle and trailer)	(1)	X	(1)	X	X	(1)
Boat Storage (dry stacked)	(1)	X	X	X	X	(1)
Boat launch ramps (motorized)	(1)	X	(1)	X	X	(1)
Boat launch ramps (non-motorized)	(1)	SSDP	(1)	X	X	(1)
Public/Private Park	(1)	C	C	C	C	C
City Park	(1)	C/SSDP (2)	C/SSDP (2)(3)	C/SSDP (2)	C/SSDP (2)	C/SSDP (2)(3)
RESOURCES						
Agriculture	X	X (1)	X (1)	X	X	X

KEY[2]

SSDP - Permitted Use subject to Shoreline Substantial Development Permit or Exemption requirements

(#) - Allowed as accessory use

C - Shoreline Conditional Use subject also to SSDP requirements

X - Use not allowed

	Aquatic	Urban Conservancy-Open Space	Urban Conservancy	Shoreline Residential	Shoreline Residential Canal	Recreational Boating
Nurseries	X	C/SSDP (2)	C/SSDP (2)	X	X	X
Aquaculture	C	X	X	X	X	X

[1] The table includes important caveats that limit use where indicated, but for brevity they have not been included in this report.

[2] Key has been modified for purposes of this report.

The environment designations also establish the dimensional requirements of the Draft SMP. Table 6-12 below (Chart 20.25E.050.A in the SMP) identifies key dimensional requirements of the Draft SMP. Similar to shoreline uses, the Draft SMP generally shows a pattern of featuring more restrictive dimensional requirements in less altered areas, and less restrictive dimensional requirements in more altered areas.

Table 6-12. Dimensional requirements.[1]

	Aquatic	Urban Conservancy-Open Space	Urban Conservancy	Shoreline Residential	Shoreline Residential Canal	Recreational Boating
Shoreline Structure Setback	NA	50'	50'	25'	25'	25'
Maximum Lot Coverage by Structures (percent)	NA	25% (2)(5)	5% (2)(5)	(3)	(3)	(3)
Maximum Building Height	NA	35'	35'	35'	35'	35'
Maximum Impervious Surface (percent)	NA	35%	10%	(4)	(4)	65%

[1] While the table notes include important caveats, for brevity they have not been included in this report.

6.2 Analysis of Cumulative Impacts by Environment Designation

This section evaluates anticipated cumulative impacts by environment designation. This section is intended to identify how the different components in the draft SMP, as well as ongoing regulations and programs, will integrate to address potential shoreline development. Where the potential for adverse cumulative effects to shoreline functions exist, they are identified below.

6.2.1 Shoreline Residential Environment Designation

Upland Development/Redevelopment

As described in Chapter 4, future residential development is expected to occur primarily through the redevelopment and remodeling of existing structures. Single-family residential development is exempt under the SMA, meaning that it does not require a Shoreline Substantial Development Permit. Nevertheless, exempt development must still be carried out in compliance with policies and standards of the SMP.

The residential use and development of shoreline uplands generally involves impacts to shoreline ecological functions that result from the replacement of pervious, vegetated areas with impervious surfaces and/or a landscape management regime that includes chemical treatments of lawn and landscaping. As discussed in the Shoreline Analysis Report, these actions have multiple potential effects on shoreline ecological functions, including:

- Increase in surface water runoff due to reduced infiltration area and increased impervious surfaces.
- Potential contamination of surface water and groundwater from use of chemicals, nutrients and heavy metals.
- Reduction in the ability of a site to improve the quality of waters passing through untreated vegetation and soils.
- Elimination of overhanging vegetation.

Standards in the Draft SMP that help limit potential water quality impacts associated with shoreline residential uses include standards limiting the size and location of accessory parking facilities and driveways, as well as standards requiring the use of best management practices to control runoff for these facilities. Residential uses must also comply with the City's current Storm and Surface Water Utility Code, the Storm and Surface Water Engineering Design Standards, and the Clearing and Grading Code.

The Draft SMP establishes a 25-foot structure setback in the Shoreline Residential environment. The proposed setback is lower than the median existing conditions, as described in Section 3.2. Along shorelines designated Shoreline Residential, the median existing setback is 47 feet on Lake Washington, 53 feet on Lake Sammamish, and 89 feet on Phantom Lake (see Table 3-14 in Section 3.2). Because the proposed setback is closer to the shoreline than the majority of existing houses in the Shoreline Residential environment, it is anticipated that as residential structures are redeveloped, many will be positioned closer to the shoreline compared to existing conditions. Where wetlands occur along Phantom Lake, wetland critical area buffers would need to be followed, which will help protect shoreline functions there.

The Draft SMP includes Greenscape Conservation Standards that apply when structures are proposed within 50 feet of the OHWM or when hardscape is proposed within the 25-foot structure setback. When a structure is proposed within 50 feet of the OHWM, a minimum of 50 percent of the shoreline setback area must be preserved or restored to "greenscape"; hardscape must make up less than 15 percent of the first 10 feet adjacent to the OHWM; and "greenscape" preservation or restoration within 50 feet of the shoreline is required at a 1:1 ratio equal to the square footage of the proposed structure. The Draft SMP allows for impervious surface area, or "hardscape," in up to 50 percent of the shoreline setback area, provided that no more than 15 percent of the 10 feet closest to the OHWM is impervious.

The impact of the impervious surface allowances in the Draft SMP will be most consequential where those surfaces replace existing vegetative functions. The City of Bellevue Land Use Code defines "greenscape" as "all living plant, tree, hedge, and shrub material" (LUC 20.50.022). This includes lawn, as well as ornamental landscaping, such as flower beds, as well as native shrubs and trees. However, whereas native trees, shrubs, and emergent vegetation provide water quality and shoreline habitat functions, maintained lawn and ornamental vegetation typically may not have the same benefits. Instead, these areas may result in water quality degradation as a result of chemical fertilizers, herbicides, and pesticides that may be applied. Additionally lawn areas and groundcover do not provide potential overhanging cover.

The conservation of lakeshore vegetation is important to the habitat of the Lake Washington and Lake Sammamish shorelines. Threatened juvenile Chinook salmon preferentially use shallow water habitats with overhanging vegetation during the spring outmigration period. Lawns and ornamental plantings will typically not provide the same level of habitat function for overhanging vegetation or shading compared to native shoreline species assemblages. Lakeshore vegetation also helps maintain water quality conditions by filtering pollutants, including nutrients and chemicals. On Phantom Lake, where

threatened salmonids are not present, lakeshore vegetation still provides nearshore shading, potential for water quality improvement, and shoreline stabilization.

The Draft SMP includes general provisions to focus land alterations on the least sensitive areas and to limit the extent of clearing and grading, but because the Draft SMP applies specific Greenscape Conservation Standards, no additional steps to document mitigation sequencing would be required to clear up to 50 percent of the setback area in order to accommodate a shoreline hardscape. SMP provisions reference the City's tree preservation code, but that reference only applies to new single family structures and additions to impervious surface areas that exceed 20 percent. In those cases, the tree preservation code (LUC 20.20.900.F.1) requires a minimum retention of 30 percent of the diameter at breast height (dbh) of significant trees (applied throughout the parcel, and not limited to shoreline jurisdiction or lakeshore vegetation). Generally, this standard tends to result in clearing along the waterward side of the residence and preservation of vegetation on the landward side of the residence. The tree preservation code allows for a reduction in forest canopy cover, it does not ensure that non-significant trees are conserved, and it does not apply any sort of preference for maintaining vegetation along the lakeshore. As a result, the tree preservation code alone is not likely to be sufficient to maintain shoreline vegetation functions along residential shorelines.

Because the Draft SMP does not require protection or mitigation for impacts to existing vegetation, and it allows residential redevelopment to reduce the existing setback area where vegetative functions presently occur, a net loss in shoreline vegetative functions is anticipated as a result of residential redevelopment under the Draft SMP.

Overwater Structures

Most residential parcels on Lake Washington and Lake Sammamish have existing overwater structures (93 percent and 91 percent, respectively). Permit trends show 26 and 29 new or replacement piers were permitted on Lake Washington and Lake Sammamish, respectively. A total of 65 Shoreline Residential parcels do not have existing docks (19 on Lake Washington, 29 on Lake Sammamish, and 17 on Phantom Lake). Given the number of parcels without docks, some entirely new piers may be developed in the coming years. The number of permitted repairs to existing docks was approximately double the number of new and replacement docks (58 on Lake Washington and 49 on Lake Sammamish). No permits were issued for new, replacement, or repaired docks on Phantom Lake; therefore, the rate of change to overwater structures in Phantom Lake in the future is expected to continue to be low or modest.

As described in the Shoreline Analysis Report, overwater cover can impact growth of aquatic vegetation and associated habitat conditions. Overwater cover can also affect the predator-prey relationship between native fish and non-native fish, particularly between threatened Chinook salmon and other salmonids and introduced bass.

