

KING COUNTY SHORELINE CUMULATIVE IMPACTS ASSESSMENT

October 2009

1. Purpose and General Description

This report assesses the potential for cumulative impacts of reasonably foreseeable future development in the shoreline jurisdiction that could result from development and activities over time under the proposed King County Shoreline Master Program. Under State shoreline guidelines, local jurisdictions are required to evaluate and consider cumulative impacts of reasonably foreseeable future development in the shorelines of the state (WAC 17-26-186(8)(d)).

The State's objective in evaluating potential cumulative impacts is to insure that, when implemented over time, the proposed Shoreline Master Program goals, policies and regulations will achieve no net loss of ecological functions from current "baseline" conditions. Current conditions are identified and described in the King County Shorelines Technical Appendix (May 2007). The proposed King County Shoreline Master Program provides procedures to evaluate individual actions for their potential to impact shoreline resources on a case-by-case basis. The purpose of this evaluation is to determine if impacts to shoreline ecological functions would result from the aggregate of activities and developments in the shoreline that may take place over time.

The State's Guidelines require "... no net loss of ecological functions and protection of other shoreline functions and/or uses." Master programs must contain policies, programs, and regulations that address adverse cumulative impacts and fairly allocate the burden of addressing cumulative impacts among development opportunities. Evaluation of such cumulative impacts should consider:

- Current circumstances affecting the shorelines and relevant natural processes;
- Reasonably foreseeable future development and use of the shoreline; and
- Beneficial effects of any established regulatory programs under other local, state, and federal laws." (WAC 173-26-186(8)(d))

This cumulative impacts assessment uses these three considerations as a framework for evaluating the potential impacts to shoreline ecological functions and processes that may result from implementation of the proposed Shoreline Master Program over time.

2. Methods and Assumptions

Existing Shoreline Conditions

A summary of existing shoreline conditions, based on the characterization of ecological process integrity in King County Shorelines Technical Appendix, is included to provide context for the impervious surface area discussion in this cumulative impacts assessment.

Shoreline Land Use and Permit Trends

Existing shoreline land use is discussed. Shoreline permit trends (dating back to 1990) are used as a basis for discussing historic versus expected future shoreline development. Shoreline permits are also included as part of the land use characterization in King County Shorelines Technical Appendix. The number and location of existing docks and piers is discussed.

Overview of Key Shoreline Protection Standards

Allowable activities and protection requirements under current and proposed shoreline management regulations are summarized and compared. This analysis is done in order to determine how proposed regulations influence potential cumulative impacts. Key regulations are discussed.

King County proposes to use eight designations to regulate uses and modifications within the shoreline zones: Aquatic, Conservancy, High Intensity, Natural, Resource, Forestry, Rural, and Residential. The King County Shoreline Master Plan, set forth in King County Comprehensive Plan, Chapter 5, defines the criteria for assigning these designations. The quantitative element of this cumulative impacts assessment focuses on landward designations. Potential cumulative impacts to the Aquatic designation are qualitatively discussed in this analysis. The amount of shoreline (in terms of shoreline miles, acres and parcels) is defined to provide context for the results of the landscape analysis.

Review of Best Available Science Analysis and Results

The results of the risk assessment conducted as part of King County's critical areas¹ regulatory update (adopted in 2004) are reviewed. This work is included as part of the shoreline cumulative impact assessment because the County proposes to rely on critical areas regulations to some extent in protecting existing shoreline ecological functions.

Landscape Analysis: Impervious Surface Area in Shoreline Jurisdiction

An analysis was conducted to describe the existing conditions in shoreline zones within the County. Seven designations were coupled with the shoreline type (i.e. lake, marine, or stream) to generate 18 possible shoreline categories that defined the spatial extent of the analysis. Cumulative impacts were then analyzed for each shoreline category using a generalized estimate of new impervious surface that could occur in the shoreline zone under proposed regulations. Current conditions were compared to a hypothesized worst case scenario of possible future impacts (the maximum potential increase in impervious surface within the shoreline jurisdiction). This worst case scenario is discussed in terms of expected shoreline development.

Because more than 1,900 miles of stream and lake shorelines and 51 miles of marine shorelines within King County's Shoreline Master Program jurisdiction are evaluated, the quantitative analyses are statistically robust according to Osenberg (1994). By being comprehensive, this analysis takes into consideration the issues of ecological scale, process and function.

It is assumed that development effects accrue in a cumulative fashion and that artificial impervious land covers are a good indicator of the level and potential degree of effect of development that occurs in proximity to shorelines of the county. To this end, the County's high-resolution GIS layer (4 feet on-a-side grid cells) of impervious areas (Marshall 2000) was used to create a quantifiable indicator of potential cumulative impacts within shoreline areas.

There are other obvious landcover alterations that are correlated with impervious surfaces and that affect ecological process and function (e.g. loss of natural vegetation and soil compaction associated with land clearing, riparian encroachment, and other direct hydrologic modifications).

¹ Critical areas include wetlands, aquatic areas (including shorelines of the state), wildlife conservation areas, geologic hazards, flood hazard areas, channel migration zones and associated protection areas.

For this analysis, however, it was assumed that impervious surfaces are a suitable indicator of cumulative impacts of land use as indicated by other research (May 1997; Wissmar 2000). Additionally, following methods of Stanley et al (2005), impervious surface data was a major factor in determining the degree of alteration of ecological processes (see King County Shorelines Technical Appendix).

Mitigation is required for new impervious surface in aquatic area buffers, and must achieve equivalent or greater ecological functions of the impacted area (per current King County critical areas regulations). Mitigation that includes buffer enhancement is expected to be effective at achieving the shoreline management goal of no net loss of ecological function (Figure 1). Mitigation requirements are discussed further in the description of the proposed Shoreline Master Program below and in Attachment 1.

