



**Washington and
British Columbia**

Credits and Ratings Guide

*A reference for homeowners,
designers, and construction
professionals to help minimize the
environmental impact of waterfront
properties and development*

December 2015

People love to live in places where water and land meet. Shorelines provide work, recreation, living space, mild climates and wonderful views. People are not the only ones drawn to shorelines. Due to their diverse resources and habitats, shorelines are *biologically rich and productive places*.

Unfortunately, many of the natural features that make shorelines so attractive are often the casualty of human activities. Native trees, shrubs, and grasses are cleared to make way for houses, lawns, and views. Bulkheads, docks and piers displace beaches and alter natural shoreline processes. Loss of shoreline vegetation allows contaminants to flow directly into the water. Prime wildlife habitats disappear, taking with them birds, mammals, fish, and beneficial insects.

The good news is that people are finding new strategies for protecting waterfront properties while also protecting and restoring habitats. Instead of concrete and sheetpile, these practices use a combination of plantings, gravel and sand, logs, stones, setbacks, and slope modification to protect against shoreline erosion and provide access while respecting the ecological attributes of the shoreline.

Adapted from *Green Shorelines*, City of Seattle, 2011



City of Seattle
Department of Planning and Development



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Introduction

Green Shores for Homes (GSH) is a program that focuses on positive steps to reduce the impact of residential development on shoreline ecosystems, and helps waterfront homeowners restore natural shorelines and enjoy the many benefits they bring.

Led by the City of Seattle in partnership with San Juan County in Washington and the Stewardship Centre for BC and Islands Trust in British Columbia, GSH is intended to address both marine and lake environments. It is based on four guiding principles:

- Preserve or restore physical processes—the natural actions of water and sediment movement that maintain healthy shorelines.
- Maintain or enhance habitat function and diversity along the shoreline.
- Prevent or reduce pollutants entering the aquatic environment.
- Avoid or reduce cumulative impacts—small individual effects that add up to large impacts on shoreline environments.

How does Green Shores benefit homeowners?

- By increasing accessibility of shorelines, eliminating drop-offs and walls, and creating opportunities for strolling, kayaking, foraging and simple beach fun.
- By beautifying shorelines, adding native vegetation, and habitat for fish and wildlife.
- By making shorelines more secure against erosion and flooding, with alternatives to costly bulkheads that still address owners' concerns.
- By offering financial benefits such as technical assistance, reduced permit fees, and tax incentives, similar to other "green" programs like LEED™, BuiltGreen™ and Sustainable Sites™.

How does Green Shores benefit the environment?

- By preserving and restoring physical processes: the natural actions of water and sediment that maintain healthy shorelines. "Immobilizing" bulkheads and rock embankments can disrupt these natural actions.
- By preserving and enhancing shoreline habitats, including both plant and animal communities, and biodiversity.
- By preventing or reducing pollution of the aquatic environment.
- By reducing cumulative impacts: the small individual effects that add up to large impacts on shoreline environments.

The GSH Rating System

The GSH Rating System has been created as a tool for waterfront homeowners and their contractors to develop their properties in a shore friendly way that meets these principles. It applies to all types of shorelines in both marine and lake environments—from rocky to sand and gravel shores, estuaries to mudflats, rock cliffs to coastal bluffs.

The GSH Rating System is built on a format similar to green building rating programs such as Built Green™ and LEED™. A shoreline project is assessed against a series of **credits** for which a homeowner or builder can achieve **points**. All of the credits and the maximum points available for each are summarized in the Credit Rating Levels table on the next page.

There are four general **application requirements** that all shoreline projects must complete in order to apply for a GSH rating. These requirements provide the baseline information for all the credits, and consist of:

- **An existing conditions plan:** Show existing site conditions and shoreline processes that will affect your project.
- **A site design plan:** Show the project in the context of the existing site conditions and processes.
- **An environmental management plan for construction:** Minimize site disturbance and address sediment and pollutant control on your site.
- **Critical or sensitive habitat identification:** Avoid disturbing or destroying these vital habitats.

There are 22 credits for which points may be achieved. The credits are organized under four categories:

- **Shoreline physical processes:** Protect or restoring natural physical processes that are vital to the health of shoreline environments.
- **Shoreline habitat:** Protect, restore, and enhance aquatic and riparian habitats.
- **Water quality:** Eliminate the amount of sediment, chemical and organic pollutants discharged to lakes and marine waters in rainwater runoff.
- **Shoreline stewardship:** General best management practices that help to support public values of shorelines.

Credit Rating Levels

It is important to realize that out of the 22 credits available, most shoreline projects will qualify for only 5 to 10 credits. Getting a GSH rating, however, is dependent not on the number of applicable credits, but on how many points you can get for the credits that do apply to your project.

A shoreline project may achieve either of two GSH rating levels based on the number of points achieved: :

<p>GSH 1 “CHINOOK”</p> <p>The project results in recognizable improvement and/or conservation of the natural features and processes of the shoreline.</p>	<p><i>20-39 points of which a minimum of 10 points (collectively) are acquired from Shoreline Processes and Shoreline Habitats credit categories.</i></p>
<p>GSH 2 “ORCA”</p> <p>The project exhibits exceptional design regarding improvement/ conservation of the natural features and processes of the shoreline.</p>	<p><i>Minimum 40 points of which a minimum of 20 points (collectively) are acquired from Shoreline Process and Shoreline Habitat credit categories.</i></p>

Incentives

In addition to the practical and environmental benefits of the initiatives described in this guide, a number of British Columbia and Washington State jurisdictions are currently evaluating the Green Shores for Homes program for the possibility of establishing incentives for homeowners to participate in this program.

As the program matures and incentive programs become available to homeowners, the Green Shores for Homes web site (greenshoresforhomes.org) will list any participating jurisdictions.

Introduction

Credits Points Summary

Credit Category	Credit	MAXIMUM Points Available:		Total Points Available
		Base	Bonus	
Shoreline Processes	1.1 No Shoreline Protection Structures	15	--	15
	1.2 Setback/Impact Avoidance	10	4	14
	1.3 Bulkhead Removal	15	8	21
	1.4 Groin Removal	5	2	7
	1.5 Soft Shore Protection or Enhancement	12	5	17
	1.6 Managed Retreat	10	3	13
Shoreline Habitats	2.1 Riparian Vegetation	10	5	15
	2.2 Trees and Snags	5	1	6
	2.3 Invasive Species	4	--	4
	2.4 Woody Material	3	--	3
	2.5 Overwater Structures	10	--	10
	2.6 Access Design	3	--	3
Water Quality	3.1 Site Disturbance	5	--	5
	3.2 Reduce and Treat Runoff	6	2	8
	3.3 Env. Friendly Building Products	4	--	4
	3.4 Creosote Material Removal	4	0	4
	3.5 Herbicides, Pesticides and Fertilizers	2	--	2
	3.6 Onsite Sewage Treatment	2	1	3
Shore Stewardship	4.1 Shoreline Collaboration	8	--	8
	4.2 Public Information and Education	1	1	2
	4.3 Conservation Easement or Covenant	6	--	6
	4.4 Shoreline Stewardship Participation	2	--	2

Types of Development

The GSH Rating System applies to both new development and renovations or modifications to existing shoreline structures, buildings, or landscaping on residential waterfront properties. Where applicable, individual credits may make a distinction between:

- *Whole site development* where the proposed project involves the entire waterfront lot, and *riparian or shoreline development* where the proposed project occurs only in the area from the intertidal zone (in a marine environment) or from the littoral zone (in a freshwater environment) to the upper edge of the riparian zone.
- *Lake* (freshwater) and *marine* (saltwater) shorelines.
- *Greenfield* (never previously developed) and *redevelopment* (previously developed) sites.
- *Urban* and *rural* sites: distinguished primarily on the basis of lot size.
- *Bedrock* and *sediment-based shorelines*. There are detailed systems for classifying shores according to their physical type; however, for the purpose of the GSH rating system, we make a distinction between *sediment-based* shores and *bedrock* shores.



Sediment shore examples Credit: H. Rueggeberg (left), N. Faghin (right)

Sediment-based shores (above) are formed of mud, sand, gravel, cobbles, and/or boulders. Depending on the size of the sediment and the nature of the shoreline processes, these shorelines are moderately to highly erodible, and are sensitive to any activities that interrupt the transport of longshore sediments and the sediment sources that feed them.

Introduction

Bedrock shores (below) are comprised of solid rock benches or cliffs. These shorelines tend to be stable and resistant to erosion and changes in shoreline processes.



Bedrock shore examples Credit: Archipelago Marine Research Ltd. (left), P. Law (right)

How to use the GSH Rating System

In most cases, applying for GSH rating would be considered at the preliminary planning stage for a shoreline project. However, the GSH process is also available to waterfront owners who want to apply for GSH rating of their existing property or a completed shoreline project.

To begin the GSH rating process, obtain a copy of the *Credits and Ratings Submittal Form* package from your GSH advisor.¹ This package describes exactly what is required to meet each application requirement and credit. Then, organize your planning around the following steps:

1. Ensure that you can fulfill the application requirements; without those, an application for GSH rating will not be considered. These requirements are covered in the next four steps. Note that many of these requirements may already be covered in development applications needed for your project.
2. Complete an *existing conditions plan* (page 12). A plan that is required by development applications for the project may suffice or can be readily adapted for this purpose.
3. Complete a *site design plan* (page 14). Again, a plan that is required for development applications for the project may suffice or can be readily adapted for this purpose.
4. Complete the onsite *environmental management plan for construction* (page 17).
5. Show any designated or identified *critical or sensitive habitats* on the existing conditions plan.

¹ The submittal form is available on the Green Shores for Homes website [greenshoresforhomes.org](https://www.greenshoresforhomes.org).

6. Review the credits and determine which ones are applicable to your project. For each applicable credit, try to determine how many points you could acquire. You may choose to adapt your design plan to meet higher point levels where possible. Total the points that you think your project can acquire to make sure that you can meet the minimum point total to achieve the desired GSH rating level.
7. Fill out the applicable submittal forms for the credits for which you are applying. The submittal forms are provided in Microsoft Excel format; when you enter points for each credit in its applicable form, the point total is automatically generated on the summary sheet.
8. The next steps will depend on where you live and the process that may be adopted in your jurisdiction. Typically you will submit your GSH submittal forms to the local jurisdiction that has adopted the GSH Credit and Rating System. A Green Shores for Homes verifier will review the application to ensure that you've met the application requirements, indicate if any changes or additional information is needed, review the applicable credits with you, and ensure that you have enough points to achieve a GSH rating².
9. Undertake your project, meeting each of the credits that you defined. The GSH verifier may be able to answer questions you may have along the way regarding achieving the credits.
10. Upon completion of the project, notify the Green Shores for Homes verifier to arrange a site visit and final evaluation.

Meeting regulations in your area

Many of the GSH credits involve activities that are regulated or require permits. Agencies at local, state/provincial and federal levels review shoreline projects to ensure that they are safe, protect aquatic habitats and species, maintain water quality, and preserve public lands and interests. The multi-layered regulations for shoreline development can be daunting.

Given the many jurisdictions involved, it is not possible to cover regulatory requirements in detail for all shoreline development situations in the Pacific Northwest. The "For more information" sections under each credit list publications by regulatory agencies that provide information on permit requirements. Your local government is often the best source of information on all of the shoreline requirements in your area.

² "See the Green Shores for Homes website (greenshoresforhomes.org) for news and updates on participating jurisdictions, any available incentives, and details about the registration, submittal, and verification process.

Introduction

Many of the items needed for GSH credits are part of permit requirements, and can be used directly in applying for a GSH rating. If you need to apply for a permit for your project, you can likely use the same information for a GSH rating application.

Many jurisdictions are trying to encourage the kinds of practices reflected in this rating system. They may have requirements that favour Green Shore approaches and are working to make the regulatory process smoother for restoration of natural processes along shorelines. Proposals that feature natural beaches and plantings will tend to be more acceptable than those that emphasize armoring; following the GSH process may make any applicable permitting process easier and faster.

Using professionals

Many types of shoreline projects require help from one or more professionals. In general, the greater the degree of wind and wave exposure, the greater the need for some professional design expertise, particularly on softer, sediment shores.

Trained, experienced consultants and contractors can help you with design, permitting, building, operating, and maintaining a cost effective, sustainable, attractive, and environmentally friendly project. Depending on the specifics of your project and site, you may need a coastal/shoreline engineer or geologist, biologist, geotechnical expert, landscape architect, site designer, machine operator, or permit specialist. Some companies do all of these things while others specialize in one or two professions.

- Start by identifying your priorities: is it erosion protection or landscape design? access or drainage improvement?
- Research possible candidates on the Internet, and by talking to friends and neighbors who have undertaken similar works.
- When talking to possible candidates, stress your interest in green shorelines and “soft engineering” approaches, and ask to see photos or visit project sites. Enquire specifically about the practices that each contractor uses to minimize pollutants, erosion, and impacts on the shore, and their familiarity with the GSH rating system.
- Once you have narrowed down to three or four candidates, invite them to your property for specific recommendations and estimates. In talking with these professionals, make sure that you are confident in their abilities and approach, and that you will be able to have a collaborative relationship.

Marine Shoreline Design Guidelines

The *Marine Shoreline Design Guidelines* (MSDG)³ were published recently by Washington State’s resource management agencies to provide a comprehensive framework to help assess the need for shore protection, and identify the techniques that best suit the conditions at a given site in the Puget Sound region. These guidelines provide a valuable resource to users of the GSH credit and rating system in helping to assess the need for alternative approaches to shore protection, and understand how best to put those approaches into practice.