The Draft SMP allows for up to four boatlifts and one translucent canopy per residential dock (LUC 20.25E.065.H.6). In the permit history, 61 new or replacement boatlifts were permitted in the City (37 in Lake Washington and 24 on Lake Sammamish). New or replacement boatlifts are expected to continue to be installed at rates similar to recent trends. Under the Draft SMP, these boatlifts would need to be located at least 30 feet waterward from the OHWM, unless otherwise permitted by State or federal agencies. In order to minimize the impacts of boatlifts, the Draft SMP states that boatlifts attached to the dock are preferred over freestanding boatlifts. However, in cases where a freestanding boatlift is proposed, it is unclear how compliance with this preference would be determined. The primary impact of new boatlifts attached to the dock would be related to shading, which may be approximately equivalent to the impact from existing boat moorage. On the other hand, where freestanding boatlifts are permitted, they will also result in alterations to in-water structure. Although these changes are individually minor, on a cumulative basis, they could be consequential.

The Draft SMP establishes dimensional standards for new and reconfigured docks, including maximum length, width, area, and location of ells. The provisions also specify the use of grated decking and non-toxic materials. These provisions are designed to minimize impacts, particularly in the nearshore 30 feet where shallow water habitats support aquatic vegetation and rearing habitats for juvenile Chinook salmon and other fish species. The proposed dock standards also help to limit boat activity in shallow, vegetated areas. Where docks are reconfigured, these standards are likely to lessen impacts compared to existing conditions; however, where new docks are established, they will increase impacts compared to existing conditions.

The Draft SMP includes a provision that allows for deviations from the prescribed limits so long as they are approved by the Corps or WDFW. This allowance means that docks larger than the proposed standard could be permitted and that the SMP relies on the permitting processes of the Corps and WDFW to ensure that no net loss of functions is maintained. Mitigation measures for new or replacement overwater structures encouraged by WDFW include the installation of grated decking, removal of unused piles (especially those formerly treated with creosote), reduction of pile size and quantity on modified structures, and general reduction in overall square footage of cover. The Corps previously permitted docks on Lake Washington and Lake

Sammamish through a Regional General Permit (RGP). That RGP expired in 2010 and has not been renewed, but the Corps still generally uses the RGP standards as permitting guidelines. These requirements are similar to the standards included in the Draft SMP. A Corps permit would also entail consultation with NMFS and/or the USFWS in waterbodies with listed fish species, which would further require demonstration of minimization and avoidance measures to limit impacts to listed salmonids.

The Draft SMP allows repair and replacement of existing docks without any requirements for grated decking or reconfiguration to meet the dimensional standards described above. This means that no improvement in shoreline functions can be assumed to result from SMP provisions in relation to these commonly occurring activities. However, State and federal oversight of in-water activities would likely require the use of grated decking and may require revised dock configuration to meet their permitting standards.

In general, it is anticipated that based on past permitting evidence, federal and State permits will require dimensional standards similar to those identified in the Draft SMP and site-specific considerations and mitigation requirements may also be incorporated. Together, the Draft SMP, along with State and federal permitting, will ensure that new and reconfigured docks will help minimize impacts to aquatic habitat. While the Draft SMP does not provide dimensional or decking standards for the repair or replacement of docks, State and federal permit processes are likely to allow for some improvements in shoreline function that could offset minor losses that would be expected to accompany any new dock development. However, the City cannot definitively predict how State and federal permit approvals will be administered.

Shoreline Stabilization

As discussed in the analysis of past permit trends in Section 4.2 and Subsection 6.1.4, new shoreline stabilization will be uncommon and the rate of future new stabilization is expected to be low; however, repair and replacement of existing stabilization measures occur with limited frequency in the City (approximately three per year).

Shoreline stabilization, particularly stabilization waterward of the OHWM, affects nearshore sediment transport processes, resulting in the artificial steepening of the shoreline and the reflection of wave energy. Past studies in Lake Washington have found that during the period from mid-February to mid-April, juvenile Chinook rear along shallow lake shorelines. Shoreline stabilization tends to truncate the nearshore gradient, leaving less suitable shallow water habitat for these threatened salmonids.

The Draft SMP establishes strict standards for new and enlarged stabilization measures, further limiting the likelihood of such structures. However, as discussed in Section 6.1.4, provisions that allow for repair and replacement of existing structures in the same location, with the same size and general design (except vertical bulkheads) allow replacement bulkheads to continue to contribute to the degradation of shoreline functions over time.

In addition to the City's provisions, the Corps and WDFW have jurisdiction over shoreline stabilization projects. As part of their efforts to minimize and compensate for shoreline stabilization-related impacts, both agencies require implementation of native shoreline enhancement for new shoreline stabilization projects. The Corps has a Nationwide Permit (NWP 13) for bank stabilization, which allows for a quicker, less involved application compared to an individual permit. The Seattle District applies Regional Conditions to NWP 13 that require both demonstration of the need for the work and "that the proposed project incorporates the least environmentally damaging practical bank protection methods." This standard affects both new and replacement stabilization, therefore applying a higher standard of environmental protection for replacement structures than the Draft SMP.

Based on past permit trends and stringent standards for new and expanded stabilization in the Draft SMP, new stabilization permits are expected to be very rare or non-existent in the City. On a cumulative basis, despite site-specific mitigation requirements, the infrequent addition or expansion of shoreline stabilization measures would likely result in some level of habitat degradation. This loss might be offset by the functional gains achieved as existing bulkheads are replaced and their impacts on shoreline habitat are reduced either through voluntary natural shoreline restoration; environmental protection standards associated with the Corps' Regional Conditions to NWP 13; or the conversion from vertical bulkheads to sloped riprap revetments as required by the Draft SMP. On its own, the SMP may allow for a reduction in shoreline functions; however, federal and State regulatory oversight is likely to establish a higher standard for the replacement of shoreline stabilization that may help to maintain no net loss of functions. As noted for overwater structures, the City cannot definitively predict how State and federal permit approvals will be administered.

6.2.2 Shoreline Residential Canal Environment Designation

The Shoreline Residential Canal environment is unique compared to other shorelines in the City for the following reasons:

- The canals were artificially created, and are maintained by vertical bulkheads.

- Bulkheads are used for moorage along many of the residential parcels.
- Where overwater structures occur waterward of the bulkhead (approximately 59 percent of parcels) they are necessarily smaller than other shoreline residential areas in the City to avoid impeding navigation.
- The designation is fully developed with residential structures with a median setback of 33 feet.

Because of these unique characteristics, the proposed setback of 25 feet, with additional limits on impervious surface coverage in the setback and the area between 25 and 50 feet from the OHWM, should approximately maintain existing water quality functions in this environment designation. As discussed above, because vegetation conservation standards do not apply, there is no assurance that vegetative functions in the Shoreline Residential Canal designation will be maintained. However, due to the artificial, steep banks and the highly altered shoreline adjacent to the bulkheads, the potential reduction in shoreline functions is small in this designation. Furthermore, because the docks occur parallel to the shoreline to accommodate moorage and maintain navigation, vegetative functions are nearly completely interrupted under existing conditions.

Proposed standards for docks and piers limit the dock size to 100 square feet and require grated decking on new and reconfigured docks. Because the shorelines in this environment designation are artificially constructed with vertical banks, there is little to no loss of habitat or hydrologic function that would be anticipated with new or replacement structures.

The Draft SMP allows for replacement of vertical bulkheads in this designation because they are required to maintain navigational access through the canals. Additionally, the Draft SMP allows for maintenance dredging to the previously approved location, width and depth. Although such dredging is expected to cause temporary disturbance from turbidity and removal of benthic species assemblages, because of the existing, highly altered condition in the Shoreline Residential Canal environment, no permanent change in ecological functions is anticipated as a result of stabilization or dredging allowances in the Draft SMP.

In summary, the Draft SMP is expected to generally maintain functions in the Shoreline Residential Canal environment.

6.2.3 Urban Conservancy & Urban Conservancy-Open Space Environment Designation

The Urban Conservancy and Urban Conservancy-Open Space environments, with the exception of the Bellefield Office Complex (discussed below), are mostly composed of active and passive recreational park uses. Occasional changes and renovation of park amenities may be anticipated; however, parks uses will need to comply with setback, vegetation conservation standards, and specific dimensional standards for shoreline public access facilities. The proposed setback of 50 feet is smaller than the median setback, but vegetation conservation standards will require conservation and mitigation for lost vegetative functions as a result of development within that area. The SMP balances the potentially competing demands of public access and ecological function by requiring that public access amenities be as close to the shoreline as possible without adversely affecting sensitive ecological features or resulting in a measureable net loss of shoreline ecological functions.

In addition to potential improvements to public access amenities, the Shoreline Restoration Plan identified several potential projects to improve shoreline conditions in the City's parks. Projects include shoreline restoration at Clyde Beach Park, Meydenbauer Beach Park, Chism Beach, Newcastle Beach Park, Mercer Slough, and Larsen Lake, among others. Implementation of these projects is not presently funded, but they are likely to be implemented in the foreseeable future; if the restoration projects are implemented, then the anticipated minor loss of functions that may be associated with development of park amenities under the Draft SMP would be expected to be offset.

Bellefield Office Complex

The Bellefield Office Complex is surrounded by the Mercer Slough Wetland. The Office complex was built on piles over a peat wetland. As a result, the land has subsided, causing regular inundation of roads and parking areas, as well as standing water in surrounding wetlands. The Draft SMP prohibits administrative office uses in the Urban Conservancy environment; therefore, the office use would be considered non-conforming. The Draft SMP does allow for alteration to and replacement of non-conforming uses in the Office or Office Limited Business Land Use Districts. The replacement structure footprint may be moved to a less sensitive portion of the site if the movement reduces impacts to critical areas or shoreline vegetation and restores functions in the areas vacated pursuant to a mitigation plan (LUC 20.25E.040.G.3.C.v.). By allowing for relocation of the office structures to a less sensitive portion of the property and requiring mitigation, the SMP standards ensure no net loss of functions in the Bellefield Office Complex.