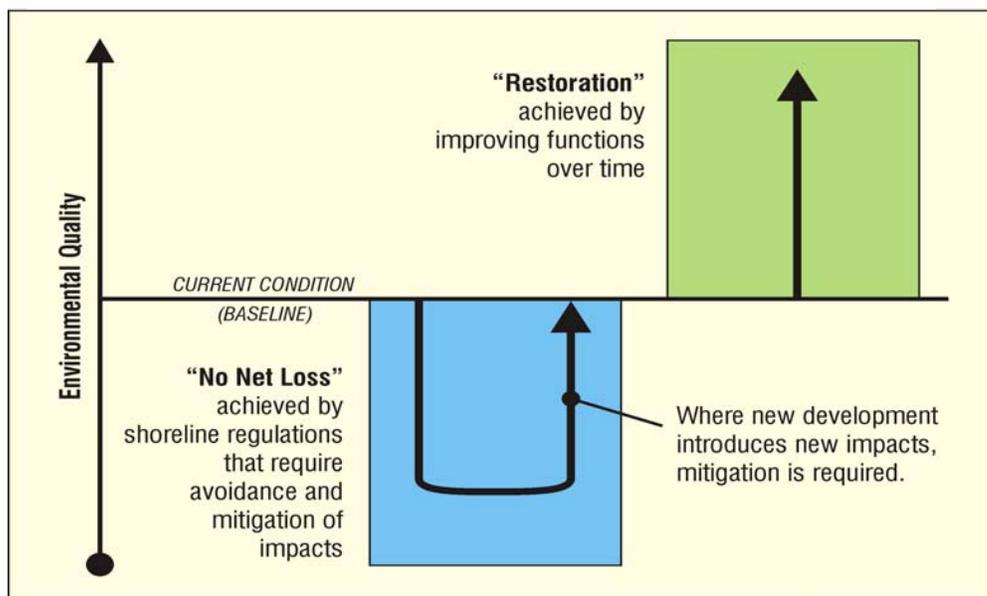


Figure 1. Environmental condition relative to disturbance. The blue square represents a disturbance and decreased environmental condition at the bottom of the arrow followed by mitigation of the impacts that returns the system’s ecological function to its pre-disturbance condition. The green square represents improved environmental function following restoration actions. (Source: Department of Ecology)

The current and potential future impervious surface is calculated for eligible shoreline parcels, and the regulatory buffers associated with each parcel. The potential future cumulative impacts were estimated by increasing buffer impervious surface coverage on eligible parcels by the amount that would be allowed under proposed shoreline regulations. Estimates of impervious area (i.e. potential cumulative impacts) were then averaged by shoreline type and designation.

To measure the differences between current and possible future conditions, a comparison of mean impervious surface percentages was performed. To further evaluate potential areas of concern, maps showing eligible parcels were reviewed to assess localized changes and consistency with designation and reach and drift cell characterization scores (pixel and summarized reach/drift cell scores).

3. Shoreline Land Use and Permit Trends

The 2007 King County Buildable Lands Report states that the urban area of King County contains almost 22,000 net acres of vacant or potentially redevelopable residential land. However, future development on 25% of the countywide land supply in single-family zones and 10% of the land in multifamily and mixed use zones would be restricted due to critical areas. The County issues approximately 7,000 residential permits per year for development throughout the unincorporated area and approximately 1,000 of those permits are reviewed with regards to critical areas (Bottheim pers. comm. 2008). Rural unincorporated King County, where the vast majority of the County's shoreline jurisdiction is located, has grown relatively slowly since the Growth Management Act took effect in the mid-1990s. According to the 2006 King County Annual Growth Report, less than five percent of countywide new residential construction and population growth occurred in the rural unincorporated area, partly due to annexations.

Analysis of building permits issued from 1990 to 2004 within the shorelands of King County indicates that 2,019 County permits were issued (Table 1). About half (1,013) of the permits that were issued did not result in new impervious areas because they were issued for maintenance and repair of existing shoreline structures, timber harvest, or stormwater management. While some short-term impacts associated with these permits may have occurred, they are not likely to have resulted in a net loss of ecological function along King County shorelines. Of the remaining permits, 562 (28%) were for new single family homes and 355 (17%) were for a variety of new shoreline development including trails, utilities, docks, and other miscellaneous structures.

Table 1. Numbers of Shoreline building permits issued by proposed designation during 1990-2004.

Proposed Designation	Building Permits 1990-2004
Conservancy	228
Forestry	23
High Intensity	7
Natural	27
Residential	162
Resource	104
Rural	186

Within critical area buffers in recent years, approximately 60 permits per year have been approved to allow expansion of a single family residence by up to 1,000 square feet (Bottheim pers. comm. 2008). Such projects are approved only if the residence is already located within the buffer area. Further, not all such permits are for development in the shoreline jurisdiction.

Regarding in-water development trends, King County compiled new data on the location of shoreline docks as part of the inventory and characterization (King County Shorelines Technical Appendix). The greatest number of docks is in the Conservancy, Rural and Residential proposed designations. The density of docks in these designations ranges from about 1 dock per conservancy shoreline mile to 4 docks per rural shoreline mile to 16 docks per residential shoreline mile (Table 2). Under proposed standards, before being permitted all proposed new docks must demonstrate that there are no other available options and any new docks in the Conservancy designation would have to be located at least 250 feet from another dock (see discussion under Shoreline Master Program in this document).

Table 2. Number of existing docks by proposed shoreline designation and water type.

Proposed Designation	Freshwater Docks	Marine Docks
Conservancy	379	12
Resource	0	1
Forestry	11	0
Natural	0	10
Rural	242	84
Residential	438	0
High Intensity	0	5

Major existing land uses and land use patterns along King County shorelines are summarized and in Comprehensive Plan Appendix M.