Reference is made throughout this guide to specific chapters or sections of the MSDG where they relate to the credits. As a general reference, Chapter 5 of the *Marine Shoreline Design Guidelines* provides guidance on how to evaluate and if needed, select an appropriate erosion control technique for a specific site. One of the tools in Chapter 5 is a “decision tree” for identifying appropriate shore protection techniques for a given site; that decision tree is reproduced in Appendix B of this guide.

How this Guide is Organized

This document guides you through the process of applying for Green Shores for Homes credits. The next section, “Applications Requirements,” walks you through the process of preparing your credit submission:

- Prepare an **existing conditions plan** that describes the site conditions
- Develop a **site design plan** describing the proposed development
- Prepare an **environmental management plan** outlining your strategies for controlling erosion, sediment, or pollution at the site.
- Identify and prepare to protect any **critical or sensitive habitats** at the site

The majority of this document outlines each of the four main credit categories:

- Category 1: **Shoreline Processes**
- Category 2: **Shoreline Habitats**
- Category 3: **Water Quality**
- Category 4: **Shore Stewardship**

Each category section lists the available credits within that category, along with the benefits, points available, and specific requirements for each credit.

³ Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman, 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington. 419 p. <http://wdfw.wa.gov/publications/01583/>

Introduction

Lastly this guide includes a glossary of terms that you may encounter within this program, and an appendices that offers landscaping guidance and lists of useful plants for shoreline projects.

For more information, visit www.greenshoresforhomes.org.

Application Requirements

To be considered for a Green Shores for Homes rating, four basic components are required: an *existing conditions plan* describing site conditions; a *site design plan* describing the proposed development; an *environmental management plan* outlining your strategies for controlling erosion, sediment, or pollution at the site; and an assessment of any *critical or sensitive habitats*. Each of these requirements is described on the following pages.

In this Section:

Existing Conditions Plan

Site Design Plan

Environmental Management Plan for Construction

Critical or Sensitive Habitats

Existing Conditions Plan

In preparation for the GSH program, identify and map out any existing site conditions that will affect—or be affected by—your proposed project.

An Existing Conditions plan is a drawing done ‘to scale’ that shows basic features such as location of the site, property boundaries, elevations and contours, trees and vegetation, buildings and structures. In the case of shoreline projects, it should show the Ordinary High Water Mark (OHWM) or natural boundary (NB) and existing structures along the shoreline and in the riparian area.⁴

An Existing Conditions plan is a common component of any set of design drawings typically required by local authorities to approve a building or development project. Therefore, if you have prepared design drawings for your project, you should be able to use or adapt the Existing Conditions plan from these design drawings to meet this Application Requirement.

Benefits

To the homeowner

Mapping site characteristics and features is an important tool to inform the design process. A thorough study of site conditions allows homeowners to gain an understanding of key site features and their individual and collective benefits, while helping to identify cost-saving opportunities and constraints. Knowing your site allows you to develop a design that benefits the environment, and can save you money in the long run by helping to prevent costly mistakes and repairs.

To the environment

Identifying and assessing site features, processes and characteristics *before* developing a detailed design allows features that play vital roles in how the site and shoreline function to be protected early on. For example, areas of valuable vegetation or erodible soils will be identified and proper buffer zones established before new infrastructure and buildings are placed, minimizing the risk of impacts to nearby aquatic environments.

How to proceed

1. If you have not already done so as part of a set of project design drawings, generate a drawing or image of the existing site conditions; otherwise, use the Existing Conditions plan from your design drawings.
2. Use the checklist provided in the Credits Submittal Package (see sheet “Application Requirement: Existing Conditions Plan”) to ensure that the site features necessary for a GSH application are met. Pay particular attention to

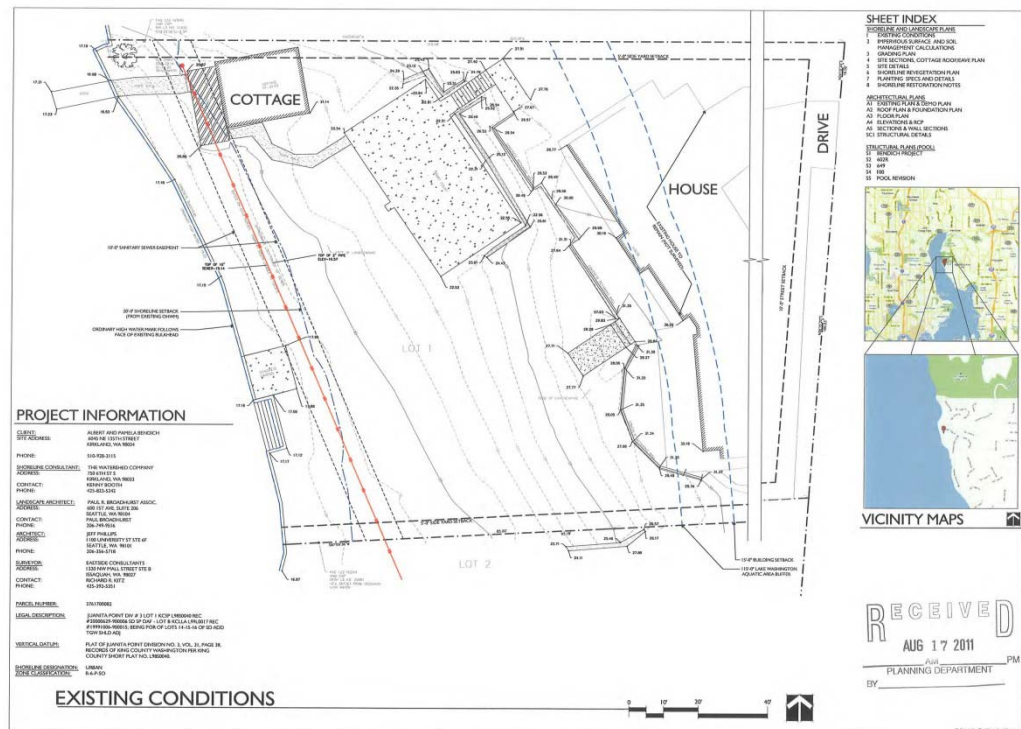
⁴ See the Glossary for definitions of OHWM, NB and riparian area.

Application Requirements

features that need to be preserved or protected during construction, such as areas of permeable soils, feature vegetation, existing woodlands, streams, wetlands, riparian areas, significant habitat areas, and water storage areas. The range of site characteristics to cover will depend on the project being planned. An existing conditions assessment may require more detail for a green field site than for a previously developed site, or a site where only modifications to existing shoreline structures are being considered.

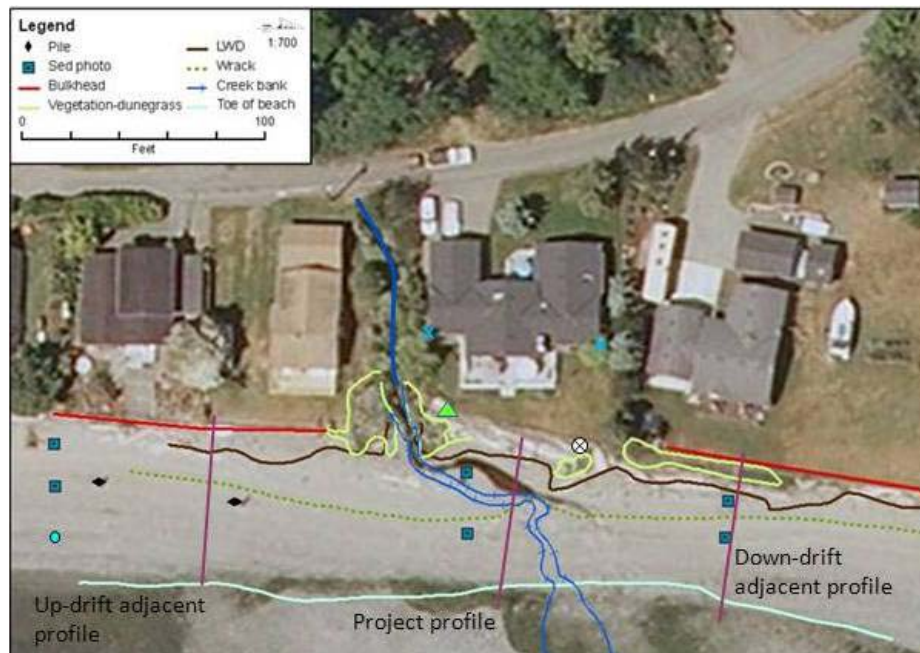
3. Take “before project” photos of the site, noting the position from which the photos are taken on the Existing Conditions Plan, so that you can replicate that same perspective in “after project” photos.

Following are two examples of Existing Conditions Plans: the first is a typical design-drawing plan for a single property; the second uses an air photo, likely downloaded from a web-based map site, to show existing conditions for a multi-property shoreline protection project. Either approach is acceptable provided the basic elements in the Submittal checklist are covered.



Example of an Existing Conditions plan for a single property Credit: The Watershed Company

Application Requirements



Example of an Existing Conditions plan using an air photo base Credit: Coastal Geologic Services Inc.

For more information

Check your local government for development application requirements, including site existing conditions assessments and site plans, for shorelines.

In Washington State, check the Shoreline Inventory and Characterization Report in the local Shoreline Master Program, which can provide valuable information on existing conditions of the shoreline in your area.

Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman, 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington. 419 p. wdfw.wa.gov/publications/01583/

Site Design Plan

Develop a Site Design plan that shows the proposed development project in the context of current site conditions and processes.

A Site Design plan is a to-scale drawing or set of drawings that shows the elements of a proposed development project. It usually contains a 'plan view' (view from above looking down, like a floor plan) and may also contain drawings that show 'side' and 'section' views. Like an Existing Conditions plan, a Site Design Plan is a component of project design drawings typically required by local authorities to approve a building or development project. Therefore, you can likely use or adapt your design drawings to meet this GSH application requirement.

Benefits

To the homeowner

Developing a Site Design Plan is part of the planning and design process to properly size and locate all the project elements on the existing site. The planning and design process allows homeowners to fit their project to their existing site and to avoid costly alterations to existing site conditions. Completing a simple design plan early in the design process will help identify potential problems and design shortcomings before they become a real problem. Rather than react to a problem, homeowners can use this to design more efficient homes, multifunctional landscapes and greener shorelines.

To the environment

A Site Design Plan will ensure that all proposed design initiatives are properly sized and located in way that protects important site features, and preserves existing site processes and functions.

How to proceed

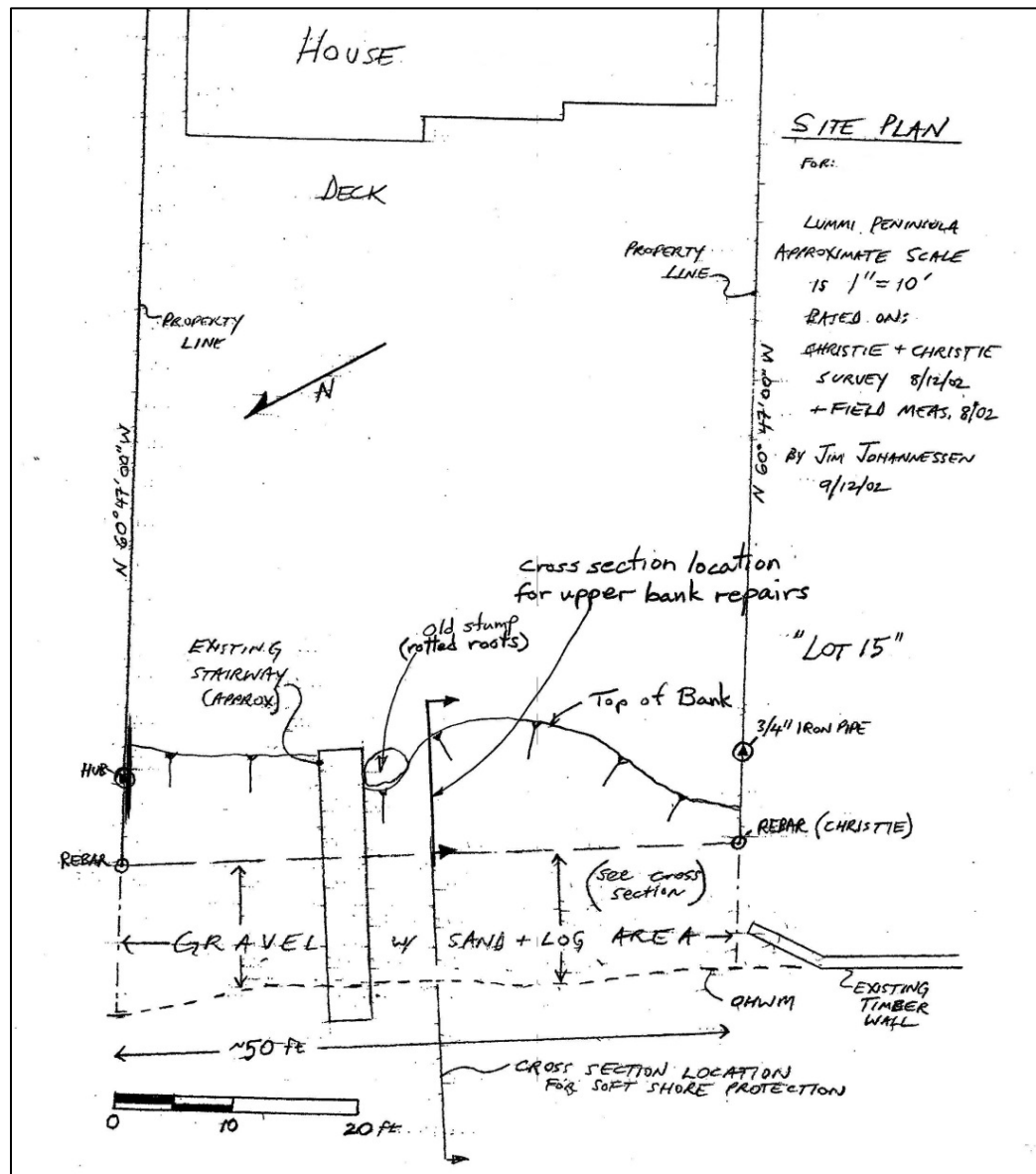
A Site Design Plan usually starts with the Existing Conditions Plan and then incorporates proposed development and site changes, including:

- Building areas and locations
- Patios
- Driveways
- Pedestrian circulation paths
- Access points
- Overwater structures
- Shore protection measures
- Soil amendment and vegetation planting

Application Requirements

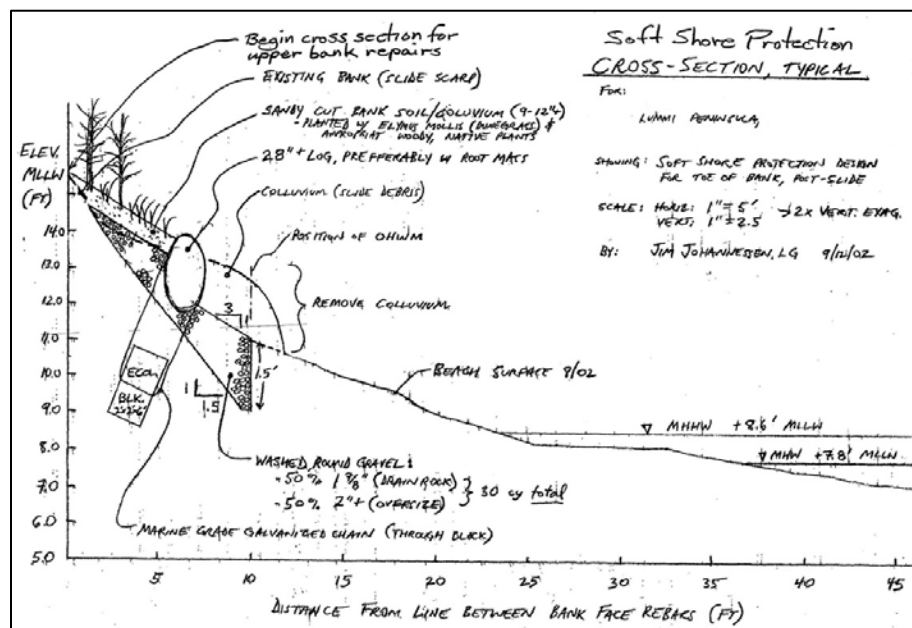
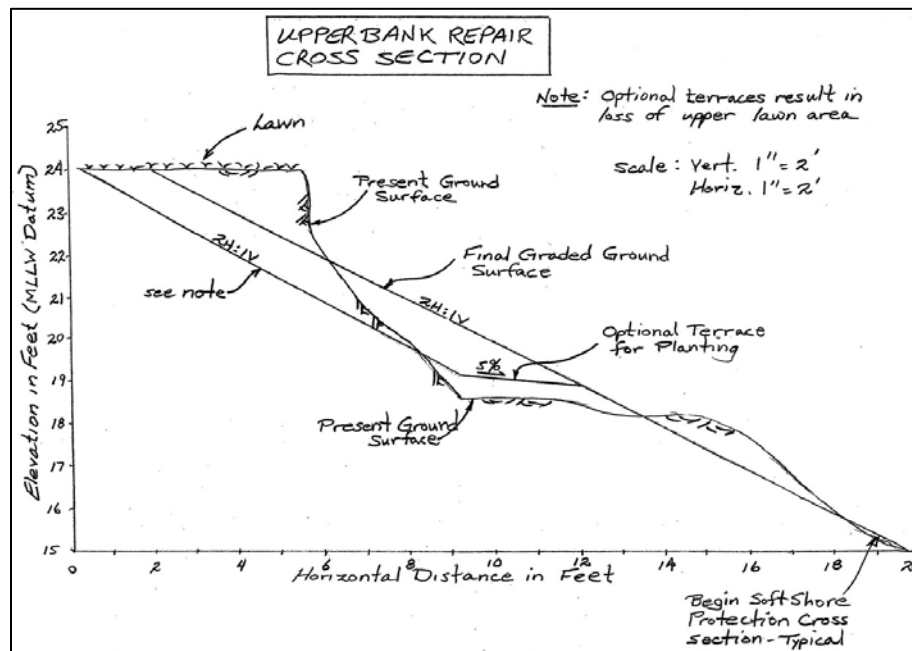
Fit these elements into the site while maintaining critical existing site features and processes identified in the existing conditions plan. The following examples depict a typical site design plan.

If protecting an existing structure from erosion is part of your project, Chapters 5 and 6 of the *Marine Shoreline Design Guidelines* (Johannessen et al., 2014 - see full reference under "For more information") may provide insights into alternative strategies and methods for weighing the options on your site. While developed for marine shorelines, there are also useful ideas for lake shoreline situations.



Example site design plan (see next page for cross-sections) Credit: Design by Coastal Geologic Services; from *Marine Shoreline Design Guidelines* (2014)

Application Requirements



Example site design plan—cross-sections to provide detail Credit: Design by Coastal Geologic Services; from Marine Shoreline Design Guidelines (2014)

For more information

Check your local government for development application requirements, including existing conditions assessments and site plans, for shorelines.

Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman, 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington. 419 p. wdfw.wa.gov/publications/01583/

Environmental Management Plan for Construction

Develop and implement a plan to limit disturbance and address erosion, sediment, and pollutant control on site during construction.

Sedimentation of receiving waters is highest when erodible materials are exposed, particularly during construction. In addition, materials such as paint, drywall compound, concrete wash, and glues need to be managed to prevent pollution. All proposed activities need an *environmental management plan for construction* to show how sediment/runoff and pollutants are managed during the construction phase of the project.

This type of plan is often required by local jurisdictions as a “stormwater management plan” (in the US) or an “erosion and sediment control plan” (in Canada). You can use these plans to fulfill this GSH requirement.

Benefits

To the homeowner

Limiting disturbance of existing vegetation and compaction of soils is the best and least expensive form of stormwater management. Managing construction activities and related waste materials before and during construction is simpler and less costly than clean-up and restoration after the fact. A healthy nearshore marine ecosystem and clean fresh water streams contribute to the allure of living on the shoreline. All landowners have a hand in preserving and improving shoreline ecosystems and the overall health of the entire Salish watershed.

As the population grows, there will be an increasing number of waterfront landowners who share the shoreline. All waterfront owners want clean water, healthy fish and wildlife, and clean beaches—these not only assure good human health but also increased property values.

To the environment

The main benefit is the prevention of runoff of construction-related sediment and pollutants into local ground and surface water. Numerous studies have shown vegetation removal and run-off from upland development to be a primary cause of degraded marine and nearshore water quality. Upland development can increase land-based erosion and land slumping, resulting in sedimentation and smothering of nearshore flora and fauna. Limiting disturbance combined with containing and treating sediment or pollutant-laden water, and containing, reusing, or recycling construction chemicals and materials will help to reverse this trend.

How to proceed

The environmental management plan lays out the proposed best management practices (BMPs) to prevent erosion and sedimentation and to prevent, reduce or eliminate water pollution from construction activity. These BMPs include:

- Clear only land necessary to successfully complete the project.
- Minimize areas of vegetation removal and earth movement.
- Conduct construction activities in dry seasons.
- Limit the amount and where heavy machinery is used.
- Know the sources of sediment and pollutants from construction activities and plan for their containment/management in areas where they will have the least impact.
- Develop a strategy for dealing with spills and leaks.
- If access to the shoreline is needed for construction, identify where and how that will occur.
- Look for a conscientious contractor who will economize on the use of construction materials, limit the necessary transport of materials to and from the site, minimize heavy equipment on site, and commit to containing, recycling, reusing, or properly disposing of construction waste.
- Set up waste collection and recycling facilities on site, and maintain them throughout and beyond the construction project as necessary.
- If any neighbors are also planning projects on their property, why not coordinate your environmental management measures? For example, set up a common sediment collector if possible, or share the waste pickup service. It could save both money and resources.

The Submittal Checklist for this requirement indicates the items to include in your GSH application to reflect these best management practices.

For more information

BC Ministry of Environment, 2012. *Develop with Care: Section Three - Site Development and Management*. www.env.gov.bc.ca/wld/documents/bmp/devwithcare/#

Capital Regional District, Victoria, BC. Erosion Prevention & Sediment Control. Go to www.crd.bc.ca and search for “erosion control”

City of Seattle, Director's Rule 16-2009 / SPU 2009-004, Vol. II - *Construction Stormwater Control Technical Requirements Manual*. Go to www.seattle.gov/dpd/default.htm and search for “construction stormwater”.

Washington State. *Stormwater Management Manual for Western Washington* Volume II- Construction Stormwater Pollution Prevention. www.ecy.wa.gov/programs/wq/stormwater/manual.html

Application Requirements

Washington State Dept. of Ecology. Resources and Guidance for the Construction Stormwater General Permit.

www.ecy.wa.gov/programs/wq/stormwater/construction/resourcesguidance.html

Environmental Protection Agency. *Construction Site Stormwater Runoff Control*.

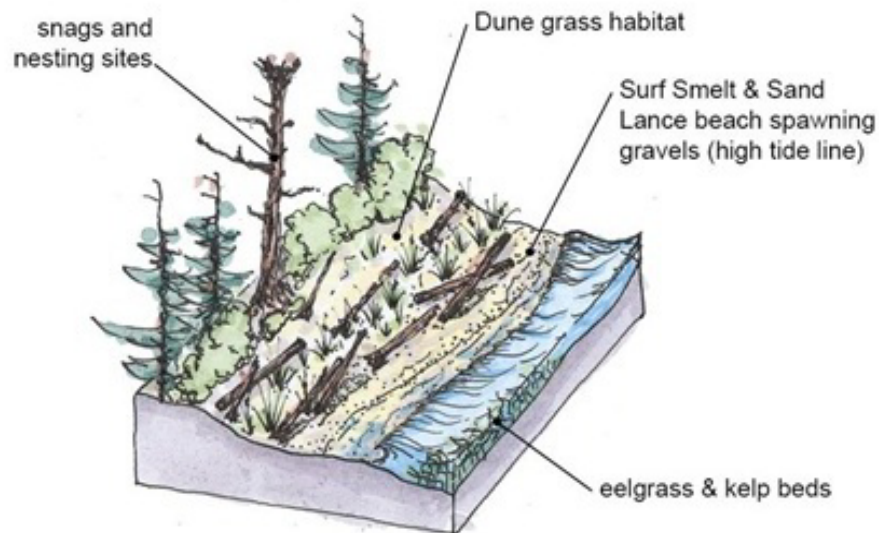
<http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-Stormwater-Run-Off-Control.cfm>

Critical or Sensitive Habitats

Avoid disturbing or destroying critical or sensitive habitats.

To ensure the conservation and protection of rare, endangered, threatened or priority species, local, state/provincial and federal laws identify and designate critical or sensitive habitats.

TYPICAL SHORELINE SENSITIVE HABITATS:



Credit: City of Campbell River Marine Foreshore Habitat Assessment and Restoration Plan (2011)

In Washington State, this includes:

- Critical habitats identified under the *Endangered Species Act* (ESA);
- Priority habitat species identified by the Washington Department of Fish and Wildlife (WDFW) in the *Growth Management Act*;
- Critical areas and critical salt water and freshwater habitat defined by the *Shoreline Master Program (SMP) Guidelines* (WAC 173-26).
 - Under the SMP, critical saltwater habitats include: kelp beds; eelgrass beds; spawning and holding areas for forage fish such as herring, smelt and sand lance; subsistence, commercial and recreational shellfish beds; mudflats; intertidal habitats with vascular plants; and areas with which priority species have a primary association.
 - Also from the SMP, critical freshwater habitats include those portions of streams, rivers, wetlands, and lakes, their associated channel migration zones, and flood plains designated as such.

Application Requirements

In Canada, and particularly in British Columbia, this includes:

- Areas providing important feeding, resting, spawning, nesting, or rearing habitat for species designated under the federal *Species at Risk Act* or the *BC Wildlife Act*, or identified as “red” or “blue” listed species by the BC Conservation Data Centre;
- “Environmentally Sensitive” or “Significant Areas” identified by the federal, provincial, regional or municipal government in your area;
- Shore and marine areas identified as “Important Bird Areas” by Nature Canada and Bird Studies Canada;
- Other valued foreshore habitats including estuaries, fresh and saltwater marshes, wetlands, eelgrass beds, kelp beds, clam beds, spawning and rearing areas for fish, and feeding and resting areas for seabirds and marine mammals.

Benefits

To the homeowner

Protecting sensitive habitats preserves your investment in what drew you to living on the shoreline. These habitats perform many ecological functions that maintain the quality of environment—like controlling erosion and maintaining water quality—far more inexpensively than engineered methods.

To the environment

Protecting sensitive habitats maintains native plant and animal populations, and with that biodiversity.

How to proceed

There may be current, approved inventories that can help you identify whether critical or sensitive habitats occur on your property. Check with your local government, or visit their website for information on local “environmentally sensitive areas” (ESAs), or check online or at local offices of provincial or state environment agencies.

In Washington State, these include (but are not limited to) inventories and maps prepared under the Growth Management Act (GMA) “critical areas,” and Shoreline Master Program shoreline characterization maps and reports. Watershed and salmon recovery organizations may also have documents that help identify these resources.

In B.C., several regional districts and municipalities have identified and mapped ESAs, and may have additional information on critical species and their habitats. You can also search by municipality for local species at risk on the Species at Risk

Primer website and the B.C. Species and Ecosystems Explorer (see “For more information” for website addresses).