6.2.4 Recreational Boating Environment Designation

As noted in Subsection 6.1.4, shoreline modifications associated with the Recreational Boating environment will likely occur infrequently compared to modifications associated with the Shoreline Residential environments. The Draft SMP establishes numerous standards for new and expanded boating facilities, but because the shoreline is nearly fully developed, establishment of new boating facilities is expected to be rare. Instead, expansion, maintenance, and repair of existing facilities is expected to be more common. The SMP sets specific standards for minimizing the potential effects of expansion of boating facilities, including using upland stacked storage where feasible, minimizing the size of structures, avoiding areas of aquatic vegetation, removing skirting, using light-penetrable decking, and avoiding the need for maintenance dredging. Additionally, the Draft SMP includes a provision allowing the Director to require compensatory mitigation to meet no net loss of functions. Repair of over 50 percent of the decking, piles, or substructure of a pier in a five-year period requires use of light-penetrable decking. As existing piers are replaced in the Recreational Boating environment over time, a gradual improvement in shoreline function is expected.

7 Summary of Net Effect on Ecological Function

The Draft SMP proposes new shoreline environment designations and development standards for shoreline modifications and uses and establishes protections for shoreline functions and processes. The system of environment designations is consistent with the established land use pattern, as well as the land use vision in the City's comprehensive plan and other long-range planning documents. The updated development standards are largely consistent with available scientific information on protecting aquatic areas. The standards help restrict activities that would cause adverse impacts to the shoreline environment, encourage other low impact development (LID) strategies, and create restoration incentives.

The Bellevue shorelines are largely developed in residential uses. There are limited opportunities for new development within shoreline jurisdiction. Therefore, major changes in development patterns or type of use are unlikely. Much of the foreseeable development activity will be redevelopment of existing structures. The Draft SMP protections will be enhanced and strengthened as a result of the other local, State and federal regulations that apply to shoreline use and development. The City will seek to implement the Shoreline Restoration

Plan, which identifies opportunities to improve or restore ecological functions that have been impaired as a result of past development activities.

NOTE: A determination of whether the Draft SMP will prevent a net loss of shoreline ecological functions from existing baseline conditions will be included in the final cumulative impacts analysis and as such the City reserves the right to modify this working draft as certain policy decisions are made by the Bellevue City Council. Included with this working draft is a Draft Recommendations Memorandum, which provides suggestions for modifications to the Draft SMP that would help the City meet the "no net loss" standard. Suggested modifications in that memorandum, however, should not be interpreted as the only means to achieve no net loss of shoreline functions.

Tables 7-1 and 7-2 below identify the key measures that help to maintain functions and those that cumulatively are expected to allow for a loss of functions, respectively. Other regulations not addressed in Tables 7-1 and 7-2 also play a substantial role in determining whether the Draft SMP will meet the standard of no net loss of functions. Generally, those regulations not addressed in Tables 7-1 and 7-2 are expected to maintain functions; however, the actual achievement of no net loss will depend on the implementation, monitoring, and enforcement of provision standards. The tables below are meant to inform the City of potential future shoreline impacts, the importance of specific Draft SMP provisions in helping to meet the standard of no net loss of shoreline ecological functions, and areas where the Draft SMP may allow for a cumulative loss of shoreline functions.

Table 7-1. Key features of the Draft SMP that help maintain shoreline ecological functions.

Category	Measures that Help Achieve No Net Loss of Functions
Environment Designations	• The Newport Shores Area is differentiated from other shoreline residential areas because of its unique characteristics and associated standards for stabilization and overwater structures.
General Requirements	• Provide standards that help to minimize effects of development on water quality and minimize the future need for new shoreline stabilization. • Vegetation conservation standards apply to the setback area in the Urban Conservancy, Urban Conservancy-Open Space and Recreational Boating environments (see concerns surrounding vegetation conservation in the Shoreline Residential environment in Table 8-2). • Compliance with the City's Storm and Surface Water Utility Code, the Storm and Surface Water Engineering Design Standards, and the Clearing and Grading Code will help limit stormwater impacts.
Use Regulations	• Prohibit uses that are incompatible with the existing land use and ecological conditions, and emphasize appropriate location and design.

Category	Measures that Help Achieve No Net Loss of Functions
Shoreline Modifications	• Dimensional and materials standards for new and reconfigured docks help limit their impact on aquatic habitat. • Provisions applicable to the repair and replacement of docks in non-residential areas help offset incremental losses that may be associated with expansion of existing facilities. • Strict standards for new and enlarged stabilization measures limit the likelihood of such structures. • Standards for replacement of shoreline stabilization will limit future vertical bulkheads. • The Draft SMP avoids a potential disincentive to softer shoreline stabilization by maintaining the regulatory OHWM and setback at its pre-project location.
Shoreline Restoration Plan	• The Restoration Plan establishes clear priorities and identifies resources to enable coordinated restoration of the City's shoreline. The Restoration Plan further identifies and defines specific projects, predominantly on public lands, that are likely to be implemented in the foreseeable future.

Table 7-2. Summary of features that may allow for net loss of shoreline ecological functions (need to explore either alternative regulations per the Draft Recommendations Memorandum or possibility of programmatic approach to fill gaps).

Category	Measures that May Allow a Net Loss of Functions
General Requirements	• The "rebuttable presumption" of no net loss in LUC 20.25E.060.B.2, assumes that standards in the SMP are sufficient to meet no net loss; however, the specific requirements are not always consistent with the no net loss standard (as described in the remainder of this table). • Mitigation sequencing is only explicitly required for Shoreline Conditional Uses, Shoreline Variance, Special Shoreline Reports, or as required for a site-specific mitigation plan. This approach might be sufficient to achieve no net loss if prescriptive standards implicitly required mitigation sequencing, yet standards for residential setbacks and new or expanded utilities fall short.
Dimensional Requirements	• Proposed shoreline setbacks are smaller than existing median setbacks, and they are expected to result in a reduction in setback area over time. As a result, pollutant generating surfaces would be expected in closer proximity to the shoreline than presently exist. Additionally, a reduction in setback could result in use conflicts when redeveloped homes move closer to the shoreline and block the views of adjacent lakeshore residences.
Shoreline Uses	• It is not clear whether mitigation for unavoidable impacts from new and expanded utilities is required under the Draft SMP. If the mitigation standard under LUC 20.25E.060.C does not apply because specific use provisions are provided, a net loss of functions could be anticipated with each new or expanded facility.
Shoreline Modifications	• Standards for replacement of shoreline stabilization allow for replacement in the same location, and with a 1:1 slope. This may minimize the extent of the impact on shoreline processes, but nevertheless, shoreline processes may continue to degrade shoreline functions. On its own, it is questionable whether the SMP would achieve no net loss of functions; however, the current application of State and federal permit review would require demonstration that the proposed project is the least environmentally damaging alternative. Therefore, no net loss would be expected as a result.
General Policies and Regulations	• Vegetation conservation standards (including the Greenscape Conservation Standards) in the Shoreline Residential designation are insufficient to ensure that existing vegetative functions will be maintained. They allow for a 70 percent reduction in significant trees on shoreline parcels, and they do not provide standards to maintain lakeshore vegetative functions.

ACRONYMS AND ABBREVIATIONS

CIP.....Capital Investment Program

City.....City of Bellevue

Corps.....U.S. Army Corps of Engineers

Draft SMP.....City of Bellevue Draft SMP

Ecology.....Washington Department of Ecology

EPA.....Environmental Protection Agency

ESA.....Endangered Species Act

FEMA.....Federal Emergency Management Agency

GIS.....Geographic information systems

Guidelines.....Shoreline Management Act guidelines

LID.....Low impact development

NMFS.....National Marine Fisheries Service

NPDES.....National Pollutant Discharge Elimination System

NWP.....Nationwide Permit

OHWM.....Ordinary high water mark

RCW.....Revised Code of Washington

RGP.....Regional General Permit

SMA.....Shoreline Management Act

SMP.....Shoreline Master Program

USFWS.....U.S. Fish and Wildlife Service

USGS.....U.S. Geological Survey

WAC.....Washington Administrative Code

WDFW.....Washington Department of Fish and Wildlife

WDNR ..... Washington Department of Natural Resources

APPENDIX A

Summary Tables of SMP Regulations that Protect Ecological Functions

APPENDIX A: SUMMARY TABLES OF SMP REGULATIONS THAT PROTECT ECOLOGICAL FUNCTIONS

The tables included in this appendix are meant to provide a brief summary of some of the key provisions in the Draft SMP that help to maintain shoreline functions. The tables are not comprehensive, and the Draft SMP may include other provisions that are essential to maintaining functions, which are not included in the tables. The tables identify the general category of function(s) that the provisions directly address (indicated by an "X"). A blank cell indicates that the SMP provision either does not affect the function or, more likely, that the provision has a secondary or indirect effect on the function. Since a provision may partially address the potential functional effect of a development action, an "X" does not imply that the provision fully protects a function, nor does a blank cell mean that a function will be lost.