4. Overview of Key Shoreline Protection Standards

State and Federal Regulations

In addition to local regulations, a number of state and federal agencies have regulatory jurisdiction over resources in the County's shoreline jurisdiction. As with local requirements, state and federal regulations apply throughout the County and significantly reduce the potential for cumulative impacts to shorelines. The major state and federal regulations affecting shoreline-related resources include, but are not limited to:

- **Endangered Species Act (ESA):** The federal ESA addresses the protection and recovery of federally listed species. Depending on the listed species, the ESA is administered by either the National Oceanic and Atmospheric Administration Fisheries or the United States Fish and Wildlife Service.
- **Clean Water Act (CWA):** The federal CWA requires states to set standards for the protection of water quality. It also regulates excavation and dredging in waters of the U.S., including wetlands. Certain activities affecting wetlands in the County's shoreline jurisdiction or work in the adjacent rivers may require a permit from the U.S. Army Corps of Engineers and/or Washington State Department of Ecology under Section 404 and Section 401 of the CWA, respectively.
- **Hydraulic Project Approval (HPA):** The Washington Department of Fish and Wildlife regulates activities that use, divert, obstruct, or change the natural flow of the beds or banks of waters of the state and may affect fish habitat. Projects in the shoreline jurisdiction requiring construction below the ordinary high water mark of Puget Sound or streams in the County could require an HPA. Projects creating new impervious surface that could substantially increase stormwater runoff to waters of the state may also require approval.
- **National Pollutant Discharge Elimination System (NPDES):** Ecology regulates activities that result in wastewater discharges to surface water from industrial facilities or municipal wastewater treatment plants. NPDES permits are also required for stormwater discharges from industrial facilities, construction sites of one or more acres, and municipal stormwater systems that serve populations of 100,000 or more.

King County Plans and Regulations Relevant to Shoreline Protection

Below is a general discussion of plans and regulations that apply in the King County shoreline jurisdiction.

King County Comprehensive Plan

The King County Comprehensive Plan seeks to balance social, environmental, and economic goals through land use and zoning regulations, critical areas regulations using best available science, and other development standards. Updated shoreline management goals and policies are proposed as Chapter 5 in the Comprehensive Plan. King County shoreline goals and policies are consistent with the State's goal to prevent a net loss of shoreline ecological processes and functions and to restore shorelines over time.

King County Code Title 21A: Zoning

The County Code establishes land use zones which implement the Comprehensive Plan's vision for future land use. Zones near shorelines include agriculture, mining, forestry, open space, residential, office, commercial and industrial. (Proposed shoreline designations are consistent with underlying zoning – see Chapter 5 of the Comprehensive Plan.) King County zoning was developed considering the results of basin plans that were developed to protect water resources and habitat.

King County Code, Chapter 21A.24: Critical Areas

This Code chapter establishes development standards, buffers and permitted uses in critical areas. Standards in this chapter are designed to protect natural resources from adverse impacts and to protect public safety. The County adopted new critical areas regulations that went into effect in 2005. The proposed Shoreline Master Program incorporates these critical areas regulations, so that shoreline protection standards will be equivalent to the critical areas standards outside of the shoreline jurisdiction.

Critical areas regulations establish buffer widths and limit uses within buffers. Shorelines of the state are protected by a 115- to 165-foot buffer. Those activities that are allowed often require the applicant to prepare a critical areas report, including an analysis of the impact of the activity on the aquatic area and its buffer.

In limited situations, under current King County critical areas regulations, existing, legal single family residential structures in aquatic areas buffers may be expanded by up to a maximum of 1,000 square feet under certain conditions. This expansion may be allowed within the aquatic area buffer provided it is in the area of least adverse impact, and if mitigation is provided such that equivalent or greater ecological functions are achieved. (A conditional use permit would be required in certain shoreline designations.) Further, King County regulations are designed to minimize construction in regulatory buffers by requiring that a specific mitigation sequence be used. This sequence requires that impacts to the shoreline be avoided, minimized and mitigated to the maximum extent practical.

King County conducted a risk assessment of critical areas regulations considering best available science, as required by the State. See Best Available Science Volume II: Assessment of Proposed Ordinances (February 2004 available at www.metrokc.gov/ddes/cao). The conclusion of the analysis for aquatic areas (including shorelines of the state), was that the critical areas standards – in combination with all other programmatic, capital, stewardship and incentive programs in which they are implemented – are highly consistent with aquatic area protection best available science. The only departure from best available science relevant to the Shoreline Master Program is that buffers may not adequately address microclimate control. However, clearing limits (see discussion of clearing and grading standards below) are expected to protect surrounding forests which should reduce local wind speeds and minimize impacts to microclimates in rural areas. The conclusion further states that for salmon there is a relatively

low incremental risk associated with the County's critical areas standards, while acknowledging that there is uncertainty and potential risk associated with highly sensitive species, such as amphibians and mussels, and depending on localized conditions.

King County Code, Chapter 9.04: Surface Water Management

King County reviews development proposals to ensure that surface water management standards are met. The County also promotes the preservation of natural drainage systems, protection of fishery resources and wildlife habitat.

The County's Capital Improvement Program also identifies, funds, and implements site-specific projects intended to provide flood control or alleviation, improve and enhance riparian habitat, replace culverts to improve fish passage, and improve water quality from stormwater runoff.

The main objective of surface water management requirements is to promote public health, safety and welfare by establishing and operating a comprehensive approach to surface and storm water problems which would reduce flooding, erosion and sedimentation, prevent and mitigate habitat loss, enhance groundwater recharge and prevent water quality degradation. This comprehensive approach includes the following elements: basin planning, land use regulation, construction of facilities, maintenance, public education, and provision of surface and storm water management services. The County requires that impervious surfaces be minimized and runoff controlled and/or treated.