For larger projects, you may need to hire a qualified professional to conduct a habitat assessment of your property. Local biologists/ecologists should be familiar with pertinent legislation, inventories, and data sources and are knowledgeable of local species and habitats.

Note that where losses of existing critical or sensitive habitats are unavoidable due to the property size or configuration, such losses must be justified and offset with onsite compensation; that is, creating or restoring the same habitat somewhere else on the property. Offsite compensation for habitat losses cannot be used to meet this requirement. A qualified professional can help to identify appropriate compensatory measures.

Ways to protect these habitats include:

- Incorporate valued habitat features as part of the desired improvements.
- Design to avoid or minimize activities and development that may result in loss of critical or sensitive habitats; e.g., avoid putting fill or installing protective works below the OHWM.
- Preserve native vegetation, especially trees and overhanging vegetation, and salvage native plants for use in your landscaping scheme. This is often less expensive than buying new plants; an increasing number of landscapers specialize in plant salvage.
- Locate overwater structures (i.e. docks, walkways, piers) over areas with little or no vegetation; minimize the size of the overwater structure to avoid impacts to fish; and use grated surfaces on overwater structures to allow light penetration.
- Avoid landscaping or siting buildings and access roads in areas of marsh or wetlands that may impact drainage to the shore.
- Restore areas disturbed during development or previously degraded areas whenever possible.

For this requirement, you will need to provide:

1. The location of any critical or sensitive habitats in the shore zone (the riparian, foreshore or subtidal/littoral zone) on your Existing Conditions Plan.

An assessment of potential impacts to habitats, consideration of alternatives, efforts taken to minimize such impacts and if necessary, mitigation measures to be taken. This may be a report by a qualified professional, or a copy of the approvals or permits from the applicable regulatory agency demonstrating that no critical/sensitive habitats are impacted or that any such losses have been adequately compensated.

Application Requirements

For more information

Canada/B.C.

Species at Risk and Local Government: a Primer for BC: www.speciesatriskbc.ca

BC Species and Ecosystems Explorer: www.env.gov.bc.ca/atrisk/toolintro.html

BC Conservation Data Centre: www.env.gov.bc.ca/cdc/

BC Sensitive Ecosystems Inventory: www.env.gov.bc.ca/sei/

Canadian Species at Risk Act (SARA): www.dfo-mpo.gc.ca/species-especes/home_e.asp

Important Bird Areas in Canada/BC: www.ibacanada.com/explore.jsp?lang=en

U.S./Washington State

Local Shoreline Master Program, Shoreline Inventory and Characterization Report.

Seattle, City of. 2011. *Green Shorelines: Bulkhead alternatives for a healthier Lake Washington*. 34 pg. Go to www.seattle.gov/dpd/ and enter “Green Shorelines” in the search box.

Washington Dept. of Fish and Wildlife. Priority Habitats and Species.
wdfw.wa.gov/conservation/phs/

Category 1: Shoreline Processes

Shoreline processes refer to the interaction of water, wind, waves, and the shore that shape our diverse beach, bluff, cliff, and estuarine areas.

The shoreline process credits are intended to encourage waterfront property owners to protect, restore, and/or maintain the natural physical processes that form shorelines and that benefit shoreline ecosystems along with the many organisms that live within them.

The credits described in this section are available for restoration and enhancement actions, and for avoiding activities that damage shoreline processes:

In this section:

Credit 1.1: No Shoreline Protection Structures

Credit 1.2: Setback/Impact Avoidance

Credit 1.3: Bulkhead Removal

Credit 1.4: Groin Removal

Credit 1.5: Soft Shore Protection or Enhancement

Credit 1.6: Managed Retreat

Credit 1.1: No Shoreline Protection Structures

Credit 1.1: No Shoreline Protection Structures

To qualify for this credit, there should be no bulkheads, groins or other shore protection structures on the waterfront property, and none proposed for the foreseeable future.



Credit: B. Emmett

Where this credit applies

This credit applies to any residential shoreline property. A distinction is made in the “Points Available” between rocky shores and sediment-based shores because rocky shores are resistant to erosion and typically do not need protective structures. Because it is easier to have no shoreline structures on rocky shores than on sediment-based shores, fewer points are available for properties with rocky shores.

Note that this credit cannot be combined with Credit 1.3: “Bulkhead Removal”; i.e., you cannot get points for this credit once a bulkhead or other shore protection structure is removed.

Benefits

To the homeowner

Having no shoreline protection structures means less maintenance and repair costs, fewer obstructions to views, and often better access to the water.

Credit 1.1: No Shoreline Protection Structures

To the environment

No shoreline protection structures means no impediments to natural shoreline processes and the conservation of shoreline features, functions, and habitats in their natural state.

Points available

This credit offers up to 15 base points.

No shoreline protection structures across 100% of the shoreline	Base points
On bedrock shore	10
On sediment shore	15

How to proceed

Whether measures to protect the shoreline from erosion are needed is an important consideration on many, though not all, waterfront properties. Chapter 4 of the *Marine Shoreline Design Guidelines* (Johannessen *et al.*, 2014 - see full reference under “For more information”) provides help on assessing coastal processes that may be the cause of shoreline erosion. Particularly relevant to this credit, Chapter 6 looks at techniques for managing onsite erosion that do not rely on shoreline structures. While developed for marine shorelines, this document offers useful ideas for lake shoreline situations.

When applying for this credit, show the condition of the shoreline before and after any development project (using site design plans and photos) to illustrate that there are no shoreline protection structures.

For more information

Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman, 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington. 419 p. wdfw.wa.gov/publications/01583/

Credit 1.2: Setback/Impact Avoidance

Credit 1.2: Setback/Impact Avoidance

To qualify for this credit, ensure that existing or proposed buildings and other major improvements are set far enough back from the shoreline or bluff crest to avoid the need for shore protection structures over the life of the buildings.



Credit: City of Seattle

Where this credit applies

This credit applies to all sites with an existing or proposed home or other major building. This credit is particularly important for bluffs that provide sediment to the natural shoreline system, known as feeder bluffs, and sites exposed to high wave-energy (Johannessen and MacLennan, 2007). The use of an adequate setback to avoid damage over the life of the building or improvement is an important design consideration. Determining an adequate setback must take sea level rise and climate changes into consideration, which generally will require larger setbacks.

Benefits

An adequate setback is the single most effective action to save money, ensure peace of mind, and protect shoreline habitat over the long run.

To the homeowner

A substantial setback distance can save a lot of money over the life of a house, particularly in avoiding the cost of installing a bulkhead, soft shore protection, or other actions to mitigate erosion and shoreline hazards.

Credit 1.2: Setback/Impact Avoidance

To the environment

A building setback that is sufficient to last for 75 or more years of safe use of a property without requiring the installation of “hard” measures is among the most effective methods of maintaining natural processes and protecting ecological functions of shorelines. Setbacks address the root causes of habitat degradation, and not just the risk or consequences of having an insufficient setback from an eroding shore.

Points available

This credit offers up to 10 base points and 4 bonus points.

Setback/Impact Avoidance (base points: choose A, B, or C)	Base points
A. Regulatory setback: Meet the current setback from the Ordinary High Water Mark (OHWM) or Natural Boundary (NB) required in your local jurisdiction, with <u>no</u> variance or relaxation of that requirement. This setback may be specified in a zoning regulation, shoreline development or habitat protection regulation, or be determined on a site-basis by local regulators. OR	3
B1. 75-year setback: Provide the distance from OHWM/NB needed to allow for natural beach or bluff erosion processes, without armoring or other major protective action, over 75 years or over the life of the building, <i>whichever is greater</i> . B2. Alternatively, if there are no data available to estimate rate of erosion, provide the minimum setback required by the local jurisdiction or 75 feet (25 m) from OHWM/NB, <i>whichever is greater</i> . OR	6
C. 75-year setback + SLR: Provide the distance from OHWM/NB needed for natural beach/bluff erosion processes, without armoring or other major protective action, over 75 years or over the life of the building, <i>whichever is greater</i> - plus take account of changes in the location of the OHWM/NB and changes in erosion processes that will occur due to projected sea level rise (SLR).	10
Bonus (available only if one of the base conditions above is met)	Bonus points
Total impact setback: Provide an additional buffer to allow for a larger erosional or landslide event beyond the 75-year setback requirements. General rule of thumb is 25 ft (7.5 m) for this additional setback unless more detailed geologic/ geotechnical work is completed and indicates otherwise.	2
Bluff site: Apply any of the above setbacks at a bluff site. This bonus point is to encourage the maintenance of a “feeder bluff” (sediment input) function as well as to maintain the diverse habitats of a bluff-beach system.	2

Credit 1.2: Setback/Impact Avoidance

How to proceed

A) Regulatory setback:

Many coastal jurisdictions have regulations defining the minimum setback from the OHWM/NB, or a similar baseline. Some regulations may exceed the setbacks determined according to the methods described in this section. In all cases, to meet this credit, the setback in your project must equal or exceed the setback required by regulation in your jurisdiction.

If you can demonstrate that the existing regulatory setback meets or exceeds the 75-year setback, the 75-year setback + SLR or the total impact setback (see below), then you are eligible for the points awarded for these setbacks.

B1) 75-year setback

The first step is to estimate the erosion rate or range of likely erosion rates for your site. Erosion rates may be available for some areas through:

- Geological/Geotechnical reports
- USGS/Environment Canada published maps
- Beach Watchers and other credible citizen science organizations

However, these sources are quite limited spatially, and erosion rates can vary significantly over short distances, so applying a rate from a different location must be done with caution. Also, erosion rates cannot be determined with only short term data.

Green Shores approaches and climate change

Climate change presents challenges to waterfront properties in the Pacific Northwest, particularly those on marine shores and less so on lakes. These challenges include:

- Sea level rise, higher wave heights and more intense storm surges— all resulting in more coastal flooding.
- Increased rainfall in winter months and with it, increased surface runoff. This may be compounded by drainage problems caused by higher sea levels that cause drainage ways to back up.
- All of the above, causing increased shoreline erosion.

To take climate change into account in your development plans, determine the predicted sea level rise (SLR) for your area; for example, SLR levels of 0.5 m to the year 2050, 1.0 m to 2100 and 2.0 m to 2200 are predicted for much of the B.C. and Washington State coast. Figure out how this will change the location of the OHWM on your property over the next 75 years or the life of the project, whichever is greater. This may require the assistance of a land surveyor to show this new location on the ground and on a site map.

Credit 1.2: Setback/Impact Avoidance

A qualified professional geologist or coastal engineer can help you determine a site-specific erosion rate, using aerial photos. Estimate the erosion rate from the best available air photos at 1:12,000 scale or better over the longest time period possible. Ideally, this would be 50 years or more, but due to limited air photo and survey records, 30-40 years is more realistic. Alternatively, small scale (less than 1:10,000) topographic or other survey maps of the site over similar time periods can be used. These maps should show bluff crest or similar identifiable shoreline features, and include documented methods so that others can assess the level of accuracy.

Once the erosion rate is estimated, the setback for the life of a building (minimum 75 years) can be calculated. For example:

If estimated average erosion rate = 4 in (10 cm)/year

Then 75-yr setback = 300 in or 25 ft (8 m) from OHWM.

B-2) Alternative

In the absence of any data to support an estimate of erosion rates as described above, use a minimum setback of 75 ft (25 m).

C) 75-year setback + SLR

To assess the impact of sea level rise, the following steps are recommended:

1. Identify the predicted sea level rise (SLR) for your area; for example, SLR levels of 0.5 m to the year 2050, 1.0 m to 2100 and 2.0 m to 2200 are predicted for most of the BC coast (Ausenco Sandwell, 2011 - see “For more information”). Several other coastal jurisdictions also assume a sea level rise of about 1 meter by the year 2100.
2. Determine how this will change the location of the OHWM on your property over the next 75 years or the life of the project, whichever is greater. This may require the assistance of a land surveyor to show this new location on the ground and on a site map. Apply the Basic Setback measured from this future OHWM/NB.

Total impact setback (bonus point)

For bluff and steep bank sites, the risk of large slope failures/landslides due to shoreline erosion and typical bluff failures must also be factored in to determine an adequate setback. This can be done in a general sense by applying an additional buffer of 25 ft (7.5 m) over and above the projected erosion rate-based setback. A more precise approach is to determine the largest slope failure or bluff recession in the local area over recent decades and measure the distance that the shoreline receded in that event—either on the ground or in comparing before and after aerial photos. In areas with a history of larger landslides, a minimum of twice this additional setback distance would be required.

Credit 1.2: Setback/Impact Avoidance

Feeder bluff (bonus point)

As noted above, this bonus point is to help maintain sediment input to shorelines by feeder bluffs and with it, the habitats of a bluff-beach system, particularly forage fish and other habitats reliant on sediments. Feeder bluff mapping throughout Puget Sound may be found at the Washington Dept. of Ecology website www.ecy.wa.gov/programs/sea/shorelines/FeederBluffs/mapping/index.html.

For more information

Arlington Group Planning and Architecture Inc. *et al.* 2013. *Sea Level Rise Primer: A Toolkit to build adaptive capacity on Canada's south coasts*. Go to www2.gov.bc.ca/ and enter "sea level rise adaptation primer" in the search box.

Ausenco Sandwell. January 2011. *Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use*. For BC Ministry of Environment. Go to www2.gov.bc.ca/ and enter "coastal flood hazard" in the search box.

Bornhold, B. 2008. *Projected Sea Level Changes for British Columbia in the 21st Century*. 12 pg. Go to www2.gov.bc.ca/ and enter "Bornhold sea level changes" in the search box.