Table A-1. **General Regulations** - Summary of key SMP general regulations that protect ecological functions.

Location in SMP (LUC)	General Regulations- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.060.B. No Net Loss of Ecological Function.	1. No Net Loss Required. Shoreline uses and development are required to ensure no net loss of ecological functions and processes.	X	X	X	X
	3. When Analysis of No Net Loss is Required. Analysis of no net loss of ecological functions is required as part of an application for a Shoreline Conditional Use Permit (LUC 20.25E.180), a Shoreline Variance (LUC 20.25E.190), and as part of a Shoreline Special Report (LUC 20.25E.160), or as required for a site-specific mitigation plan. The presumption described in paragraph B.2 of this section does not apply when analysis is required under this paragraph.	X	X	X	X
20.25E.060.D. Mitigation Requirements and Sequencing.	1. Mitigation Plans – When Required: Mitigation plans are required as part of an application for a Shoreline Conditional Use (LUC 20.25E.180), a Shoreline Variance (LUC 20.25E.190), or when required for a Special Shorelines Report. Applicants shall submit as part of the application package, a mitigation plan meeting the performance criteria of this paragraph D. Mitigation plans shall be approved as part of the permit required for the underlying project. To the extent applicable, analysis of environmental impacts and identification of required mitigation shall be consistent with the rules implementing the State Environmental Policy Act (refer to WAC 197-11, Bellevue Environmental Procedures Code Chapter 22.02 BCC, and LUC 20.35.200 through 250.	X	X	X	X

Location in SMP (LUC)	General Regulations- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
	2. Mitigation Sequencing Analysis Required. a. Mitigation sequencing. The applicant shall demonstrate compliance with the mitigation sequencing guidelines in the following order of preference: i. Avoiding the impact altogether by not taking a certain action or parts of an action; ii. Minimizing impacts by limiting the degree or magnitude of the action and its implementation by using appropriate technology, or by taking affirmative steps, such as project redesign, relocation, or timing to avoid or reduce impacts; iii. Performing the following types of mitigation (listed in order of preference): (1) Rectifying the impact by repairing, rehabilitating or restoring the affected environment; (2) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; (3) Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and (4) Monitoring the hazard or other required mitigation and taking remedial action when necessary.	X	X	X	X
	5. Mitigation Plan Requirements. d. Monitoring Program. The plan shall include a program for monitoring construction of the mitigation project and for assessing a completed project. The mitigation project shall be monitored for a period necessary to establish that performance standards have been met, but not for a period less than one year for residential projects and five years for nonresidential projects. The required monitoring period for a plan involving restoration only shall be reduced to a period of not less than three years for non-residential projects.	X	X	X	X
20.25E.060.E. Requirements Applicable to Development and Uses in the Shoreline Overlay District.	1. Disruption of shoreline resources, including land disturbing activity such as clearing and grading and tree removal, shall be the minimum necessary to accommodate the permitted use or development.	X	X	X	X
	2. New development should be located and designed to avoid the need for shoreline stabilization.	X		X	X

Location in SMP (LUC)	General Regulations- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.060.H. Accessory Parking, Loading Space, and Maintenance Access.	3. Where Allowed. Accessory parking, loading space, and maintenance access are permitted within the dimensions of the shoreline setback or vegetation conservation area (refer to LUC 20.25E.060.K) only if there is no technically feasible alternative, pursuant to the requirements of LUC 20.25E.060.C. New accessory parking, loading space, and maintenance access is prohibited in the following locations: a. On any over-water structure; or b. In a shoreline wetland or habitat associated with species of local importance. (Refer to LUC 20.25H.150).	X	X	X	X
	4. Performance Standards. a. Development in the Shoreline Overlay District. i. Location. Accessory parking, loading space, and maintenance access should be located outside the Shoreline Overlay District when functional objectives for the allowed shoreline use can be met.	X	X	X	X
	ii. Size. Area devoted to accessory parking, loading space, and maintenance access in the Shoreline Overlay District shall be the minimum necessary to support the allowed shoreline use.	X	X	X	X
	iii. Storm and Surface Water (1) Surface water runoff from accessory parking and loading spaces shall be prevented from contaminating water bodies and endangering aquatic life by using best management practices as set forth in Chapter 24.06 BCC (Storm and Surface Water Utility Code), and the City's Storm and Surface Water Engineering Design Standards (2011); now or hereafter amended.		X		
	(2) Low impact development techniques and natural drainage practices should be incorporated into new and redeveloped accessory parking and areas dedicated to loading space and maintenance access when feasible (refer to the City of Bellevue Storm and Surface Water Engineering Standards (2011), now or hereafter amended).	X	X		

Location in SMP (LUC)	General Regulations- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.060.I. Public Access.	4. Performance Standards. a. General. Design of public access locations and public access improvements shall provide opportunities for the public to reach, touch, and enjoy the water's edge and to view the water and the shoreline from adjacent locations. Public access improvements shall be located as close horizontally and vertically to the shoreline's edge as feasible, and consistent with the terms of LUC 20.25E.070.C (Recreation); provided that public access does not adversely affect sensitive ecological features or result in a measureable net loss of shoreline ecological functions.	X	X	X	X
20.25E.060 K. Vegetation Conservation.	5. Vegetation Conservation Area Dimensions. For shoreline environments other than Shoreline Residential and Recreational Boating, the dimension of the shoreline vegetation conservation area for the corresponding shoreline environment designation is as follows: Vegetation Conservation Area Dimensions Shoreline Environment — Distance Measured from OHWM Shoreline Residential — N/A Urban Conservancy — 50 feet Urban Conservancy Open-Space — 50 feet Recreational Boating — N/A	X	X	X	X
	6. Vegetation Conservation Area Landscape Standards. Upon development or redevelopment within the Urban Conservancy and Urban Conservancy Open Space Environments, the full vegetation conservation area shall be provided with native vegetation as part of the development proposal, except that those portions of the vegetation conservation area where water dependent uses are located may be developed in accordance with the specific use provisions of LUC 20.25E.070.	X	X	X	X
	7. Tree Retention and Native Vegetation Standards in the Shoreline Vegetation Conservation Area. Within the shoreline vegetation conservation area, all native vegetation as defined in the City of Bellevue Critical Areas Handbook (2009), now or hereafter amended, and existing significant trees shall be retained, provided that the trees are determined to be healthy and the trees can be safely retained consistent with the proposed development activity. Any removal of significant trees or native vegetation shall be in compliance with this section.	X	X	X	X

Location in SMP (LUC)	General Regulations- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
	8. Replanting Requirements in the Shoreline Vegetation Conservation Area. When vegetation removal is allowed, all significant trees removed within the vegetation conservation area shall be replaced at a ratio of 3:1 with a minimum 5 gallon or 2 inch caliper size for replacement plantings. Native vegetation other than trees shall be replaced at a ratio of 1:1 to replicate the structural habitat and ecological functions provided by native species.	X	X	X	X
20.25E.060 L. Water quality, stormwater, and nonpoint source pollution.	5. Construction Materials. All structures that may come in contact with water shall be constructed of materials, such as untreated wood, concrete, approved plastic composites or steel, that will not adversely affect water quality, aquatic plants, or animals. Materials used for decking or other structural components shall be approved by the Environmental Protection Agency for contact with water to avoid discharge of pollutants from wave splash, rain, or runoff. Wood treated with creosote, copper chromium arsenic, or pentachlorophenol is prohibited in or above shoreline water bodies. If ammoniacal copper zinc arsenate (ACZA) materials are proposed, the applicant will meet all of the Best Management Practices, including a post-treatment procedure, as outlined in the amended Best Management Practices of the Western Wood Preservers. Preservative and surface treatments are limited to products approved for use in aquatic environments and must be applied according to label directions. Construction hardware that comes into contact with water either directly or through precipitation that causes discharges either directly or indirectly into surface waters shall not be susceptible to dissolution by corrosion. Materials used for construction of moorage facilities shall conform to the provisions of paragraphs LUC 20.25E.065.I.3.a and 20.25E.080.E.3.c.		X		

Table A-2. **Residential Uses** - Summary of key SMP regulations relating to residential development that protect ecological functions.