King County Code, Chapter 16.82: Clearing and Grading Standards

This Code chapter defines the Clearing and Grading Standards for development within the County. The code regulates clearing and removal of vegetation, excavation, grading and earthwork construction including cuts and fills, gravel pits, dumping, quarrying and mining operations within King County in order to protect public health, safety and welfare by:

1. Minimizing adverse stormwater impacts generated by the removal of vegetation and alteration of landforms;
2. Protecting water quality from the adverse impacts associated with erosion and sedimentation;
3. Minimizing aquatic and terrestrial wildlife habitat loss and impacts to other riparian functions, such as microclimate, caused by the removal of surrounding vegetation;
4. Protecting sensitive areas from adverse clearing and grading activities;
5. Facilitating and encouraging long term forest practice and agricultural production operations where appropriate;
6. Minimizing the adverse impacts associated with quarrying and mining operations; and
7. Preventing damage to property and harm to persons caused by excavations and fills.

Shoreline Master Program

King County adopted its Shoreline Master Program in 1978 and has not been significantly updated since then. The County's existing Shoreline Master Program goals and policies are included as an element in the land use chapter of the County's current Comprehensive Plan. These goals and policies are consistent with State guidelines. The Comprehensive Plan establishes King County's shoreline jurisdiction and environment designations.

Currently, shoreline development regulations and permitting procedures are codified in Chapter 25 of the King County Code. The County's Shoreline Master Program established a system of "shoreline environment designations" that provide a uniform basis for applying policies and use regulations within distinctly different shoreline areas. Generally, environment designations are

based on existing and planned development patterns, biological and physical capabilities and limitations of the shoreline, and a community's vision or objectives for its future development. The County's existing Shoreline Master Program uses four shoreline environment designations: Urban, Conservancy, Rural, and Natural.

The proposed Shoreline Master Program (October 2009) includes a new system of environment designations, in compliance with State guidelines (WAC 173-26-211). The new system applies designation criteria and management policies consistently across areas with similar current and planned land uses and ecological characteristics. The proposed Shoreline Master Program environment designations include High Intensity, Residential, Rural, Conservancy, Forestry, Resource, Natural and Aquatic (Table 3). The criteria for these shoreline designations are described in detail in Chapter 5 of the Comprehensive Plan.

Table 3. Proposed shoreline designation miles, acres and parcels.

Part A.

Current Designation	Proposed Designation	Current Program		Proposed Draft Program	
		Miles	Acres	Miles	Acres (% of total)
Conservancy	Conservancy	897	21,755	313	11,001 (18.2%)
	Resource			127	16,160 (26.7%)
Natural	Forestry	109	2,640	921	21,569 (35.6%)
	Natural			304	7,230 (11.9%)
Rural	Rural	108	2,620	73	3,064 (5.1%)
Urban	Residential	13	324	23	1,127 (1.9%)
	High Intensity			5	446 (0.7%)

Part B.

Proposed Designation	Shoreline Type	Parcels*
Conservancy	Lake	775
	Marine	434
	Stream	2,897
Resource	Marine	5
	Stream	695
Forestry	Lake	49
	Stream	710
Natural	Lake	14
	Marine	422
	Stream	215
Rural	Lake	614
	Marine	1,507
	Stream	857
Residential	Lake	968
	Stream	357
High Intensity	Lake	3
	Marine	24
	Stream	105

*Due to spatial inconsistencies among data layers, there is some error in determining the exact number of parcels in each designation.

The draft Shoreline Master Program proposes changes to the development regulations that encourage shoreline protection and avoid, minimize and mitigate activities that would cause adverse impact to shoreline functions and processes. After avoidance and minimization, mitigation of impacts may generally include replacement or enhancement of buffer and or

affected critical areas (according to codified ratios associated with the affected resource and level of impact) and collection of a bond to ensure implementation and monitoring. Key changes include: incorporation of critical areas protections into the shoreline regulations, and updated standards for shoreline stabilization, docks and piers, and trails in shorelines. The proposed changes to development standards and use regulations are more protective than the existing Shoreline Master Program in large part due to formal inclusion of critical areas protections into the shoreline regulations. Attachment 1, Summary of Potential Cumulative Impacts Associated with Proposed Shoreline Master Program, qualitatively assesses how cumulative impacts may occur per designation and how those impacts would be offset by the requirements of the proposed Shoreline Master Program, other local, State and Federal regulations and non-regulatory actions.

Consistent with state guidelines (WAC 173-26-186), the proposed Shoreline Master Program includes new goals and policies addressing shoreline restoration within King County. The goals and policies for restoration acknowledge that the County’s intent is to meet the “no net loss” standard, and result in an overall improvement to the condition of the habitat and resources within the shoreline jurisdiction of the County. The draft Shoreline Protection and Restoration Plan identifies restoration opportunities that include capital and programmatic restoration opportunities identified in salmon recovery and flood hazard management plans, and potential funding and partnership opportunities. The Plan acknowledges areas where shoreline functions have been degraded by past development activities and flood hazard reduction efforts (e.g. bank armoring and levee building) and recommends actions appropriate for existing conditions and constraints to ecological processes. Implementation of the Protection and Restoration Plan is expected to guide improvement of shoreline ecological functions within the County over time.

5. Existing Shoreline Conditions

As part of the County’s Shoreline Master Program update process, the County completed a shoreline inventory and characterization (King County Shorelines Technical Appendix) which assessed the degree to which ecological functions and processes in the County’s shoreline jurisdiction have been altered by existing development and rates each shoreline reach accordingly. A summary of the process alteration ratings by shoreline type and reach and broad geographic area (i.e., Vashon-Maury Island, lowlands, and federal and non-federal forest production areas) is provided in Table 4. Shoreline geographic areas include the unincorporated lowland (western third) of the County that primarily supports residential, commercial, and agricultural use; the privately managed Forest Production District (FPD Non-Federal Lands); and the state and federal forest lands and wilderness areas (FPD Federal Lands). In general, the analysis indicates that the majority of King County shorelines are in medium to high condition (relatively unaltered).