Coastal Geologic Services. 2010. Current and Historic Coastal Geomorphic (Feeder Bluff) Mapping of San Juan County, Washington. Friends of the San Juans. 76p. www.sanjuans.org/maps.htm

Johannessen, J.W. and A.M. MacLennan, 2007. *Beaches and bluffs of Puget Sound and the Northern Straits: A valued ecosystem component*. Published by WA Sea Grant, Seattle WA. Go to http://pugetsoundnearshore.org/technical_reports.html and scroll down to report 2007-04.

Lamont, G., J. Readshaw, C. Robinson and P. St-Germain. 2014. *Greening Shorelines to Enhance Resilience; an Evaluation of Approaches for Adaptation to Sea Level Rise*. Prepared for the Stewardship Centre of BC. 46 p. http://stewardshipcentrebc.ca/Green_shores/resources/

University of Washington Climate Impacts Group and Washington Department of Ecology. 2008. *Sea level Rise in the Coastal Waters of Washington State*. 11 pg. www.cses.washington.edu/db/pdf/moteetalslr579.pdf

Washington Dept. of Ecology, Feeder Bluff Mapping of Puget Sound
www.ecy.wa.gov/programs/sea/shorelines/FeederBluffs/mapping/index.html

Credit 1.3: Bulkhead Removal

To qualify for this credit, reduce or remove any type of hard shore armor (collectively called “bulkheads”).

Bulkheads and shore armor include seawalls, revetments, riprap, gabions and similar along-shore structures designed to protect against wave attack or serve as a retaining wall at the shore. Bulkheads have been constructed on all types of shorelines, but are most common along erodible beaches and non-bedrock bluff sites. The goal of this credit is for complete armor removal, although lower points are awarded for partial removal.



Bulkhead examples Credit: The Watershed Company, H. Rueggeberg

Credit 1.3: Bulkhead Removal

Where this credit applies

This credit applies to any site where bulkheads exist. Bulkhead removal is particularly important at feeder bluff sites where it can restore the natural sediment supply, potentially providing the most benefit to shoreline processes and habitats. Bulkhead removal is also important on beaches where forage fish spawn, because it can help to restore critical habitat in the nearshore and foreshore food web.

Bulkhead removal may not be feasible on small lots with limited space between a house and the shore and no room to move the house back. A qualified professional (coastal geologist or engineer) can advise on the stability of a site and the effect of bulkhead removal prior to considering this action. It may be possible to move part of a bulkhead or move a bulkhead back to restore a partial beach.

When a bulkhead is removed, some form of protection from erosion is often still needed. In these situations, the beach profile is modified using “soft shore protection” measures, in which natural materials (beach gravel, sand, logs, vegetation, etc.) are added to the shore to mimic natural conditions and maintain natural processes.

The point values under this credit take the replacement of hard armoring with a soft shore into account. ***Therefore, points cannot be earned for both this credit (1.3) and Credit 1.5 “Soft Shore Protection and Enhancement” for the same length of shoreline, EXCEPT if a bulkhead is removed from a portion of the shoreline (Credit 1.3) and a portion of the previously unprotected shoreline is treated with soft shore methods (Credit 1.5).***



Bulkhead removal - before, during and after
Credit: King County Water and Land Resource Division

Benefits

To the homeowner

Benefits for shoreline owners and users of the beach include reduced maintenance of shoreline structures, improved shoreline access, increased aesthetic value, and improved fish and wildlife viewing.

- Bulkheads have a finite life expectancy and require maintenance or replacement over time. Bulkheads can fail either incrementally or catastrophically for a number of reasons including undermining of the base, battering by drift logs, loss of integrity due to rot or other deterioration, or flanking erosion at the ends of structures. In addition, future sea level rise may accelerate damage to bulkheads.
- A bulkhead often creates a barrier for a property owner to the shore; replacing it with a soft shore eliminates that barrier and can make for safer access to the water.
- Sand and pebble beaches are highly valued, but bulkheads often block the replenishment of finer beach materials, changing a sand/pebble beach into a boulder, cobble one.
- Although aesthetic values are hard to quantify, the removal of non-natural materials such as concrete and riprap from an otherwise natural beach environment is generally viewed as an improvement.
- Fish and wildlife tend to favour beaches with adjacent vegetated areas, which are almost always increased in quantity and quality following bulkhead removal. This leads to increased fish and wildlife use and increased viewing opportunities.
- Over the long run, it is often more cost effective to relocate buildings landward than to build, mitigate, and maintain shore armoring.

To the environment

Bulkhead removal is one of most beneficial actions that can be performed on an armored waterfront property, in terms of improving natural processes and nearshore habitat conditions. These high-impact structures have a broad suite of impacts on shorelines:

- Bulkheads hinder shoreline processes such as sediment supply and the transport and recruitment of large woody debris (LWD).
- Bulkheads can indirectly impact down-drift shores by decreasing sediment supply and increasing erosion. The physical presence of a structure can reduce or block the movement of upland and bluff sediment from feeder bluffs, which provide sediment to the beach through erosion and landslides. Blocked sediment supply affects both onsite and down-drift beach profiles

Credit 1.3: Bulkhead Removal

and substrate composition—often turning sand or pebble beaches into cobble and rock.

- Many nearshore fish and wildlife species require functioning high intertidal habitats to provide sources of food, migration corridors, cover/micro-climate effects, and spawning habitat. Bulkheads can bury or cause the loss of these important habitats (Rice 2006). The removal of bulkheads allows for the recovery of nearshore habitats previously buried beneath or behind armor.
- Bulkheads may not have been built using the most environmentally friendly materials (creosote treated wood, concrete, etc.). As these materials age and fail either incrementally or catastrophically, they negatively affect water quality and shoreline habitat.
- Bulkheads impede the connectivity between terrestrial and aquatic ecosystems. They hinder riparian vegetation from providing insects and leaf litter as food for fish and invertebrates; prevent the recruitment of woody debris to the shore; alter groundwater regimes; and hamper animals from reaching shoreline food sources.

Points available

This credit offers up to 15 base points plus up to 6 bonus points.

Bulkhead removal	Base points
Net bulkhead removal* along 95-100% of the shoreline	15
Net bulkhead removal* along 75-94% of the shoreline	11
Net bulkhead removal* along 50-74% of the shoreline	8
Net bulkhead removal* along 25-49% of the shoreline	4
Net bulkhead removal* along 10-24% of the shoreline	2
Bulkhead moved back	Base points
Move bulkhead back along 80-100% of the shoreline so that it is minimum 3 ft (1 m) above the Ordinary High Water Mark (OHWM)	8
Move bulkhead back along 40-79% of a the-shoreline so that it is minimum 3 ft (1 m) above OHWM	4
Bonus (available once one or more base conditions have been met)	Bonus points
Area of bulkhead removal is in a drift cell and/or at a feeder bluff**	2
Bulkhead removal is within a shore area with documented spawning habitat for marine or freshwater fish and/or invertebrate species.	2
Set up and implement a system for monitoring what happens to the beach and property after the bulkhead is removed or moved back.	2

*Net bulkhead removal means:

- For a bulkhead that extends the full length of the shoreline, the length removed minus any length that is retained or replaced with armoring. E.g., if 100 ft of seawall is removed and 20 ft is replaced

Credit 1.3: Bulkhead Removal

with a riprap revetment, the net bulkhead removal is 80%.

- For a bulkhead that extends along only a portion of the shoreline, the % shoreline along which the bulkhead is removed minus the % shoreline where armoring is retained or replaced. E.g., if a seawall extending along 75 ft of a 100 ft shoreline is removed and none of it is replaced with armoring, the net bulkhead removal is 75%. If 15 ft of the original wall is replaced with riprap, the net bulkhead removal is $75 - 15 = 60$ ft or 60% of the shoreline.

**In Washington State, to determine if a site is in a drift cell, check mapping at the Washington Dept. of Ecology Coastal Atlas map server: <https://fortress.wa.gov/ecy/coastalatlas/>. In the Gulf Islands of BC, go to www.islandstrust.bc.ca and search for "Integrated Shoreline and Watershed Maps".

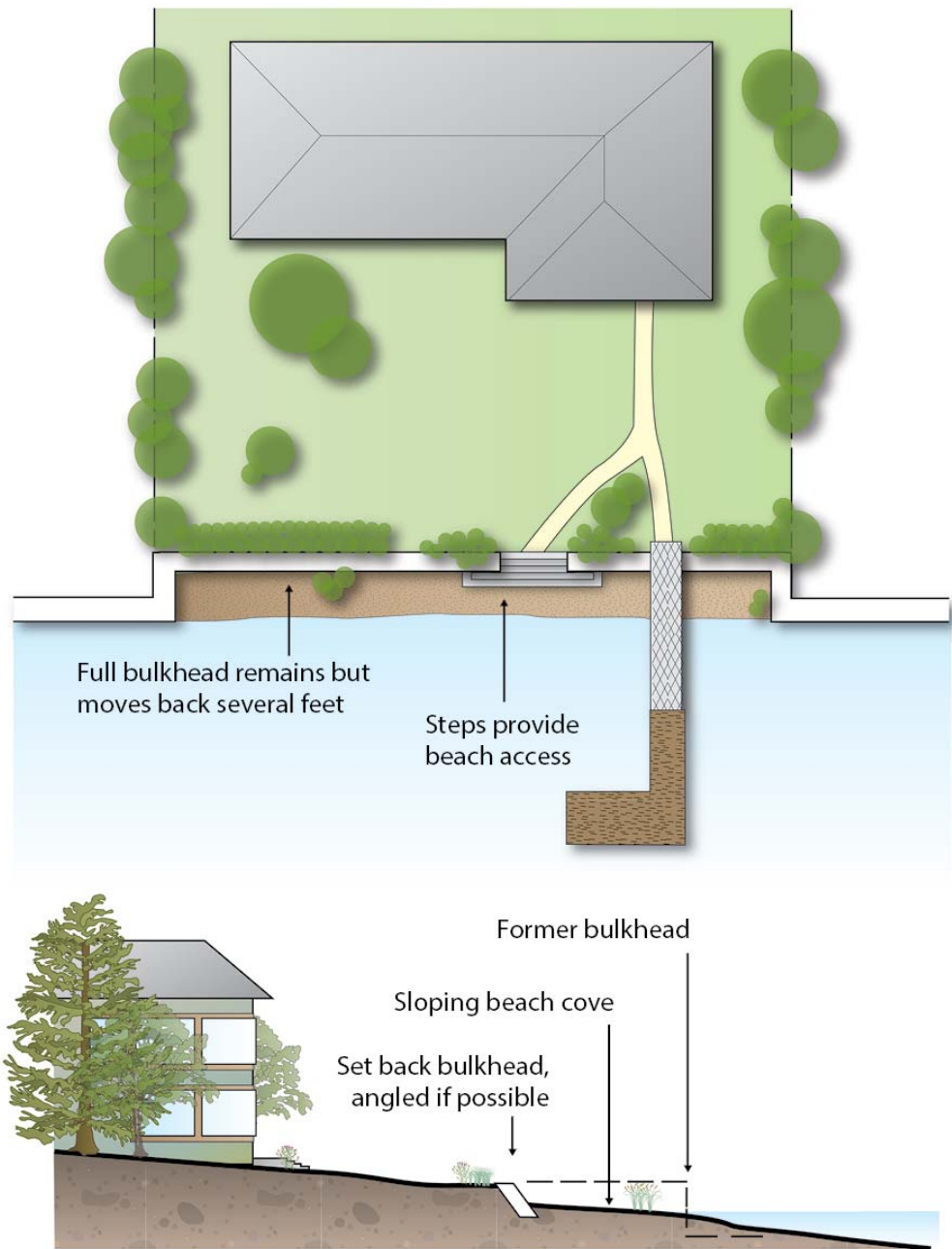
How to proceed

Bulkhead removal projects can involve single or multiple properties and can take different approaches, depending on how much of the bulkhead is removed and what is done to the shoreline afterwards. Bulkhead projects may require permits or other approvals from regulatory agencies. Check your proposed project with local, state/provincial or federal authorities before getting started.

The following explains the Points Available table above.

- Bulkhead removal: Full (100%) bulkhead removal is ideal, but may not always be possible; for example, it may be necessary to retain portions of a bulkhead or keep end walls to tie into adjacent bluffs or bulkheads on neighboring properties. Some shore armor may need to be retained or replaced to protect foundations and underground services. Therefore, points are available for removing a bulkhead from 10% to 100% of the shoreline of a property.
- Moving a bulkhead back/landward: In some cases, limited lot size may dictate the need for some sort of armoring to protect a home or important infrastructure. In these cases, it may be possible and advantageous to replace a deteriorating bulkhead with a new bulkhead further back from the OHWM. This can allow room for restoring shoreline habitat AND put the bulkhead where it will require much less maintenance or be prone to damage. By moving a bulkhead back, a homeowner can gain a beach with its many amenities as well as re-establish habitat for shoreline flora and fauna (see the following figure).
- Bonus points: It is particularly beneficial to shore habitats to remove or move bulkheads where they block natural erosion and accretion processes (i.e., in a drift cell or below a feeder bluff), and where they occur next to fish and invertebrate habitat. Monitoring the effect of the bulkhead removal over the following 2-5 years allows everyone to learn more about the effectiveness of this action on habitat and shoreline processes. It also provides an owner the opportunity to modify or improve the shoreline design before any serious 'failures' occur.

Credit 1.3: Bulkhead Removal



Moving a bulkhead back schematic Credit: City of Seattle (2011)

Bulkhead removal projects should maximize the restoration of natural processes while balancing the need for property protection. A removal or modification design needs to balance risk of damage to primary structures with the enhancement of shoreline processes and habitat. Full bulkhead removal and enhancement is the goal of these projects, unless geologic or engineering analyses recommend the use of lower impact shore protection at the site.