Location in SMP (LUC)	Residential Uses- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.065.B. General Requirements Applicable to all Residential Development.	2. Site Planning a. Shoreline Stabilization. New residential development should be located and designed to avoid the need for future shoreline stabilization to the extent feasible.	X		X	X
	b. Parking and Driveways. New driveways and garages associated with residential development shall comply with the following applicable standards: i. New residential parking shall not be permitted overwater or within the shoreline setback.	X	X	X	X
	ii. New parking surfaces and driveway areas should be designed to incorporate Natural Drainage Practices and Low Impact Development practices where feasible. (For further information regarding city-wide requirements, refer to the Storm and Surface Water Utility Code, Chapter 24.06 BCC, and the Storm and Surface Water Engineering Standards (2011), now or as hereafter amended.)	X	X		
	iii. Construction, maintenance, and repair of parking surfaces and driveways shall prevent surface water runoff from contaminating water bodies by using best management practices. (For further information regarding city-wide requirements, refer to the Bellevue Storm and Surface Water Utility Code, Chapter 24.06 BCC, and the Storm and Surface Water Engineering Design Standards (2011); now or as hereafter amended.)		X		
	c. Accessory Utilities. To minimize disturbance in the Shoreline Overlay District, and to reduce the impact on shoreline ecological functions, utilities serving residential development shall be consolidated when reasonable within existing or proposed roadway and driveway corridors that provide access to the development. Consolidation of utilities within the roadway and driveway corridor is not reasonable when consolidation will not achieve the intended function of the utility, or the cost of avoiding disturbance is substantially disproportionate when compared to the environmental impact of proposed disturbance.			X	X
	d. Clearing and Grading. ii. Minimum Necessary. Clearing, grading, excavation, and filling is permitted only in association with an approved residential use or development and shall be the minimum necessary to support the approved residential use or development. Filling to create dry land is prohibited.	X	X	X	X

Location in SMP (LUC)	Residential Uses- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.065.C. Dimensional Requirements for Shoreline Residential and Shoreline Residential Canal Environments.	Chart 20.25E.065.C Shoreline Dimensional Requirements for Residential Uses. Notes: Shoreline Dimensional Requirements for Residential Uses (5) A structure may be required to be located greater than 25 feet from OHWM when a flood hazard critical area exists on the site adjacent to Lake Sammamish or Phantom Lake. See Land Use Code section 20.25H for additional information.	X	X	X	X
20.25E.065.H. Residential Moorage (Overwater Structures)	4. General Requirements Applicable to New or Reconfigured Residential Docks. b. New and Reconfigured Residential Docks – Limitations. Iv. Boathouses. New boathouses are prohibited. Existing boathouses waterward of OHWM are subject to the rules for nonconforming overwater accessory structures set forth in paragraph I of this section.			X	X
	6. Boat and Watercraft Lifts. b. Location. The landward stanchion of any boat or watercraft lift shall be located more than 30 feet waterward of OHWM or within 30 feet waterward of OHWM if located in at least 9 feet of water depth when measured from the OHWM unless otherwise approved by State or Federal Agencies pursuant to LUC Chart 20.25E.065.H.4 Note 4.			X	X
	c. Number of Lift Canopies Allowed. One fabric watercraft or boat lift canopy is allowed per single use dock. Two fabric watercraft or boat lift canopies are allowed per joint use dock. Canopy fabric shall be light-transmitting, unless alternative materials are approved by State or Federal Agencies pursuant to LUC Chart 20.25E.065.H.4 Note 4.			X	X

Table A-3. **Aquaculture** – Summary of key SMP regulations relating to aquaculture that protect ecological functions.

Location in SMP (LUC)	Aquaculture- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.070.B. Aquaculture	1. When Allowed. An aquaculture use is allowed only when developed as part of fish recovery program sponsored, developed, and overseen by a government entity or tribe.	X	X	X	X
	2. Performance Standards. a. When development of an aquaculture use is permitted, the structures shall be designed to minimally interfere with water quality and flow, fish circulation, and aquatic plant life. Construction of aquaculture structures shall be done with minimum disturbance to the existing shoreline.	X	X	X	X
	b. Water discharged or released from an aquaculture projects shall not adversely affect water quality, and shall be designed to minimize interference with water quantity and flow, fish circulation, and aquatic plant life. Construction of aquaculture structures shall be done with minimum disturbance to the existing shoreline;	X	X	X	X
	3. No Net Loss Required. An aquaculture use shall not be permitted in areas where it would result in a net loss of ecological functions, and shall be designed and located to prevent the spread of disease to native aquatic life, and the establishment of non-native species.	X	X	X	X

Table A-4. **Recreation** – Summary of key regulations related to recreation that protect ecological functions.

Location in SMP (LUC)	Recreation- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.070 C. Recreation	2. General Requirements Applicable to all Recreational Facilities. d. Dimensional Requirements iii. Pervious and Impervious Surfaces - Limitations. Pervious surfaces, and when allowed impervious surfaces, associated with recreational facilities, including trails, shall be the minimum necessary to support the intended function of the recreational use, and in no event shall the total amount of pervious or impervious surfaces exceed 30% of the required shoreline setback. Impervious surfaces when allowed in the shoreline setback count towards the total maximum allowed impervious surface limit set forth in LUC 20.25E.050.A (Dimensional Requirements in the Shoreline Jurisdiction).	X	X	X	X
	f. Clearing of vegetation shall be the minimum necessary for infrastructure maintenance and public safety.			X	X
	g. Areas of new permanent disturbance and all areas of temporary disturbance shall be mitigated and/or restored pursuant to a mitigation and/or restoration plan meeting the requirements of LUC 20.25E.060.D.	X	X	X	X
	3. New or Expanded Recreational Facilities. c. Design Criteria Applicable to all New or Expanded Recreational Facilities. iii. The proposed recreational facility should be designed so that its construction and operation does not degrade natural systems and functions.	X	X	X	X
	e. New and Expanded Marinas, Yacht Clubs, and Community Clubs – Use Specific Performance Standards. ii. New or expanded marina facilities shall be designed to preclude moorage in locations that would have insufficient water depth to avoid boats resting at any time of year on the substrate of the lake and in areas, and where deep water access can be only obtained with excavation, filling, and dredging.	X	X	X	X
	f. Accessory Structures in the Shoreline Setback – Development Specific Performance Standards. ii. Performance Standards. (1) The structure shall be located no closer than 10 feet landward from ordinary high water mark; and	X	X	X	X
	(2) The area of shoreline setback impacted by the placement of the structure shall be mitigated by planting native vegetation in an equivalent area elsewhere in the setback on the recreational facility property.	X	X	X	X

Location in SMP (LUC)	Recreation- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
	g. Overwater Structures – Development Specific Performance Standards. (3) The structure shall be located as far a reasonably possible from a stream, public stormwater outfall, or adjacent to aquatic and wildlife habitat areas; and	X	X	X	X
	h. Shoreline Promenades – Development Specific Performance Standards. ii. Performance Standards. (1) Location. A shoreline promenade shall be setback a minimum of 20 feet landward of the ordinary high water mark, except where the promenade provides direct access to a moorage facility, soft shoreline stabilization has been installed, or where a Shoreline Special Report, LUC 20.25E.160.E, is used to modify the dimensional limitations listed here.	X	X	X	X
	i. Recreational Trails – Development Specific Performance Standards. ii. Construction Type. Recreational trails shall be constructed of a soft-surface material or pervious, hard-surfaced material. Impervious surfaces are allowed when the surface is supported by a low-impact development practice as contained in the City's Engineering and Design Standards;	X	X		
	iii. Width. Trails shall be the minimum width necessary to accommodate the intended function or objective, but in no case shall the width exceed 10 feet;	X	X	X	X
	iv. Location. (2) Hard-surfaced pervious trails. Hard-surfaced pervious trails may be located in the setback and may meander no closer than 15 feet from the ordinary high water mark, except that a hard-surfaced pervious path may be located closer than 15 feet to the ordinary high water mark to allow for access to a viewing facility.	X	X	X	X
	(3) Impervious Surface Trails. Impervious surface trails shall be located as far away from the ordinary high water mark as feasible. In no event may an impervious surface trail be located closer than a minimum of 25 feet from the ordinary high water mark.	X	X	X	X
	v. Trails shall be designed and located to avoid disturbance of significant trees and to limit disturbance of native understory vegetation and avoid disturbance of habitat used for salmonid rearing or spawning or by any species of local importance; and	X	X	X	X
	vi. When critical areas are present in the shoreline setback, crossings over and penetrations into wetlands and stream riparian corridors shall be generally	X	X	X	X

Location in SMP (LUC)	Recreation- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
	perpendicular to the critical area, and shall be accomplished by bridging or other technique designed to minimize critical area disturbance considering the entire trail segment and function.				

Table A-5. **Transportation** - Summary of key regulations related to transportation facilities that protect ecological functions.

Location in SMP (LUC)	Transportation- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.070.D Transportation	2. General Requirements Applicable to all Transportation Uses and Development. d. Transportation and utility facilities shall be required to the greatest extent feasible to make joint use of rights-of-way, and to consolidate crossings of water bodies to minimize adverse impacts to the shoreline.	X	X	X	X
	e. Transportation facilities located in the shoreline jurisdiction shall be designed and maintained to prevent erosion and to permit the natural movement of surface water.	X	X		
	f. Clearing of vegetation within areas of permanent disturbance associated with transportation uses and development shall be the minimum necessary for infrastructure maintenance and public safety. The City shall give preference to mechanical means rather than the use of herbicides for the clearing of vegetation in the shoreline jurisdiction.			X	X
	3. New and Expanded Transportation Uses and Development. b. General Performance Standards applicable to all Transportation Uses and Development. i. Where required pursuant to LUC 20.25E.030 Transportation and Utilities Chart Note (2), an applicant shall demonstrate that no technically feasible alignment or location alternative with less impact exists for the proposed transportation use or development pursuant to the requirements contained in 20.25E.060.D. Transportation development that provides access to approved shoreline uses is not required to demonstrate that no technically feasible alternative exists.	X	X	X	X
	ii. New or expanded transportation uses and development should be designed to minimize impacts to shoreline ecological functions. To minimize impacts, the design should locate facilities outside of critical areas and their buffers, aquatic areas and the shoreline setback, and habitat used by salmonids or by any species of local importance, except where no technically feasible alternative exists;	X	X	X	X
	iii. Disturbance of shoreline features, including vegetation and soils, shall be minimized;	X	X	X	X
	iv. Transportation uses and development within shoreline jurisdiction shall be designed with the minimum permanent disturbance feasible, and walls and other design techniques shall be employed to minimize the impact on	X	X	X	X

Location in SMP (LUC)	Transportation- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
	shoreline ecological functions;				
	vi. Low impact development techniques should be used where feasible for transportation uses and development and related drainage system construction;	X	X		
	vii. Transportation uses and development shall be designed to fit the topography so that alterations to the natural site conditions will be minimized; and,	X			
	3. New and Expanded Transportation Uses and Development. g. Regional Light Rail Transit Facility or System ii.1.b. New and expanded regional light rail transit facilities and systems shall comply with the terms of LUC 20.25E.060.C.2.a through e.	X	X	X	X

Table A-6. **Utilities** - Summary of key regulations related to utilities that protect ecological functions.