Table 4. Degree of Ecological Process Integrity. Average Reach Ratings by ecological process and shoreline type for unincorporated King County. Scores are based on the Characterization described in the Comprehensive Plan Appendix M. For each process, the average rating for all reaches within a location is reported. Potential ratings range from high (H), meaning ecological processes relatively unaltered to Low (L), meaning processes are highly altered by existing development. A summary of the percent of reaches for each rating categories is also presented.

Ecological Process	Marine	Lake scores by geographic location			River scores by geographic location		
	Vashon/Maury	Lowland	*FPD Federal lands	FPD Non-Federal Lands	Lowland	*FPD Federal lands	FPD Non-Federal Lands
Light	M	MH	H	H	MH	H	H
LWD	M	MH	MH	MH	M	MH	M

Ecological Process	Marine	Lake scores by geographic location			River scores by geographic location		
	Vashon/ Maury	Lowland	*FPD Federal lands	FPD Non- Federal Lands	Lowland	*FPD Federal lands	FPD Non- Federal Lands
Nitrogen	MH	H	H	H	MH	H	H
Phosphorus	MH	MH	H	H	MH	H	H
Pathogens	MH	MH	H	H	MH	H	H
Toxins	M	MH	H	H	MH	H	H
Sediment	ML	MH	MH	MH	M	H	MH
Water cycle	M	M	H	MH	M	H	MH
Wave energy	M	MH	H	H	N/A	N/A	N/A
Tidal influences	MH	N/A	N/A	N/A	N/A	N/A	N/A
OVERALL	M	MH	H	H	MH	H	H

Percentage of reaches in each rating category:

Low	2.9	0.0	0.0	0.0	0.0	0.0	0.0
Medium Low	23.7	1.0	0.0	0.0	2.2	0.0	0.0
Medium	31.7	1.1	0.0	0.0	34.6	0.0	0.1
Medium High	15.6	78.9	9.5	3.1	45.7	2.0	11.1
High	26.1	19.1	90.5	96.9	17.6	98.0	88.8

*FPD = Forest Production District.

Impervious surfaces, among other data, is used to evaluate the degree of alteration of all of the ecological processes listed in Table 4, with the exception of wave energy. Discussion in the shoreline characterization analysis recognizes the direct relationship between impervious surface and the status of ecological processes (King County Shorelines Technical Appendix (May 2007)).

6. Landscape Analysis: Impervious Surface in Shoreline Jurisdiction

This analysis was developed to generally identify the extent to which shoreline designations may be at risk from future development, to assist in refining the proposed Shoreline Master Program and to help guide protection and restoration efforts. It estimated potential increase in buffer impervious surfaces in the shoreline jurisdiction assuming that 1,000 square feet of new impervious surface is built on every eligible shoreline parcel. For purposes of this analysis, eligible parcels include private parcels that currently have impervious surface located within the 165-foot critical area buffer. Some designations (Forest, Resource, and High Intensity) are excluded from the analysis as there is minimal or no existing single family development in those areas. This analysis assumes that (1) any impervious surface in the buffer is a single family residence, which is the criteria for allowing expansion; (2) there is an existing single family residence in the buffer on every parcel where there is current impervious surface; (3) new impervious surface is not sited outside of the shoreline jurisdiction where it could be on large rural parcels and as required by the mitigation sequence; and (4) all property owners will choose to expand single family residences on eligible parcels. Therefore, this is a conservative worst case scenario.

This scenario shows a potential increase in the percent impervious for shoreline buffer areas. Overall, the total current percent impervious surface for all shoreline parcel buffers is 8.0% (Attachment 2). Given assumptions described above, the potential future impervious surface would be 9.4% for a net overall increase of 1.4%. While a seemingly small potential change,

clearly some areas have much more potential for change than others. The most dramatic potential change in buffer imperviousness is for Residential lakes and Rural marine where percent buffer impervious surface could change from current 12.5% and 5.1% to potential future 35.9% and 29.6%, respectively (Table 5). A more moderate degree of change could occur for Rural lake and Rural stream, where percent buffer impervious could change from 10.7% and 0.1% currently to 22.3% and 13.6%, respectively for the future. Conditions for these shorelines generally range from low to medium/high; areas of high condition are generally not present in these areas and therefore had very little potential for change. Additionally, the Rural and Residential shorelines make up 7.0% of the total shoreline area (Table 3).

In contrast, most areas representing the highest conditions could experience no to relatively small increases in impervious surface in the buffer. For the Natural designation (11.9% of the total shoreline area) impervious surface is expected to change by less than 2%. This area is in high condition for the most part. Buffer impervious surfaces along Forestry, Resource and High Intensity shorelines would not be expected to increase at all as there are very few single family uses. Ultimately, 92.3% of King County's shorelines – including most shorelines that are in the highest ecological condition – would not likely experience a large change in impervious surface.

In addition to being mostly confined to a relatively small percentage of the shoreline buffer area, the effect of increased impervious surface in the buffer would be mitigated. As stated previously, it is estimated that this provision to allow expansion of single family residences by 1,000 square feet has been used in about 60 permits per year (less than 1% of about 7,000 total residential permits and about 1,000 permits that get detailed critical areas review per year). Furthermore, there are specific conditions under which this expansion is allowed within the shoreline jurisdiction, including:

- A mitigation sequence that requires avoidance, minimization and mitigation of shoreline ecological resources is applied (as discussed previously).
- Mitigation requirements specify that a comparable area of degraded buffer area must be enhanced (nonnative plants removed and replaced with native vegetation per an approved landscaping plan). For example, in shoreline areas where existing conditions are poor, such as in Quartermaster Harbor where water quality is low and where there may be a concentration of new impervious surface in the shoreline buffer, enhancement as a mitigation requirement may result in an improvement in ecological function over existing conditions. In other instances where conditions are currently moderate to high and on-site opportunities to restore degraded conditions are limited, such as along middle reaches of Bear Creek, Issaquah Creek, Raging River and the Cedar River, off-site mitigation may be required to offset impacts. Off-site mitigation would be guided by the Shoreline Protection and Restoration Plan priorities.
- A shoreline conditional use permit is required if expansion occurs in the Conservancy, Resource, Forestry or Natural shoreline environment. A conditional use permit is not required in the High Intensity, Residential and Rural shoreline environments. These 3 designations make up 7.7% of the shoreline jurisdiction.
- If an expansion is greater than 1,000 sf, a shoreline variance is required.
- A 3-year bond and monitoring is required to ensure at least 80% survival of native plants.
- A cumulative total of up to 1,000 sf expansion is allowed per parcel.