Credit 1.3: Bulkhead Removal

Ongoing maintenance

Note that removing a bulkhead and replacing it with a soft shore is not a zero-maintenance solution. Most soft shore protection measures require maintenance or replenishment in several years, depending on the level of activity of shoreline processes.

The *Marine Shoreline Design Guidelines* (Johannessen *et al.*, 2014 - see full reference below under “For more information”) devotes a chapter to bulkhead removal (Chapter 7, Technique 4). It provides guidance on whether it is appropriate to remove a bulkhead given site conditions, and provides insights on effects, cost, monitoring, and maintenance. While developed for marine shorelines, there are still useful ideas for lake shoreline situations.

Adding a soft shore, or not

Often when a bulkhead is removed, the beach profile is modified using soft shore protection measures; natural materials (beach gravel, sand, logs, vegetation, etc.) are added to the shore above and below the OHWM to mimic natural conditions. Soft shore materials are added when protection from erosion is still needed after a bulkhead is removed, or when it would assist shore habitat restoration.

In some situations, a bulkhead may be removed and the beach profile left to be restored naturally by waves and currents – i.e., with no added soft shore material. The upland above the bulkhead may still need to be graded to a more gradual slope, particularly where the bulkhead was originally backfilled; otherwise, the fill could slough into the foreshore and intertidal areas, smothering the habitat. Whether or not soft shore protection is needed in a bulkhead removal project should be discussed with a qualified professional (coastal geologist or engineer).

For more information

Seattle, City of. 2011. *Green Shorelines: Bulkhead alternatives for a healthier Lake Washington*. 34 pg. Go to www.seattle.gov/dpd/ and enter “Green Shorelines” in the search box.

Coastal and Shoreline Management, from Washington Department of Ecology, Shorelands and Environment Assistance website: www.ecy.wa.gov/programs/sea/sea-env.htm

Gianou, K. 2014. *Soft Shoreline Stabilization: Shoreline Master Program Planning and Implementation Guidance*. Washington Dept. of Ecology Publication no. 14-06-009. 101 p.

Johannessen, J.W. and A.M. MacLennan, 2007. *Beaches and bluffs of Puget Sound and the Northern Straits: A valued ecosystem component*, US Army Corps of Engineers, Published by WA Sea Grant, Seattle WA. Go to http://pugetsoundnearshore.org/technical_reports.html and scroll down to report 2007-04.

Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman, 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington. 419 p. wdfw.wa.gov/publications/01583/

Credit 1.3: Bulkhead Removal

Penttila, D. 2007. Marine Forage Fishes in Puget Sound. Puget Sound Nearshore Partnership Report No.2007-03, Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington. Go to http://pugetsoundnearshore.org/technical_reports.html and scroll down to report 2007-03.

Rice, C. A. (2006). Effects of Shoreline Modification on a Northern Puget Sound Beach: Microclimate and Embryo Mortality in Surf Smelt (*Hypomesus pretiosus*). *Estuaries and Coasts*, v 29, n 1, p. 63- 71. Go to www.sanjuanco.com/index.aspx and search for "Rice shoreline modification".

Credit 1.4: Groin Removal

To qualify for this credit, remove groins and any other structures that extend perpendicular to the shoreline (cross-shore) and impede sediment transport or tidal circulation (wherever removal is feasible, and would restore physical processes).

These types of structures include groins/groynes, boat ramps, jetties, large stormwater outfall pipes, and other structures which extend across the shore and trap littoral sediment on one side or significantly alter tidal circulation. The goal is for complete structure removal, although lower points are awarded for partial removal.

Where this credit applies

This credit applies to any site where a groin or similar perpendicular structure significantly impedes littoral transport or tidal circulation. Emphasis is on sites within littoral drift cells, although removal of a groin can benefit all types of shorelines.

Where this credit does not apply...

This credit is applicable to groins, or portions thereof, that impede natural sediment transport, which occurs primarily in the foreshore (shallow littoral zone) along lakes and the intertidal zone in marine environments.

In marine systems, groins that extend into the subtidal typically do not affect long-shore sediment transport, and in fact, may provide reef-type habitat. In most cases, subtidal groins or subtidal portions of groins should not be considered for removal. In lakes, however, groins that extend into the deep littoral zone may force juvenile fish into deeper water where they fall prey to predatory fish species. In these cases, groin removal may be desirable. Check with local expertise on whether or not to remove deeper portions of a groin.



Examples of groins Credit: H. Rueggeberg (left), M. Henigman (right)

Credit 1.4: Groin Removal

Groin removal is not feasible in locations where removal would cause significant up-drift or down-drift erosion in developed areas; for example, if a house is already located very close to a beach that is being held in place by a groin, it may not be feasible to remove the groin as part of renovations on the property. A qualified professional (coastal geologist or engineer) can advise on the stability of a shoreline and the effect of groin removal on that stability prior to considering this action.

Several beaches enhanced through beach nourishment have used “drift sills” which are low-elevation groins with the up-drift beach filled to the top of the groin with nourishment sediment. These drift sills were used in areas with impeded natural processes or where major buildings or infrastructure are located very close to moderately energetic shores. Removal of drift sills is typically not advised as the beach nourishment sediment may become unstable.

Benefits

To the homeowner

Benefits for shoreline owners and beach users include reduced time and cost for maintenance, increased aesthetic value, and possibly improved fish and wildlife viewing. Groins, like bulkheads, have a finite life expectancy and require maintenance or replacement over time. Groins can fail either incrementally or suddenly for a number of reasons including undermining, battering by drift logs, and loss of integrity due to rot or other deterioration. If a groin is removed it will no longer require maintenance.

To the environment

The benefits of groin removal include restoring sediment transport processes and alongshore connectivity, as well as the recovery of intertidal and backshore habitats buried beneath the structure.

Groins and similar beach structures often result in a variety of negative impacts to nearshore areas, which are similar to those associated with bulkheads. The magnitude of the impacts varies depending on the individual site and size and configuration of the structure and amount and size of sediment. Larger groins that extend below lower low water levels often result in littoral sediment being shunted offshore and lost from the beach system.

The impacts associated with groins include:

- Decreased sediment supply to down-drift shores,
- Localized erosion on the down-drift side of structures,
- Burial of habitat areas,

Credit 1.4: Groin Removal

- Disruption of shoreline processes; particularly when sited where interactions with wave and tidal forces are greatest, and
- Altered sediment composition surrounding structures.

Decreased sediment supply can affect on-site and down-drift beach profiles and substrate composition. Groins and other cross-shore structures can cause the burial of important habitats such as marine forage fish spawning areas and lake sockeye spawning areas (Rice 2006).

Additional adverse impacts depend on the level of impaired along-shore connectivity resulting from the structure, which can include loss or reduction in the transport of sediment and large woody debris (LWD). Each of these impacts has direct and indirect effects on riparian areas, spawning habitats, eelgrass beds, and shellfish areas (Clancy et al. 2009).

Points available

This credit offers up to 5 base points and 2 bonus points

Groin removal	Base points
Removal of a large groin or other cross-shore structure that spans from the lower intertidal zone (below 1/2 of the local tidal range) to above the Ordinary High Water Mark (OHWM)	5
Removal of a groin or similar structure that spans the upper intertidal zone (above 1/2 of the local tidal range) to above OHWM	3
Bonus (available once the base conditions have been met)	Bonus points
Demonstrate that littoral sediment transport has been reduced or blocked by the structure to be removed, as evidenced by a higher beach level on one side of the structure.	2

How to proceed

Since it involves working in the foreshore and fish habitat, groin removal may require permits or other approvals from regulatory agencies. Check your proposed project with local, state/provincial or federal authorities before getting started. Also be aware that removing a groin may affect your neighbor's property—positively or negatively. If you suspect that groin removal might lead to a negative impact next door, seek the advice of a qualified professional before getting started.

Groin removal typically involves pulling out a structure, filling all depressions with appropriate beach sediment, and planting native vegetation if appropriate. It is important to remove all portions of the structure, including materials buried below grade, such that buried material does not become exposed on the beach surface over time. This avoids armor material or debris from surfacing in the future following adjustments in beach elevation.

Credit 1.4: Groin Removal

Removal of groins of moderate or larger size can change accretion and erosion patterns. Assess shoreline processes at and around your site and how they might be changed as part of design plans (as described earlier in the sections “Existing Conditions Plan” and “Site Design Plan”).



Groin removal on Whidbey Island WA: before and after. Although removal was not complete, erosion on the left or down-drift side is diminished due to reduced littoral drift interruption; note that the shoreline to the left of the groin is less indented or offset after removal. *Credit: J. Johannessen*

For small removal projects, do a general assessment of the effects on local erosion and deposition on your shoreline and your immediate neighbors' shorelines; for larger removal projects, do a broader assessment of implications for the shoreline in your area—see Clancy et al. (2009) for details. Items to include in your assessment are:

- Identify the geologic setting of the site, sediment transport processes, general erosion/accretion trends for the project area and the role of the existing groin regarding sediment transport processes.
- Identify areas that are currently being influenced by the existing groin or beach structure.
- Consider the erosion potential associated with adjacent properties.

You may be able to determine whether your structure is in a drift cell using maps published by the Department of Ecology in Washington State, the Island Trust in BC, or other sources as available (see “For more information” below). To determine if sediment transport is blocked or impeded, observe the beach level on each side of the structure to see if one side is higher by 1.5 ft. (0.5 m) or more.

For more information

Clancy, M., I. Logan, J. Lowe, J. Johannessen, A. MacLennan, F. B. Van Cleve, J. Dillon, B. Lyons, R. Carman, P. Cereghino, B. Barnard, C. Tanner, D. Myers, R. Clark, J. White, C. Simenstad, M. Gilmer, and N. Chin, 2009. Management Measures for Protecting the Puget Sound Nearshore. Puget Sound Nearshore Ecosystem Restoration Project Report No. 2009-01. Published by Washington State Department of Fish and Wildlife, Olympia, Washington. see MM 7 Groin Removal and Modification chapter. Go to www.pugetsoundnearshore.org/technical_reports.html and scroll down to 2009-1.

Credit 1.4: Groin Removal

In Washington State, to determine if a site is in a drift cell, check mapping at Washington Dept. of Ecology Coastal Atlas map server: <https://fortress.wa.gov/ecy/coastalatlas/>

In BC, the Islands Trust has mapped the shorelines of each of the member Gulf Islands. Go to www.islandstrust.bc.ca/ and search for “Integrated Shoreline and Watershed Maps”.

Credit 1.5: Soft Shore Protection or Enhancement

Credit 1.5: Soft Shore Protection or Enhancement

To qualify for this credit, construct soft shore protection rather than hard shore protection structures where shoreline erosion control is needed.

Soft shore protection refers to installing natural, flexible shoreline material where erosion control is needed. Soft shore protection approaches may use beach “nourishment,” logs and large natural woody debris, vegetation, and re-sloping a bank or bluff. Often these soft shore protection approaches are used in combination to augment site stability or to address different issues in different parts of a site.

Beach “nourishment” or “replenishment” is a common means of soft shore protection in which sediment lost to erosion is replaced or augmented with imported sediment, often from an upland source, that resembles native beach substrate in both size and composition, but may be slightly larger/coarser. No “fines” - grain size less than 0.5 mm - can be present in nourishment material. Gravel is used most commonly as it is less mobile than sand.

Beach nourishment can protect beach resources by creating a larger sand or gravel reservoir, moving the shoreline seaward. In areas where sediment supply has been substantially reduced due to armored bluffs, beach nourishment can mitigate the lost sediment supply and enable local beaches to more closely resemble their historic sediment composition.

Note that soft-shore protection measures are not zero-maintenance solutions to shore erosion. Any soft shore protection may require maintenance or replenishment every few years, depending on the level of activity of shoreline processes.

Using soft shore protection to address shoreline erosion is an environmentally friendly alternative to armoring; however, it is important to note that for a project to receive points for this credit, the site must:

a) truly require shoreline erosion control to protect existing major buildings *OR*



Beach nourishment before and after, west Marchs Point, Skagit Co. WA Credit: Coastal Geologic Services

Credit 1.5: Soft Shore Protection or Enhancement

- b) have degraded shore habitat that can be demonstrably enhanced by soft-shore measures.

Beach *enhancement* refers to actions, other than bulkhead removal (Credit 1.3) that augment natural features of shoreline systems that may be degraded. Typical beach enhancement projects include adding beach sediment to enlarge a beach, pocket beach, or marsh area where these habitats are moderately impacted. Ideally, beach enhancement designs would replicate historic conditions or those from a nearby unaltered beach with similar dominant drivers (waves, geology, etc.).

Where this credit applies

This credit applies to marine and freshwater shores with sediment-based shorelines. **Adding sediment to a naturally rocky shore does not qualify for this credit.**

As noted above, this credit applies to sites at risk to shoreline erosion and/or where there is potential to restore damaged shoreline habitat. If neither of these two criteria is met, **sediment cannot be added just to qualify for this credit.**

Finally, points cannot be earned for both this credit and Credit 1.3 “Bulkhead Removal” for the same length of shoreline, EXCEPT if a bulkhead is removed from a portion of the shoreline (Credit 1.3) and a portion of the previously unprotected shoreline is treated with soft shore methods (Credit 1.5).

Soft shore protection projects are most successful on more protected shorelines, and typically not feasible where there are high wave energy and high erosion rates. In areas that are unsuitable for soft shore protection, moving buildings further landward should be considered over installing hard shoreline protection structures.

Benefits

To the homeowner

Soft shore methods can help to protect buildings that are threatened by erosion while avoiding the typically more expensive bulkhead and related types of engineering approaches. Additionally, the use of soft shore protection as compared to hard approaches often results in increased resilience and greater aesthetic appeal of the finished product, particularly after several years when vegetation has been established and the site has naturalized. Enhancement projects typically also increase the available beach or salt marsh area, which allows for additional recreational and fish and wildlife observation opportunities. All of these effects improve property values.