Location in SMP (LUC)	Utilities- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.070.E Utilities	2. General Requirements Applicable to all Utility Uses and Developments. d. Clearing of vegetation within utility corridors shall be the minimum necessary for infrastructure maintenance and public safety.			X	X
	e. Areas of temporary disturbance and new permanent disturbance associated with a maintenance, repair, or minor expansion projects on an existing utility shall be minimized and mitigated, and/or restored to pre-project conditions pursuant to a mitigation and/or restoration plan meeting the requirements of LUC 20.25E.060.D (Mitigation Sequencing).	X	X	X	X
	3. New and Expanded Utilities. a. Permit Required. New and expanded utility systems and facilities are permitted in the shoreline jurisdiction pursuant to the process identified in 20.25E.030 (Shoreline Use Charts) only when there is no technically feasible alternative with less impact on shoreline ecological functions. (Refer to LUC 20.25E.060.C).	X	X	X	X
	b. Performance Standards. Where an applicant demonstrates that no technically feasible alternative with less impact exists, then the applicant shall comply with the following performance standards. Where critical areas are involved, the performance standards in this paragraph are in addition to those contained in LUC 20.25H.055.C.2.b (Critical Areas Overlay District). i. New or expanded utility systems and facilities shall be designed and aligned to minimize impacts to natural systems and features and shall minimize topographic modification.	X	X	X	X
	ii. New or expanded utility systems and facilities shall be co-located underground and within existing or planned improved rights-of-way, driveways, and/or utility corridors whenever possible.	X	X	X	X
	iii. New or expanded utility systems and facilities should be designed to minimize impacts to shoreline ecological functions. To minimize impacts, the design should locate systems and facilities outside of critical areas and their buffers, aquatic areas and the shoreline setback, except where no technically feasible alternative exists (refer to LUC 20.25E.060.C);	X	X	X	X
	iv. Stormwater Outfalls and Discharge Points. (1) Any outfall or discharge point to the shoreline aquatic area shall be located landward of the ordinary high water	X			

Location in SMP (LUC)	Utilities- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
	mark in a manner that limits impact to existing native vegetation while providing appropriate protection against erosion and sedimentation. Where a location ordinary high water mark is required, outfall should discharge waterward of the littoral zone or further to protect nearshore habitat; and				
	(2) Any disturbed upland or aquatic areas shall be revegetated and enhanced with native plants and habitat features. (Refer Shoreline Handbook, now or as amended.)			X	X

Table A-7. **Breakwaters, Jetties, and Groins** - Summary of key regulations related to breakwaters, jetties and groins that protect ecological functions.

Location in SMP (LUC)	Breakwaters, Jetties, and Groins- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.080.B. Breakwaters, Jetties and Groins	1. Prohibited Development. a. Jetties and groins are prohibited within the Shoreline Overlay District and should be removed when the use for which they were constructed is discontinued or the purpose or function for which the jetty or groin was originally installed no longer exists.	X			X
	b. Solid landfill or rockery breakwaters are prohibited in the Shoreline Overlay District.	X			X
	3. Breakwaters – Performance Standards. a. The applicant shall demonstrate that no technically feasible alternative exists (refer to LUC 20.25E.060.C).	X			X
	b. Breakwaters shall be designed by a qualified professional using minimally invasive techniques to protect shoreline ecological functions and shall not preclude fish passage or adversely affect sediment migration.	X			X
	c. As part of the application submittal, the qualified professional designing the breakwater must certify that the breakwater is the minimum necessary to accomplish its purpose.	X			X
	d. The applicant shall demonstrate that the design will not result in a net loss of shoreline ecological functions.	X			X
	e. Areas of new permanent disturbance and all areas of temporary disturbance shall be mitigated and/or restored pursuant to a mitigation and restoration plan meeting the requirements of LUC 20.25E.060.D (Mitigation Sequencing).	X			X

Table A-8. **Clearing, Grading, and Fill** - Summary of key regulations related to clearing, grading and fill that protect ecological functions.

Location in SMP (LUC)	Clearing, Grading, and Fill- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.080.C. Clearing, Grading, and Fill in the Shoreline	1. Clearing, Grading, and Fill – Limitations. b. Minimum Necessary. Clearing, grading, excavation, and filling is permitted only in association with an approved use or development and shall be the minimum necessary to support the approved use or development. Filling to create dry land is prohibited.	X	X	X	X
	c. Filling and excavation, excluding dredging (see LUC 20.25E.080.D), below the ordinary high water mark is allowed only for the following activities, and when the applicant demonstrates the project will result in not net loss of ecological functions using appropriate technical studies: i. Placement of beach or aquatic substrate when part of an approved ecological restoration activity; ii. Replenishing sand on public and private community beaches; iii. Alteration, maintenance, or repair of existing transportation facilities and utilities located within the Shoreline Overlay District, and no technically feasible alternative is available as set forth in LUC 25.25E.060.C. iv. Constructing facilities for public water-dependent uses or public access; provided that the excavation or filling is limited to the minimum required to accommodate the use or facility, and no technically feasible alternative is available as set forth in LUC 25.25E.060.C; v. Activities incidental to the repair of legally-established shoreline stabilization measures; vi. Approved flood control projects; vii. Components of an approved stream restoration project, including vegetation restoration; and viii. Activities that are part of a remedial action plan approved by the Department of Ecology pursuant to Model Toxics Control Act (MTCA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or otherwise authorized	X	X	X	X
	3. Filling and Excavation – Performance Standards. a. Fill Material—Suitability. Fill material shall not be detrimental to water quality or existing habitat, or create any other significant adverse impacts to the environment. Fill shall be properly stabilized and maintained during and following construction to prevent erosion.	X	X		X

Table A-9. **Dredging and Dredge Disposal** - Summary of key regulations related to dredging and dredge disposal that protect ecological functions.

Location in SMP (LUC)	Dredging and Dredge Disposal- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.080.D. Dredging and Dredge Material Disposal	2. Dredging – Limitations. Dredging is allowed only for the following activities, and when the applicant demonstrates the project will result in not net loss of ecological functions using appropriate technical studies: a. To maintain navigability; provided the dredging is limited to the extent of the previously approved dredging and/or existing authorized location, depth, and width; b. To maintain an existing agricultural activity that supports an existing agricultural use within City Parks; c. To remedy conditions endangering the public health, safety or welfare; d. To carry out a habitat improvement project; and e. Dredging performed pursuant to a remedial action plan approved under authority of the Model Toxics Control Act (MTCA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or pursuant to other authorization by the Washington State Department of Ecology, U.S. Army Corps of Engineers, or other agency with jurisdiction.	X	X	X	X
	3. Dredging and Disposal - Performance Standards. a. The proposal, including any necessary mitigation, will result in no net loss of shoreline ecological functions.	X	X	X	X
	b. Dredging shall be limited to the minimum necessary and appropriately balance navigational or other needs with impacts to shoreline ecological functions. The minimum necessary proposal shall be determined based on an analysis of technically feasible alternatives and consider both short-term and long-term impacts associated with the action, including mitigation measures.	X	X	X	X
	c. The dredging shall not cause long-term adverse impacts to water quality, aquatic habitat, or human health in adjacent areas.		X	X	X
	d. The lateral spread of re-suspended sediment created by a dredging operation shall be contained within previously approved limits.	X	X	X	X
	e. To prevent impairment of water quality any dredge spoil temporarily stored in an upland location must be set back an adequate distance from the water to prevent the discharge of pollutants to the receiving water, and the containment measure shall contain sufficient filtering to prevent discharge of sediments to the receiving water. Temporary disposal sites shall not be allowed except in areas designated by the City of Bellevue.	X	X	X	X

Table A-10. **Non-Residential Moorage Facilities, Boat Ramps, and Launches** - Summary of key regulations related to non-residential moorage facilities, boat ramps, and launches that protect ecological functions.