- 1,000 sf expansion is not allowed on parcels that were previously developed via a Rural Stewardship Planning permit.

Table 5. Potential Change in Buffer Imperviousness of King County shorelines. Percent impervious areas are estimated from averages of all eligible parcels within each designation.

Designation*	Shoreline Type	Average Existing Shoreline Buffer % Impervious, including hazard areas	Potential Future Average Buffer % Impervious, including hazard areas	Difference between Existing and Potential Future Average Buffer % Impervious
Conservancy	Lake	16.9	21.7	4.8
	Marine	8.2	11.8	3.6
	Stream	9.8	11.5	1.8
Natural	Lake	0.0	0.0	0.0
	Marine	4.7	6.5	1.8
	Stream	1.6	3.0	1.4
Residential	Lake	12.5	35.9	23.4
	Stream	20.6	25.6	5.1
Rural	Lake	10.7	22.3	11.6
	Marine	5.1	29.6	24.5
	Stream	0.1	13.6	13.5
Forestry	Lake	3.4		
	Stream	3.3		
High Intensity	Lake	63.5		
	Marine	31.3		
	Stream	62.0		
Resource	Marine	6.8		
	Stream	0.5		

* There is minimal opportunity for use of the 1,000 sf expansion standard in the Forestry, High Intensity and Resource designations; these designations are excluded from the analysis.

**Exclude publicly-owned parcels and parcels that are in landslide hazard areas or severe channel migration zone.

Conclusion

Consistent with State shoreline management goals, the Shoreline Master Program proposes new shoreline environment designations, updated development standards and regulations for shoreline modifications and uses and better protection for shoreline processes. The updated standards and regulations are generally more protective of the shoreline environment and are largely consistent with best available science in protecting aquatic areas.

As discussed in this analysis and summarized in Attachment 1, proposed development and mitigation standards help to ensure that new residential structures do not cumulatively affect shoreline ecology. The Shoreline Protection and Restoration Plan identifies opportunities to improve or restore ecological functions that have been impaired as a result of past development activities. In addition, the proposed Shoreline Master Program augments several County, state and federal regulations that also protect shoreline functions and values for a variety of goals, including the recovery of threatened salmon and Puget Sound restoration.

The King County shoreline is generally in good condition while including a variety of existing land uses. There are opportunities for new shoreline development on vacant lots or by expanding existing structures. However, it is reasonable to conclude that less than the

estimated development or expansion will actually occur, given shoreline development trends since 1990.

The cumulative actions (protection, restoration, regulations, and stewardship) taken over time in accordance with the provisions of the updated Shoreline Master Program are not likely to result in a net loss of shoreline ecological functions from existing baseline conditions, and may result in an increase in shoreline ecological functions.

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Attachment 1. Summary of Potential Cumulative Impacts Associated with Proposed Shoreline Master Program

Proposed Shoreline Designation	Length (miles), area (acres) and Proportional Area (%) of Designation	Potential Change in Buffer (165-ft wide) Impervious Surface (see Table 5)	Major Types of Foreseeable Future Development Likely to Affect Shoreline Condition	Potential Impacts to Shoreline Ecological Processes	Proposed SMP and Other Regulatory Offsets (Regulatory Citation)	Non-Regulatory Offsets
Natural	304 mi., 7,230 acres (11.9%)	<p>Potential change in % buffer impervious surface ranges from 0% (lakes), 1.4% (rivers) to 1.8% (marine).</p> <p>On freshwater shorelines, no concentration of eligible parcels in high quality areas. On marine shorelines, a small high density clump of eligible parcels in Quartermaster Harbor and sporadic distribution of parcels along outer edge of Maury Island – along medium to high quality shorelines.</p>	No major changes expected due to predominance of public lands managed for wilderness and natural resource condition	None or slight improvement over time where historic land uses are removed and restoration occurs	<ul style="list-style-type: none"> • KC CAO (buffers, clearing limits, mitigation for all impacts, and roads and other infrastructure follow low impact design) and FHMP (zero-rise), • WDNR FPA rules (ESA HCP applies), WDFW HPA • US Federal Land Policy and Management Act, Northwest Forest Act, ESA, CWA, Federal Wilderness Act and Mt. Baker-Snoqualmie National Forest Plan. • Conditional Use Permit (with Ecology review) required for 1,000 sf expansion in buffer 	Forestry and rural stewardship programs, tax incentive and TDR programs
Forestry	921 mi., 21,569 acres (35.6%)	There is little potential change as there are very few eligible parcels in this designation.	<ul style="list-style-type: none"> • No or only minimal changes expected due to predominance of lands in forestry and municipal uses. • Parcels are generally required to be at least 80 acres and limited non-forest related development is allowed • Very limited amount of new roads and other supporting infrastructure for residential development may occur 	<ul style="list-style-type: none"> • None or, at worst, very limited, infrequent and localized impact primarily to riparian vegetation and associated LWD and sediment processes caused by allowable development not able to be sited outside of regulatory buffer. • Limited construction of access roads and associated stream crossings 	<ul style="list-style-type: none"> • KC CAO (buffers, clearing limits, mitigation for all impacts, and roads and other infrastructure follow low impact design) and FHMP (zero-rise), • WDNR FPA rules (ESA HCP applies), WDFW HPA US Federal Land Policy and Management Act, Northwest Forest Act, ESA, CWA, Federal Wilderness Act and Mt. Baker-Snoqualmie National Forest Plan. • Conditional Use Permit (with Ecology review) required for 1,000 sf expansion in buffer 	Forestry and rural stewardship programs, tax incentive and TDR programs