Credit 1.5: Soft Shore Protection or Enhancement

To the environment

Soft shore methods can provide effective erosion control on suitable sites where protection is required, while not impacting geomorphic processes or substantially degrading nearshore habitats.

Properly designed soft shore projects work with natural conditions, and compared to hard shore protection, offer a suite of more desirable outcomes. For instance, beach nourishment may provide spawning habitat for forage fish species such as Pacific sand lance and surf smelt and lake-spawning sockeye salmon, as well as provide food sources for salmon and other food fish species, birds, and marine mammals. Unlike bulkheads, beach nourishment contributes to natural sediment transport and shoreline habitats.

Soft shore beach enhancement projects can restore or augment shoreline features to provide a net gain in shoreline habitats and ecological services. In some cases, enhancement actions can mitigate for the loss of habitat, such as creating a lagoon where an historic lagoon had been filled nearby and constraints on the original site prevent full restoration.

Points available

This credit offers up to 12 base points and up to 5 bonus points.

Use soft shore measures <u>instead of armoring</u> for protection from erosion over*:	Base points
95-100% of the shoreline	12
75-94% of the shoreline	8
50-74% of the shoreline	6
25-49% of the shoreline	4
10-24% of the shoreline.	2
Bonus (available once one of the base conditions has been met)	Bonus points
In areas where the beach and nearshore habitat have been degraded, provide documentation that the soft shore measures recreate, restore or enhance spawning habitat for marine or freshwater fish and/or invertebrate species.	3
Set up and implement a system for monitoring the effectiveness of your soft shore protection project.	2

* Note that the remaining % of the shoreline NOT subject to soft shore measures may be bulkheaded OR may have had a bulkhead removed and received points under credit 2.3.

How to proceed

Note that in the US, beach nourishment projects that extend below the Ordinary High Water Mark (OHWM) must be reviewed by federal, state and local regulatory agencies. Similarly in Canada, any beach nourishment below the

Credit 1.5: Soft Shore Protection or Enhancement

OHWL must be reviewed by Fisheries and Oceans Canada (due to the potential impact on fish habitat), reviewed by provincial land authorities (the foreshore is owned and managed by the Provincial Crown), and is subject to local government regulation.

Soft shore projects should be designed and supervised by a qualified coastal engineer or geologist. The project must employ a design that allows for the continuation of natural processes such as littoral drift and riparian vegetation growth, and not completely alter beach or backshore areas.

If you have to work in the foreshore (below the OHWM), approval from state, provincial or federal fisheries or environment agencies is required. Also, any work in shoreline and riparian areas will likely be regulated at the local level (e.g., as “development permit areas”). Always consult with your local government to find out what approvals are needed.

If forage fish spawning has been documented on the subject beach, soft shore protection projects must not bury these habitats without designing in their replacement. Use an appropriate sediment composition (rich in 1-7 mm sized sediment) to assure that spawning habitat is enhanced rather than degraded. Up to five years is needed for this to come to fruition at more impacted sites. Monitor the project to assure that spawning habitat is preserved or enhanced.



Beach nourishment with logs at Tyee Spit in Campbell River, British Columbia Credit: P. Harrison

Credit 1.5: Soft Shore Protection or Enhancement

Logs or other woody debris may be placed to add complexity and elevation to a beach nourishment project, and to help to hold added beach material. In some cases, logs may be anchored to buried boulders or concrete blocks. Do NOT use creosoted or chemically treated woody debris in soft shore protection projects.

On marine sites, woody debris are typically only used above the higher high tideline to protect the area landward of the beach during storms at low to moderate wave energy sites. Logs have only been used successfully at lower elevations on the beach in low wave energy sites (less than 2 miles, or 3.2 km fetch, or open water distance).

Vegetation is often used for soft shore protection in conjunction with other approaches. For marine sites, do not bury backshore vegetation without replanting. Planting with salt-tolerant species like native dune grass and native trees and shrubs is focused on the area immediately above the normally inundated beach. On low energy shores with fine-grained sediment, salt marsh vegetation can be installed or enhanced to reduce intermittent erosion, although this would typically not be a site that would require soft shore protection and would instead be considered beach enhancement.

Bank re-sloping reduces the slope of an unstable bank and smoothes out landslide scarps or other features that are particularly steep and unstable. This may require installation of erosion control fabric on the slope in very unstable slope sites. To be successful over time, re-sloping is immediately followed by intensive planting of native vegetation selected for high root strength. Re-sloping may not be feasible on small waterfront lots where there is little room between the bank and major buildings, or room to move the buildings back.

Limited hard elements where necessary: Soft shore protection projects may need to employ limited amounts of rock in sites with moderate to high wave energy, severely impacted shoreline processes and/or a minimal available setback (refer to Johannessen 2000 for more detail). However, do not include significant amounts of rock armor except in limited areas, and never use vertical elements such as cement walls, lock block, etc.

Monitoring bonus point: Observing the effect and/or effectiveness of an action indicates whether that action has a positive, negative or neutral effect on ecological or physical processes on the site. Monitoring can also indicate whether a project is having the desired effect, and whether any changes are required. Monitoring will also help stay on top of necessary maintenance issues such as gravel replenishment. Small, incremental corrections early in the life of a project usually cost a lot less than correcting a major failure further down the road.

A monitoring program requires a record of “before” and “after” an activity is completed. This can take the form of before and after photos and measurements, ensuring that they are taken from the same locations and

Credit 1.5: Soft Shore Protection or Enhancement

vantage point(s) and, if possible, similar season and weather conditions. It can also include a list of project features or indicators that can be measured consistently before and after construction.

Set up a schedule for inspecting the protection measures on a seasonal basis as well as after major storm events, to determine how key features stand up to erosion, deposition, wind, waves, etc. Typical features or effects to monitor are toe erosion at the bottom of a berm, log or rock movement, losses/gains in plant material, beach profiles, etc.

To achieve this bonus point, commit to monitor and record your observations for a minimum of six years (six summer and winter seasons). It is always a good idea to monitor your protective structure on an ongoing basis to ensure it continues to serve its original purpose.

The *Marine Shoreline Design Guidelines* (Johannessen *et al.*, 2014 - see full reference under “For more information”) devotes a chapter to beach nourishment (Chapter 7 - Technique 1), which provides insights on effects, cost, monitoring and maintenance. While written for marine shorelines, there are still useful ideas for lake shoreline situations.

For more information

Brennan, J.S. (2007). Marine Riparian Vegetation Communities of Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-02. Go to www.pugetsoundnearshore.org click on Technical Reports and scroll down to 2007-02.

Clancy, M., I. Logan, J. Lowe, J. Johannessen, A. MacLennan, F. B. Van Cleve, J. Dillon, B. Lyons, R. Carman, P. Cereghino, B. Barnard, C. Tanner, D. Myers, R. Clark, J. White, C. Simenstad, M. Gilmer, and N. Chin, 2009. Management Measures for Protecting the Puget Sound Nearshore. Puget Sound Nearshore Ecosystem Restoration Project Report No. 2009-01. Published by Washington State Department of Fish and Wildlife, Olympia, Washington. See: Chapters 2, Beach nourishment; 11, Large wood placement; and 17, Revegetation. Go to www.pugetsoundnearshore.org click on Technical Reports and scroll down to 2009-01

Gerstel, W.J., J.F. Brown, 2006. Alternative Shoreline Stabilization Evaluation Project. Report for the Puget Sound Action Team. Go to <https://salishsearestoration.org/wiki/> and enter “Gerstel Brown 2006” in the search box.

Gianou, K. 2014. Soft Shoreline Stabilization: Shoreline Master Program Planning and Implementation Guidance. Washington Dept. of Ecology Publication no. 14-06-009. 101 p.

Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman, 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington. 419 p. <http://wdfw.wa.gov/publications/01583/>

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Zelo, I., H. Shipman, and J. Brennan, 2000. Alternative Bank Protection Methods for Puget Sound Shorelines, prepared for the Shorelands and Environmental Assistance Program, Washington Department of Ecology, Olympia, Washington, Publication # 00-06-012.

Credit 1.6: Managed Retreat

Credit 1.6: Managed Retreat

To qualify for this credit, move existing buildings inland to help prevent shoreline erosion and adapt to ongoing or predicted shoreline recession.



Relocation of house back from eroding coastline on New Zealand's west coast Credit: New Zealand Ministry of Environment (2008)

Moving buildings inland will avoid the need for shore protection and other negative impacts associated with managing erosion in the future.

Where this credit applies

This credit applies to any site where buildings are at risk from shoreline erosion. It applies to marine and freshwater shores, and particularly marine shores that are subject to long term sea level rise and shoreline recession.

Retreat should only be considered or recommended if the building in question can be moved to a location that is above the area affected by shoreline erosion/recession predicted to occur within 75 years or the life of the building, whichever is greater. Also, only consider retreat if the property is large enough to allow this move without compromising other legal setback requirements, or if the building can be relocated off the property.

Benefits

To the homeowner

Moving a building avoids substantial short or long-term expenses for shore protection and the loss of valuable assets. Moving a building within a lot can often cost less than installing protective works.

To the environment

Moving major buildings allow the homeowner to avoid an array of negative impacts on shoreline processes and habitats that comes with construction and maintenance of shore protection and other erosion control measures. This single

Credit 1.6: Managed Retreat

action, although not necessarily the easiest, would have a widespread and long-lasting benefit if needed in the future.

Points available

This credit offers up to 10 base points plus 3 bonus points.

Managed retreat	Base points
Move an existing major building* to a location that is above the area affected by shoreline erosion and recession predicted to occur within 75 years or the life of the building, whichever is greater.	8
Move an existing minor building** to a location that is above the area affected by shoreline erosion and recession predicted to occur within 75 years or the life of the building, whichever is greater	2
Bonus (available once one or more base conditions have been met)	Bonus points
Add the effects of sea level rise into determining the relocation of a major or minor building.	3

*Major building refers to a permanent house or dwelling.

**Minor building includes garage, boathouse, shed, etc.

How to proceed

To meet this credit requires:

- A site plan that shows the original building footprint and the site to which the building has been or will be relocated. The relocation site must be landward of the area affected by projected erosion for 75 years or the life of the building, whichever is greater. General rules of thumb for an adequate distance are 35 ft (10 m) from the predicted receded Ordinary High Water Mark(OHWM) or Natural Boundary (NB), or receded bluff/bank edge for low to moderately eroding sites, and 70 ft (20 m) for rapidly eroding sites;
- To include climate change-induced sea level rise, determine what the projected SLR is for your area. For example, SLR of 0.5 m by 2050, 1.0 m by 2100 and 2.0 m by 2200 is predicted for most of the BC coast (Ausenco Sandwell, 2011). Determine how this will change the location of the OHWM over 75 years or life of the building (whichever is greater), and determine the relocation site accordingly.

Measurements of planned/existing building setbacks and the usable space available for moving the buildings back would have to be assessed and quantified from project drawings and also in the field. This involves simple linear measurements and does not require any special qualifications other than judging where suitable land is available.

Credit 1.6: Managed Retreat

For more information

Arlington Group Planning and Architecture Inc. *et al.* 2013. *Sea Level Rise Primer: A Toolkit to build adaptive capacity on Canada's south coasts*. Go to www2.gov.bc.ca/ and enter "sea level rise adaptation primer" in the search box.

Ausenco Sandwell. January 2011. *Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use*. For BC Ministry of Environment. Go to www2.gov.bc.ca/ and enter "coastal flood hazard" in the search box.

Bornhold, B. 2008. *Projected Sea Level Changes for British Columbia in the 21st Century*. 12 pg. Go to www2.gov.bc.ca/ and enter "Bornhold sea level changes" in the search box.

New Zealand Ministry for the Environment, July 2008. *Coastal Hazards and Climate Change: A Guidance Manual for Local Government in New Zealand*
www.mfe.govt.nz/publications/climate/coastal-hazards-climate-change-guidance-manual/

Nickel Brothers House Moving: www.nickelbros.com

University of Washington Climate Impacts Group and Washington Department of Ecology. 2008. *Sea level Rise in the Coastal Waters of Washington State*. 11 pg.
www.cses.washington.edu/db/pdf/moteetalslr579.pdf

Category 2: Shoreline Habitats

The Shoreline Habitat credits encompass actions that protect, enhance or restore shoreline habitat, including aquatic and riparian habitats. For our purposes, shoreline habitat includes:

- the subtidal zone (in marine environments) or the littoral zone (in lake environments) to a depth of 35 feet (10 m) below datum;
- the foreshore or intertidal zone; and
- the riparian and backshore up to 200 feet (60 m) from the Ordinary High Water Mark (OHWM) or Natural Boundary (NB; see Glossary).

In this section:

Credit 2.1: Riparian Vegetation

Credit 2.2: Trees and Snags

Credit 2.3: Invasive Species

Credit 2.4: Woody Material

Credit 2.5: Overwater Structures

Credit 2.6: Access Design

Credit 2.1: Riparian Vegetation

Credit 2.1: Riparian Vegetation

To qualify for this credit, maintain existing or plant new native vegetation in the riparian area to help conserve or enhance the ecological functions that it provides along the shoreline.

Riparian areas where land and water converge are among the most biodiverse of any habitats. Riparian vegetation is trees, shrubs, and ground cover that exists or is planted up to 200 feet (60 m) landward of the Ordinary High Water Mark (OHWM).



From this.....



to this Credit: The Watershed Company

Native vegetation is preferred for shorelines because native species:

- are better adapted to local physical conditions such as soil, geology, and climate and therefore require less maintenance;
- are resistant to most pests and diseases;
- require little or no irrigation or fertilizers, once established;
- are non-invasive (do not dominate to the extent of excluding all other species); and
- usually provide better food sources for native fish and wildlife.