Location in SMP (LUC)	Non-Residential Moorage Facilities, Boat Ramps, and Launches -SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.080.E. Non-Residential Moorage Facilities, Boat Ramps, and Launches.	3. General Requirements Applicable to all Non-residential Moorage Facilities, Boat Ramps and Launches. a. New skirting, covered moorage, including boatlift canopies, is prohibited.	X		X	X
	4. New and Expanded Non-Residential Moorage Facilities, Boat Ramps and Launches. b. Moorage facilities shall be located in an area where impacts to shoreline ecological functions can be avoided or mitigated to achieve the standard of no net loss of ecological function. To ensure no net loss of ecological functions occurs, the Director may require a compensatory mitigation plan pursuant to LUC 20.25E.060.D (Mitigation Sequencing), when impacts related to new or expanded moorage facilities are identified and not addressed by the performance standards set forth in paragraph E.4.d of this section.	X	X	X	X
	c. New or Expanded Non-Residential Moorage Facilities - Design Criteria. i. Facilities should be designed to avoid dredging to establish new moorage, and the need for maintenance dredging consistent with LUC 20.25H.080.D	X	X	X	X
	ii. Facilities should be designed to avoid impacts to shoreline ecological functions through consideration of water depth, water circulation, sediment inputs and accumulation, and wave action.	X	X		
	iii. Facilities should be located to avoid impacts to shoreline ecological functions through avoidance of submerged aquatic vegetation, shoreline associated wetlands, or habitat associated with species of local importance.			X	X
	iv. Facilities shall be designed to minimize overwater coverage and be the minimum size necessary to provide the desired moorage function when considering the beam and draft of the type of boat anticipated to be moored. Preference shall be given to designs that provide two berths per finger pier.	X		X	X

Location in SMP (LUC)	Non-Residential Moorage Facilities, Boat Ramps, and Launches -SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
	d. New and Expanded Non-Residential Moorage Facilities – Performance Standards. iv. Dock and Pier Access. Docks and piers shall be accessed from upland support areas through a ramp or gangway and walkway system with the first set of finger piers (ells) located at a depth of 9 feet or greater. Facilities for human-powered vessel launching and moorage may be located in depths of less than 9 feet.			X	X
	v. The width and length of all structures shall be limited to what is reasonable for the intended use; provided that: (1) Walkways shall not exceed 8 feet in width; (2) Ells shall not exceed 4 feet in width; and (3) Ramps and gangways shall not exceed 6 feet in width.			X	X
	vi. Docks, ramps, piers, and walkways shall be grated or surfaced with light penetrable materials. To the extent feasible, structures shall be designed to minimize overwater coverage and avoid shading of aquatic vegetation.			X	X
	ix. Docks shall be designed with piers and other structures placed to facilitate, rather than to obstruct, water circulation. Basins shall be designed to prevent stagnant water that tends to collect debris or cause shoaling or flushing problems.	X	X		
	g. New and Expanded Boat Ramps and Launches – Performance Standards. i. The proposed size of the boat ramp or launch shall be the minimum necessary to safely launch the intended craft;	X	X	X	X
	ii. Removal of native upland vegetation shall be minimized to the greatest extent feasible;			X	X
	v. Boat launches shall be located so that they do not significantly impact fish and wildlife habitats and shall not occur in areas with native emergent vegetation;			X	X
	vi. Boat launches shall be located to provide access to a sufficient water depth to allow use by boats without maintenance dredging;	X		X	X

Table A-11. **Shoreline Stabilization** - Summary of key regulations related to shoreline stabilization that protect ecological functions.

Location in SMP (LUC)	Shoreline Stabilization- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
20.25E.080.F. Shoreline Stabilization	4. New or Enlarged Shoreline Stabilization Measures. a. When Allowed. New or enlarged shoreline stabilization measures shall be permitted only to protect existing primary structures, public facilities, or public use structures. Shoreline stabilization measures shall be allowed only where avoidance measures are not technically feasible.	X		X	X
	b. Type of Shoreline Stabilization Measure Used. Where a new or enlarged shoreline stabilization measure is allowed, soft shoreline stabilization measures shall be used, unless the applicant demonstrates, in accordance with paragraph F.3 of this section, that soft shoreline stabilization measures are not technically feasible. Only after the Director determines that soft shoreline stabilization measures are not technically feasible, will hard shoreline stabilization measures be permitted. Provided, that developed sites with less than 10 feet between the primary structure and the ordinary high water mark are assumed to require some form of hard stabilization and applicants are not required to demonstrate technical feasibility. This provision does not apply to legally-established stabilization measures in the Shoreline Residential Canal environment. (See paragraph F.5.b.iv for repair options applicable in the Shoreline Residential Canal environment.)	X		X	X
	f. Mitigation and Restoration. Areas of new permanent disturbance and all areas of temporary disturbance associated with new shoreline stabilization measures shall be mitigated and/or restored pursuant to a mitigation and restoration plan meeting the requirements of LUC 20.25E.060.D (Mitigation Sequencing).	X		X	X
	6. Replacement of Existing Shoreline Stabilization. c. Comparable Design. i. Existing vertical shoreline stabilization measures may not be replaced with a similar structure unless the Director concludes that there is no practical alternative based on a report by a qualified professional. Except that existing legally-established hard stabilization measures located in the Shoreline Residential Canal environment may be repaired or replaced in their vertical concrete configuration, and the applicant shall not be required to demonstrate that there is no practical alternative.	X		X	X
	ii. An angled riprap rock revetment with 1:1 slope or less is an appropriate replacement structure for existing vertical	X		X	X

Location in SMP (LUC)	Shoreline Stabilization- SMP Provision Providing Protection of Ecological Functions	Primary Function			
		Hydrologic	Water Quality	Vegetation	Habitat
	or near vertical walls or bulkheads when designed by a qualified professional. Appropriate sand, gravel, or other beach material may be placed as necessary to backfill that portion of the revetment constructed below ordinary high water.				

APPENDIX B: KEY INFORMATION SOURCES ON SHORELINE FUNCTIONS AND EFFECTS OF SHORELINE DEVELOPMENT IN THE CITY OF BELLEVUE

The following references provide context for the conditions, ecological functions, and potential impacts of development on shoreline functions in the City of Bellevue. This list is not meant to be comprehensive, but rather provide an overview of the references that frame the ecological understanding of the City's shorelines.

Regional Context
Herrera Environmental Consultants. 2005. City of Bellevue's Critical Area Update: 2005 Best Available Science (BAS) Review. Prepared for the City of Bellevue.
Kerwin. 2001. Salmon and Steelhead Habitat Limiting Factors Report for the Cedar-Sammamish Basin (Water Resource Inventory Area 8).
The Watershed Company and Makers. 2009. Shoreline Analysis Report- Including Shoreline Inventory for City of Bellevue's Shorelines: Lake Washington, Lake Sammamish, Phantom Lake, Kelsey Creek, and Mercer Slough. Prepared for the City of Bellevue, Washington.
The Watershed Company. 2009. Bellevue Urban Wildlife Habitat Literature Review. Prepared for the City of Bellevue, Washington.
WRIA 8. 2005. Lake Washington/Cedar/Sammamish Watershed (WRIA 8) Chinook Salmon Conservation Plan.
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APPENDIX C

Shoreline Analysis Methodology

TECHNICAL MEMORANDUM

THE WATERSHED COMPANY

Date: August 2, 2011
To: Michael Paine, City of Bellevue
Cc: David Pyle, City of Bellevue
Kevin LeClair, City of Bellevue
Heidi Bedwell, City of Bellevue
From: Dan Nickel
Project Number: 070613
Project Name: Bellevue SMP

Subject: Shoreline Analysis Methodology

The following information is provided in response to the Washington State Department of Ecology (Ecology) comments on the 2009 Draft Shoreline Analysis Report dated January 16, 2009. Ecology comments, dated April 21, 2009 from Dave Radabaugh, Shoreline Planner, included comments from Stephen Stanley, Landscape Ecologist with Ecology. Mr. Stanley requested that additional information be provided to better understand the methods involved in the shoreline analysis. Therefore, this technical memorandum is intended to provide a more detailed description of the methodology utilized during the analysis of existing ecological functions as presented in the draft 2009 report. Some of the following information related to the development of shoreline reach breaks is excerpted directly from this report to give context to the discussion of methodology.

Listing of Ecological Functions

The analysis of Shoreline reach functions was based on the four major function categories identified in the Department of Ecology's guidelines: hydrologic, vegetation, hyporheic[1], and habitat. These four primary functional categories were further broken down into relevant functions which were used to evaluate reach performance. These relevant functions are listed in Table 1, both by Stream and Lake functions since there are discrete differences between the two.

[1] Hyporheic functions were evaluated for lakes as part of the City of Bellevue Shoreline Analysis Report as they were a required element per Department of Ecology guidelines at the time this study was completed. However, Department of Ecology Hydrogeologist Patricia Olson later confirmed that "hyporheic function" is a non sequitur for lakes, which do not have true hyporheic zones as by definition a hyporheic zone can only be found along flowing waters.