Proposed Shoreline Designation	Length (miles), area (acres) and Proportional Area (%) of Designation	Potential Change in Buffer (165-ft wide) Impervious Surface (see Table 5)	Major Types of Foreseeable Future Development Likely to Affect Shoreline Condition	Potential Impacts to Shoreline Ecological Processes	Proposed SMP and Other Regulatory Offsets (Regulatory Citation)	Non-Regulatory Offsets
Resource	127 mi., 16,160 acres (26.7%)	There is little potential change as there are very few eligible parcels in this designation.	<ul style="list-style-type: none"> Minimal to moderate changes possible due to potential for new mining and agriculture. Limited number of new roads and other supporting infrastructure for mining and agriculture activities may occur 	Agriculture and mineral activities may impact vegetation and soils, modifying hydrology, sediment, LWD and nutrient processes and creating new sources for pathogens and toxics	<ul style="list-style-type: none"> KC CAO (buffers, clearing limits, mitigation for all impacts, and roads and other infrastructure follow low impact design) and FHMP (zero-rise), WDNR FPA rules (ESA HCP applies), WDFW HPA WDNR Surface Mining Act Mitigation required for all impacts and roads and other infrastructure must follow low impact design. Conditional Use Permit (with Ecology review) required for 1,000 sf expansion in buffer 	Agricultural stewardship (farm plans) WDNR Surface Mining Act requires reclamation for all but a very limited set of mining activities
Conservancy	313 mi., 11,001 acres (18.2%)	<p>Potential change in % buffer impervious surface ranges from 4.8 (lakes), 1.8% (rivers) to 3.6% (marine).</p> <p>On rural lakes and streams, high concentrations of eligible parcels in medium/high to high quality areas. On marine shorelines, low density and broad distribution of eligible parcels along medium to high quality shorelines.</p>	<ul style="list-style-type: none"> No or only minimal changes expected due to predominance of lands in hazardous, ecologically or culturally significant condition. <p>Parcels with development potential are generally of sufficient size to be able to locate new development outside of shoreline and are required to remain in largely forested condition Limited number of new roads and other infrastructure for septic and water to supply residential development may occur</p>	Relatively limited, infrequent and localized impact primarily to riparian vegetation and associated LWD and sediment processes caused by allowable development not able to be sited elsewhere and limited construction of access roads and associated stream crossings. Agriculture and mineral activities may impact water quality	<ul style="list-style-type: none"> KC CAO (buffers, clearing limits, mitigation for all impacts, and roads and other infrastructure follow low impact design) and FHMP (zero-rise), WDNR FPA rules (ESA HCP applies), WDFW HPA Conditional Use Permit (with Ecology review) required for 1,000 sf expansion in buffer 	<p>Forestry and rural stewardship programs tax incentive and TDR programs</p> <p>FHMP and Salmon Recovery CIPs</p>
Rural	73 mi., 3,064 acres (5.1%)	<p>Potential change in % buffer impervious surface ranges from 11.6% for (lakes), 13.5 % (rivers) to 24.5 % (marine).</p> <p>On rural lakes and streams, high concentration of eligible parcels in medium/low to medium/high condition. On marine shorelines, high concentration of parcels in Quartermaster Harbor and several clumps of parcels throughout marine shoreline – along low to medium/low condition drift cells.</p>	<ul style="list-style-type: none"> Minimal to moderate changes possible due to potential for: new residences, some of which may qualify for shoreline variance and be built in buffers, and expansion of up to 1,000 sq. ft for existing single family residential structures Limited number of new roads and other supporting infrastructure to accommodate new or expanded development 	New or expanded development may impact vegetation, LWD, sediment, hydrology, water quality, and light energy.	<ul style="list-style-type: none"> KC CAO (buffers, clearing limits, mitigation for all impacts, and roads and other infrastructure follow low impact design) and FHMP (zero-rise), WDNR FPA rules (ESA HCP applies), WDFW HPA. 	<ul style="list-style-type: none"> Rural stewardship programs tax incentive and TDR programs, Public involvement and education Open space acquisition, restoration and stormwater retrofit programs FHMP and Salmon Recovery CIPs