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Table 1: Ecological Functions

Stream Functions	Lake Functions
1. Hydrologic Functions • Storing water and sediment • Transport of water and sediment • Attenuating flow energy • Developing pools, riffles, and gravel bars • Removing excess nutrients and toxic compounds • Recruitment of large woody debris (LWD) and other organic material	**1. Hydrologic Functions** • Storing water and sediment • Attenuating wave energy • Removing excess nutrients and toxic compounds • Recruitment of large woody debris (LWD) and other organic material
2. Vegetative Functions • Temperature regulation • Water quality improvement • Slowing riverbank erosion; bank stabilization • Attenuating of flow energy • Sediment removal • Provision of LWD and organic matter	**2. Vegetative Functions** • Temperature regulation • Water quality improvement • Attenuating wave energy • Sediment removal and bank stabilization • LWD and organic matter recruitment
3. Hyporheic Functions • Removing excess nutrients and toxic compounds • Water storage and maintenance of base flows • Support of vegetation • Sediment storage	**3. Hyporheic Functions** • Removing excess nutrients and toxic compounds • Water storage • Support of vegetation • Sediment storage and maintenance of base flows
4. Habitat Functions • Physical space and conditions for life history • Food production and delivery	**4. Habitat Functions** • Physical space and conditions for life history • Food production and delivery

Shoreline Reach Delineation

Assessment of each function is based upon both quantitative data results derived from the GIS inventory information and a qualitative assessment based on aerial photography and field inventory, where possible. Each shoreline waterbody was divided into reaches based on various morphological, ecological, and land-use conditions. These reaches

were then subsequently grouped where similar environmental and land use conditions existed (e.g. the 18 "residential" reaches along Lake Washington were condensed into 7 groups having similar characteristics).

Lake Washington:	Reaches 1-28
Kelsey Creek/Mercer Slough:	Reaches 29-32
Lake Sammamish:	Reaches 33-37
Phantom Lake:	Reaches 38-42

GIS Data Evaluation and Scoring of Ecological Functions

Table 2 at the end of this memo provides a listing of the GIS data files (parameters) which were utilized in the evaluation of ecological functions. This table lists the data parameter (e.g. impervious surface area, presence of steep slopes, etc.), how the data output is represented in GIS (e.g. percentage of total shoreline reach area), and the criteria used to score the data for each shoreline reach. Scores are reported from 1 to 5 with 1 representing "low" function, 3 representing "moderate" function, and 5 representing "high" function. The criteria used to create the spread of scores were derived using best professional judgment, and are a mix of numeric and categorical "values" depending on the parameter. For example, the scientific literature notes significant ecological impacts may occur when impervious surfaces cover more than 35 percent of the overall land area. Therefore, shoreline reaches with impervious surface cover greater than 35 percent were given a score equal to 1 (i.e. "low" function). Reaches with impervious surface cover less than 35 percent are then given subsequently greater scores, where values of 25-35% = 2, 15-25% = 3, 10-15%=4, and <10% = 5. Each shoreline reach was scored for each parameter listed in Table 2 based on the listed scoring criteria.

Once the shoreline reaches had been scored for each parameter as described above, the next task was to evaluate the overall ecological functions based on those functions listed in Table 1 (i.e. storing water and sediment, removing excess nutrients and toxic compounds, providing food production and delivery). Table 3 at the end of this memo provides a matrix showing which parameters listed in Table 2 contributed to the evaluation of each ecological function from Table 1. Which parameters were used depended upon their applicability in addressing the ecological function[2]. For instance, for the vegetative function of improving water quality, the following parameters were utilized: percent area of total vegetative cover (positive relationship - higher vegetative cover relates to a higher potential to remove excess nutrients and toxic compounds),

[2] It should be noted that at the finest scale, most of the parameters may play some role in any of the functions. For this assessment, only the strongest parameters are used.

percent area of wetlands (positive relationship - wetlands provide valuable water quality improvement functions), and housing density (negative relationship - higher density developments typically have more roads, parking and manicured landscapes which may contribute to surface water pollutants during periods of runoff). The scores for each parameter were averaged to come up with a vegetative function score for "improving water quality." A detailed example is shown below for the Lake Washington Residential Group R1 (Group R1 - Reaches 1, 3, 5, and 8[3]).

As seen in Table 3, different parameters are used when evaluating the various functions. Where multiple parameters were utilized (as described above for "improving water quality"), the average ranking score between parameters was used (see the detailed example provided below).

Example 1: Individual Function Score for Group R1 (Reaches 1, 3, 5, and 8)
The following table provides an example of the evaluation of the vegetative function for improving water quality for Group R1.

Parameter	Value for Group R1 (from GIS data)	Score (see Table 2)
Total Vegetative Cover	50%	3
Wetlands	2%	1
Housing Density	2	2
	Group Score	**2.0**

Similar calculations for each group were made for each of the ecological functions which are listed in Table 3. The scores for each function were then averaged within each of the four major processes such that each reach has a hydrologic, vegetative, hyporheic, and habitat score. Finally, these four values were averaged, so as not to weigh one process more than another, resulting in a final reach score. Tables 28 – 31 of the Shoreline Analysis Report (January 16, 2009) contain the quantitative results for each reach group along with a qualitative "performance" summary to provide more detailed reach-specific information. The example listed above for Group R1 is continued below in Example 2.

[3] In order to condense this information as much as possible and limit the repetitiveness of the ecological function summary and corresponding tables, reaches which have similar functional characteristics have been grouped together. For example, residential reaches 1, 3, 5, and 8 were grouped together since they occupy the land area within Meydenbauer Bay and thus exhibit similar functional characteristics.

Example 2: Overall Function Score for Group R1 (reaches 1, 3, 5, and 8)

The following table completes the calculation for the overall ecological function of Group R1.

Ecological Function	Ecological Function Score	Averaged Process Function	Averaged Score
Storing water and sediment	2.0	Hydrologic Function Score **1.7**	**1.6** = Low/Moderate
Remove excess nutrients and toxic compounds	1.7		
Wave and/or flow attenuation	1.5		
Recruit. of LWD and other organic material	1.7		
Shade: temp regulation	2.0	Vegetative Function Score **1.7**	
Water quality improvement	2.0		
Wave attenuation	1.5		
Sediment Removal	1.5		
LWD and organic matter recruitment	1.5		
Remove excess nutrients and toxic compounds	1.7	Hyporheic Function Score **1.4**	
Water storage	1.6		
Support of vegetation	1.5		
Sediment storage and maintenance of base flows	1.0		
Food Production and delivery	1.5	Habitat Function Score **1.6**	
Physical Space and conditions for Life History	1.6		

Table 2: GIS Parameters and Scoring Criteria

Parameter	Data Output	Data Scoring				
		1	2	3	4	5
Impervious Cover	% of Reach Area	>35	25-35	15-25	10-15	<10
Total Vegetative Cover	% of Reach Area	<35	35-50	50-70	70-85	>85
Area of wetlands	% of Reach Area	<5	5-10	10-20	20-50	>50
Slopes greater than 40%	% of Reach Area	<2.5	2.5-4	4-10	10-20	>20
Shoreline Armoring	% of Reach Length	>75	50-75	35-50	10-35	<10
Housing density	Zoning Density*	high density		moderate density		low density
Forest Patch and Fragments	% of Reach Area	<20	20-40	40-60	60-80	>80
Vegetation: Tree Cover	% of Reach Area	<20	20-40	40-60	60-80	>80
Vegetation: Coniferous Tree Cover	% of Reach Area	<20	20-40	40-60	60-80	>80
Soils: filtration capacity	Predominant Soil Type	alderwood	---	sand/gravel	sand/silt	muck
Adjacent Open Space	% of Reach Area *	<10	10-20	20-40	40-60	>60
Streams	Stream length per shoreline length	<5	5-15	15-30	30-60	>60
Shoreline Exposure: influence on temperature	Predominant direction of shoreline exposure	south	southern	east/west	northern	north
Shoreline Exposure: for wave attenuation & transport of organics by prevailing winds	Predominant direction of shoreline exposure	south	southern	east/west	northern	north
Habitat Score	Upland Area as % of Total Area **	1	2	3	4	5
snag & perch tree	Number per Reach Area	<1	1-5	5-10	10-15	>15

* Values are best professional judgment interpretations
** Habitat scores provided in the Shoreline Analysis Report: Technical Appendix II for Habitat

Table 3: GIS Parameters and Scoring Criteria

Parameter	Hydrologic Functions						Vegetative Functions						Hyporheic Functions				Habitat Functions	
	Storing water and sediment	Transport of sediment and water (Riverine Only)	Remove excess nutrients and toxic compounds	Wave and/or flow attenuation	Recruit. of LWD and other organic material	Devel. of pools, riffles, gravel bars (Riverine Only)	Shade: temp regulation	Water quality improv.	Slowing riverbank erosion/ bank stabilization (Riverine Only)	Wave attenuation	Sediment Removal	LWD and organic matter recruitment	Remove excess nutrients and toxic compounds	Water storage	Support of vegetation	Sediment storage and maint. of base flows	Food Production and delivery	Physical Space and conditions for Life History
Impervious Cover	x		x			x	x		x				x	x	x			
Total Vegetative Cover	x	x					x	x	x	x	x			x				
Area of wetlands								x		x				x			x	x
Slopes greater than 40%	x	x		x		x	x			x	x		x	x				
Shoreline Armoring				x							x	x				x	x	
Housing density			x					x					x					
Forest Patch and Fragments			x										x					
Vegetation: Tree Cover					x							x			x			
Vegetation: Coniferous Tree Cover					x							x						
Soils: filtration capacity			x						x					x		x		
Adjacent Open Space			x														x	x
Streams					x							x						
Shoreline Exposure: influence on temperature							x											
Shoreline Exposure: for wave attenuation & transport of organics by prevailing winds				x														
Habitat Score																	x	
snag & perch tree																		x