Proposed Shoreline Designation	Length (miles), area (acres) and Proportional Area (%) of Designation	Potential Change in Buffer (165-ft wide) Impervious Surface (see Table 5)	Major Types of Foreseeable Future Development Likely to Affect Shoreline Condition	Potential Impacts to Shoreline Ecological Processes	Proposed SMP and Other Regulatory Offsets (Regulatory Citation)	Non-Regulatory Offsets
Residential	23 mi., 1,127 acres (1.9%)	<p>Potential change in % buffer impervious surface ranges from 23.4 (lakes) to 5.1 % (rivers). There is no marine Residential shoreline.</p> <p>On rural lakes and streams, high concentration of eligible parcels along medium/low to medium/high condition shorelines. No eligible parcels on marine shoreline.</p>	<ul style="list-style-type: none"> Minimal to moderate changes possible due to potential for: new residences, some of which may qualify for shoreline variance and be built in buffers, and expansion of up to 1,000 sq. ft for existing single family residential structures Limited number of new roads and other infrastructure will be built to accommodate new or expanded development 	New or expanded development may impact vegetation, LWD, sediment, hydrology, water quality, and light energy.	<ul style="list-style-type: none"> KC CAO (buffers, clearing limits, mitigation for all impacts, and roads and other infrastructure follow low impact design) and FHMP (zero-rise), WDFW HPA 	<ul style="list-style-type: none"> Rural stewardship programs tax incentive and TDR programs, Public involvement and education Open space acquisition, restoration and stormwater retrofit programs FHMP and Salmon Recovery CIPs
High Intensity	5 mi., 446 acres (0.7%)	There is little potential change as there are very few eligible parcels in this designation.	<ul style="list-style-type: none"> Minimal changes expected due to high level of existing development. Limited potential for: new residences, some of which may qualify for shoreline variance and be built in buffers, and expansion of up to 1,000 sq. ft for existing single family residential structures Small amount of new roads and other infrastructure expected because most are already in place. 	Conditions expected to stay the same or improve somewhat over the existing baseline because new development or redevelopment will have to follow higher standards for environmental protection than was required of the older, existing development.	<ul style="list-style-type: none"> KC CAO (buffers, clearing limits, mitigation for all impacts, and roads and other infrastructure follow low impact design) and FHMP (zero-rise), WDFW HPA 	<ul style="list-style-type: none"> Public involvement and education Open space acquisition, restoration and stormwater retrofit programs FHMP and Salmon Recovery CIPs

Proposed Shoreline Designation	Length (miles), area (acres) and Proportional Area (%) of Designation	Potential Change in Buffer (165-ft wide) Impervious Surface (see Table 5)	Major Types of Foreseeable Future Development Likely to Affect Shoreline Condition	Potential Impacts to Shoreline Ecological Processes	Proposed SMP and Other Regulatory Offsets (Regulatory Citation)	Non-Regulatory Offsets
Aquatic	N/A	N/A	Minor change (positive and negative) possible due to implementation of the FHMP (a positive) but off-set by limited number of new docks and localized, limited use of dredging and bank armoring for emergency, private residence and critical facility protections	<ul style="list-style-type: none"> • Future conditions difficult to predict --- may stay the same or decline somewhat over the existing baseline because some new development in or along water is expected. • Alternatively, implementation of the FHMP could provide net improvement in river shoreline conditions due to construction of flood hazard reduction projects that remove, set-back or modify existing flood control structures and floodplain development. • Construction of docks and piers allowed in areas w/ past legal alterations and that currently provide less significant habitat. For marine shorelines, nearshore environmental conditions would be evaluated for potential impacts prior to approval of new docks or piers. Options such as sharing existing docks or installing a moorage buoy are preferred. 	<ul style="list-style-type: none"> • KC CAO (buffers, clearing limits, mitigation for all impacts, and roads and other infrastructure follow low impact design) and FHMP (zero-rise), • WDFW HPA • Conditional Use Permit required for new docks and piers in Natural and Resource shorelines. 	<ul style="list-style-type: none"> • Public involvement and education • Open space acquisition, restoration and stormwater retrofit programs • FHMP and Salmon Recovery CIPs

Attachment 2. Summary of Potential Change in Buffer Impervious Surface on Eligible Parcels

Designation*	Shoreline Type	Existing Conditions				Potential Future Conditions (1,000 sf added to the buffer of each eligible parcel)**						
		Average Shoreline Parcel % Impervious	Acres of Existing Impervious Surface in Buffer including hazard areas	Average Shoreline Buffer % Impervious including hazard areas	# Parcels with Existing Impervious in Buffer	# of Parcels with Existing Impervious in Buffer outside of Hazard areas	Acres of Potential Future Impervious Surface in Buffer, including hazard areas	Potential Future Average Buffer % Impervious, excluding hazard areas	Potential Future Average Buffer % Impervious, including hazard areas	Potential Future Average Parcel % Impervious including hazard areas	% of Total Parcels Potentially Affected	Total Parcels in Each Designation and Type
Conservancy	Lake	13.0	45.6	16.9	564	510	58.6	21.5	21.7	15.1	65.8	775
	Marine	7.4	14.2	8.2	274	74	20.5	9.6	11.8	10.2	17.1	434
	Stream	9.2	212.9	9.8	1,685	1,496	251.7	11.8	11.5	10.0	51.6	2,897
Natural	Lake	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0.0	14
	Marine	4.9	12.2	4.7	196	57	16.7	5.2	6.5	6.3	13.5	422
	Stream	1.5	0.9	1.6	34	21	1.6	2.2	3.0	1.9	9.8	215
Residential	Lake	25.8	56.4	12.5	779	708	74.3	34.6	35.9	31.6	73.1	968
	Stream	23.2	22.2	20.6	238	233	27.7	27.2	25.6	25.1	65.3	357
Rural	Lake	14.6	21.6	10.7	379	373	30.4	22.1	22.3	18.5	60.7	614
	Marine	21.3	93.5	5.1	1,312	624	123.7	33.4	29.6	27.1	41.4	1,507
	Stream	11.8	54.4	0.1	428	404	64.2	14.2	13.6	12.7	47.1	857
Forestry	Lake	3.5	6.5	3.4	12		6.5					49
	Stream	3.4	137.2	3.3	263		137.2					710
High Intensity	Lake	85.0	1.5	63.5	3		1.5					3
	Marine	27.3	1.0	31.3	22		1.0					24
	Stream	70.7	48.7	62.0	78		48.7					105
Resource	Marine	6.1	1.4	6.8	4		1.4					5
	Stream	7.2	94.4	0.5	361		94.4					695
Total Acreage			824.4				959.8					
Overall Buffer % Impervious***				8.0				9.4				

* There is minimal opportunity for use of the 1,000 sf expansion standard in the Forestry, High Intensity and Resource designations; these designations are excluded from the analysis.

**Exclude publicly-owned parcels and parcels that are in landslide hazard areas or severe channel migration zone.

***There are 10,258 total acres in the 165-foot buffer in King County's shoreline jurisdiction.