However, mature non-invasive or “native adapted” plant species may be maintained if they provide the same or similar ecological functions.

Overhanging shoreline vegetation in both marine and lake shores provides important organic input to the aquatic environment. Research in Puget Sound has shown that up to 40% of juvenile chinook food items are terrestrial in origin, much of it falling or blowing into the water from nearshore vegetation. In addition, surf smelt tend to spawn in beach areas with overhanging vegetation.

Credit 2.1: Riparian Vegetation

In lakes, native emergent vegetation such as cattails, sedges and rushes as well as clusters of fine woody debris provide important nearshore cover for juvenile fish, including salmon.

Where this credit applies

This credit applies to all types of projects on a waterfront property, but particularly development occurring within the riparian area. It applies to any type of shore in both marine and lake environments. The characteristics of riparian vegetation are somewhat different in marine versus freshwater shorelines, but it serves the same functions and generates the same benefits in either situation.

Benefits

The goal is to have functioning riparian vegetation along the shoreline, consistent with the natural soil, climate, and flora and fauna characteristics of the site.

To the homeowner

Riparian vegetation provides natural shoreline stabilization and is less expensive than installing hard shoreline armor. Retaining existing native vegetation saves on landscaping costs; the maintenance of vegetation is also less expensive than the maintenance of hard shoreline structures. Maintaining riparian vegetation may help avoid the need to install costly stormwater treatment facilities and home air quality systems. Riparian vegetation attracts birds, fish and other wildlife for viewing. A healthy riparian area offers better aesthetics, noise reduction and increased privacy, and higher property value.



Typical lake shore with overhanging vegetation

Credit: Herrera Environmental Consultants



Juvenile coho salmon in submerged vegetation

Credit: P. Law



Overhanging vegetation on marine shore

Credit: H. Rueggeberg

Credit 2.1: Riparian Vegetation

To the environment

Protection or re-establishment of riparian vegetation provides key ecological features, functions, and values of shoreline habitats and maintains the high biodiversity of riparian areas. Riparian vegetation with its associated network of branches, trunks, stems and roots:

- provides water quality and quantity benefits by enhancing the infiltration and retention of rainwater;
- delivers woody material as habitat for fish and other aquatic organisms;
- delivers food sources such as insects and leaf detritus for the aquatic food web;
- moderates temperature in the riparian area for climate-sensitive plant and wildlife species, as well as in the beach substrate where forage fish spawn;
- stabilizes shoreline banks. The roots of riparian vegetation hold soils and maintain shoreline bank integrity.
- provides habitat for birds and terrestrial animals, and cover for juvenile salmonids to avoid predation by birds.
- on shallow slopes, can help to dissipate wave energy, thus moderating erosion and supporting the accumulation of beach sediment.

For more information on how protecting and enhancing ecological benefits on private property increases property value, read: *The Economic Benefits of Protecting Healthy Watersheds* (see “For more information”).

Points available

This credit offers up to 10 base points plus up to 5 bonus points

For the purpose of this guide, “riparian buffer” (RB) is the shoreline area that lies within the minimum riparian buffer or setback required by the local jurisdiction OR within 35 ft/10 m of the OHWM (measured as the horizontal distance landward of the OHWM), **whichever is greater**.

Riparian vegetation	*For lots ≤¼ acre	*For lots >¼ acre	Base points
Maintain and/or plant native vegetation in -	75-100% of the RB	90-100% of the RB	7
Maintain and/or plant native vegetation in -	50-74% of the RB	70-89% of the RB	5
Maintain and/or plant native vegetation in -	30-49% of the RB	50-69% of the RB	2
Retain or plant overhanging and/or emergent vegetation			3

Credit 2.1: Riparian Vegetation

along \geq 50% of the shoreline length	
Retain or plant overhanging and/or emergent vegetation along \geq 25-49% of the shoreline length	2
Retain or plant overhanging and/or emergent vegetation along \geq 10-24% of the shoreline length	1
Bonus (available once one or more base conditions have been met)	Bonus points
Maintain and/or plant native vegetation in additional 10 ft (3 m) width inland from the riparian buffer for the length of the shoreline, <i>or equivalent</i> . Equivalency may be measured as greater than 10 ft (3 m) additional width over less than the entire shoreline.	1 bonus point per 10 ft (3 m) of additional width of riparian vegetation, up to a maximum of 3 bonus points (i.e., 30 ft/9 m of additional riparian vegetation width)
Provide and implement a plan for monitoring and maintaining your riparian plantings	2

*%RB criteria are greater for larger lots because there is more capacity to locate buildings and infrastructure outside the RB on large lots.

How to proceed

Choose native species that are suitable to your site. As much as possible, planting should be comprised of multi-storied vegetation that includes trees, shrubs and ground cover; however, in some environments, such as south facing rocky bluffs with thin dry soils, only shrubs, grasses and other ground cover may be suitable.

Mature non-invasive non-native or “native adapted” plant species can be maintained as they provide some ecological functions; however, avoid planting new non-native species. Example plant species lists, one for lakes and one for marine shorelines, are provided in Appendix C.

Space plants to achieve full vegetation coverage within 10 years. For example, space trees at 8–14 feet on center and shrubs at 2–6 feet on center depending on the plant species. You may need some assistance from a landscape architect, restoration biologist or landscaper with riparian planting experience to determine the best species and spacing to achieve the desired effect.

Retain and/or plant overhanging vegetation that extends out over the water. Trees such as alder, native maples, and willows and tall shrubs such as oceanspray and red-osier dogwood are excellent overhanging species.

Similarly, along lake shores, retain existing or plant native emergent vegetation as much as possible. Emergent vegetation are plants that thrive in partially submerged conditions; examples of emergent species are cattails, bulrushes and

Credit 2.1: Riparian Vegetation

sedges. They create excellent rearing and feeding habitat for juvenile forage fish and salmon. In lake shore properties, consider dedicating a section of your shore as juvenile fish rearing habitat by planting emergent vegetation and adding clusters of branches along the high water mark (see Credit 2.4). However, in ‘managed’ lakes where water levels may fluctuate significantly on an annual basis, emergent vegetation may be difficult to maintain; check with local expertise on appropriate native species and location of planting to support their survival.

For more information

Brennan, J.S. 2007. Marine Riparian Vegetation Communities of Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-02. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington. Go to www.pugetsoundnearshore.org click on Technical Reports and scroll down to 2007-02.

Brennan, J.S., and H. Culverwell. 2004. Marine Riparian: An Assessment of Riparian Functions in Marine Ecosystems. Published by Washington Sea Grant Program Copyright 2005, UW Board of Regents, Seattle, WA. 34 p.

EnviroVision, Herrera Environmental, and Aquatic Habitat Guidelines Program. 2010. Protecting Nearshore Habitat and Functions in Puget Sound. wdfw.wa.gov/publications/00047/

Knutson, K. Lea and Naef, Virginia L. 1997. Management Recommendations for Washington’s Priority Habitats: Riparian. Washington Department of Fish and Wildlife. wdfw.wa.gov/publications/00029/

Naturescape British Columbia: www.naturescapebc.ca

US Environmental Protection Agency. 2012. The Economic Benefits of Protecting Healthy Watersheds. Healthy Watersheds Initiative Fact Sheet. U.S. Environmental Protection Agency (EPA), publication #EPA 841-N-12-004; available at this website: http://water.epa.gov/polwaste/nps/watershed/ecoben_factsheet.cfm

Washington State Department of Ecology. Slope Stabilization and Erosion Control - role of vegetation: www.ecy.wa.gov/programs/sea/pubs/93-30/using01.html

Washington State Department of Ecology. Vegetation Management: a guide for Puget Sound bluff property owners, Publication 93-31, May 1993. Go to <https://fortress.wa.gov/ecy/publications/> and enter “vegetation management” in the search box.

Washington State University Beach Watchers EZ-ID Guides - Shoreline Plants: www.beachwatchers.wsu.edu/ezidweb/

Credit 2.2: Trees and Snags

To qualify for this credit, preserve existing trees, including standing dead trees (snags), or plant new trees in the riparian area.



Trees and snags Credit: B. Emmett (left), N. Faghin (right)

Where this credit applies

This credit applies to all types of projects and shore types. Emphasis is on retaining trees and snags in riparian areas.

Benefits

To the homeowner

Trees provide shade from the sun and shelter from winds. Their roots assist with soil retention and bank stabilization. Trees filter air pollutants and provide us with oxygen. Trees also reduce surface runoff by breaking rainfall on their leaves, absorbing or transpiring much of the water, or directing it down the trunk and into the ground. This helps to prevent stormwater from carrying pollutants into the receiving lake or sea. Trees, both living and dead, create beautiful landscapes while providing increased fish and wildlife viewing opportunities.

To the environment

Both living and dead trees provide valuable feeding, nesting, resting and hiding habitat for birds and small mammals. Living trees absorb carbon dioxide, removing and storing the carbon while releasing oxygen, thereby helping with the reduction of greenhouse gases.

Points available

This credit offers up to 5 base points plus 1 bonus point. For the purpose of this guide, “riparian buffer” (RB) is the shoreline area that lies within the minimum riparian buffer/setback required by the local jurisdiction OR within 35 ft/10 m of the OHWM (measured as the horizontal distance landward of the OHWM), **whichever is greater.**

Credit 2.2: Trees and Snags

Trees and snags	Base points	
	For lots <¼ acre	For lots >¼ acre
Retain existing trees of minimum size 4" (10 cm) DBH (diameter at breast height) within the RB OR Plant new trees of minimum size 3" (7.5 cm) DBH in the RB.	1 point per existing or new tree to maximum of 4 points	1 point per two existing or new trees to maximum of 4 points
Retain a minimum of two snags/acre on the property; for properties less than 1 acre, retain a minimum of one snag. Snags may be of any diameter but must be a minimum 12 ft (4 m) in height.	1	
Bonus (available once one or more base conditions are met)	Bonus points	
In addition to one or more of the above basic actions, install one or more nest boxes for cavity dwelling birds. ¹	1	

¹ Cavity dwelling birds are birds that excavate nesting holes themselves (such as woodpeckers), use natural cavities resulting from decay of trees or pilings (such as purple martins), or use holes created by other species in dead or deteriorating trees (such as owls and wood ducks). According to the US Dept. of Agriculture, some 85 species of birds in North America are cavity nesters (Scott et al., 1977), but many of their populations are in decline because of habitat loss, particularly nesting habitat. Nest boxes can be designed specifically to attract one or more of these species.

How to proceed

Living trees do not have to be very large to provide the many benefits listed above. When doing any project work, protect the tree and its roots from damage by installing a construction fence at the drip line around the tree to exclude soil disturbance and heavy equipment. Use trees to frame views to the water.

Evaluate existing dead standing trees on the site for their potential as wildlife trees. According to Santiago and Rodewald (2004), large snags (greater than 15 inches diameter at breast height and taller than 6 feet) are required for larger species such as



Trees and snags Credit: H. Rueggeberg

Credit 2.2: Trees and Snags

certain woodpeckers; smaller birds and animals may use snags or dead limbs from 4 inches in diameter. Generally, the value of a snag tree increases as its size increases. The species of snags retained should reflect the native trees found in the area.

Landowners may need to consult a professional when determining if a snag presents a substantial hazard, particularly given the relative location of the snag to existing or proposed buildings. If removal must occur, remove only unwanted portions of the trees; this allows the remaining portions to provide valuable wildlife habitat. Remember that trees and snags are part of functional riparian vegetation (Section 3.1).

For more information

BC Wildlife Tree Stewardship Program: <http://wildlifetree.ca>

Santiago, Melissa J. and Rodewald, Amanda D. 2004. Dead Trees as Resources for Forest Wildlife. The Ohio State University Extension, School of Natural Resources. Publication #W-18-04. Go to <http://ohioline.osu.edu/search.php> and enter “dead trees” in the search box.

Scott, Virgil E., Keith E. Evans, David R. Patton, and Charles P. Stone. 1977. Cavity-nesting birds of North American forests. U.S. Dep. Agric., Agric. Handbook. 511, 112 p. Go to www.na.fs.fed.us and enter “cavity nesting birds” in the search box.

Tree People www.treepeople.org/top-22-benefits-trees

Credit 2.3: Invasive Species

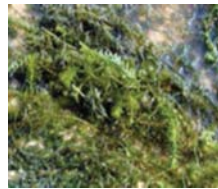
Credit 2.3: Invasive Species

To qualify for this credit, remove, reduce and manage invasive vegetation and noxious weeds.

This credit recognizes efforts to remove invasive or noxious vegetation and re-plant with native vegetation (see Credit 2.1 “Riparian Vegetation”). Some common invasive species are noted below. (For more detailed inventories and information on invasive/noxious species and their management, see “For more information.”)



Scotch broom
(*Cytisus scoparius*)



Hydrilla
(*Hydrilla verticillata*)



Purple loosestrife
(*Lythrum salicaria*)



Tamarix or Saltcedar
(*Tamarix ramosissima*)



Butterfly bush
(*Buddleia davidii*)



Water chestnut
(*Eleocharis dulcis*)



Himalayan blackberry
(*Rubus armeniacus*)



Common reed
(*Phragmites australis*)

Common invasive plants on Pacific NW shorelines Sources: *Washington Invasive Species Council*, www.invasivespecies.wa.gov; *Invasive Species Council of BC*, www.bcinvases.ca

While it is possible to eradicate some invasive species, others can only be reduced and then managed to contain or curtail their spread. In most cases, management and eventual eradication is an ongoing and long-term effort.

Where this credit applies

This credit applies to whole-site and shoreline/riparian development, on any shore type and in either marine or lake environments.

Benefits

To the homeowner

Benefits are similar to those noted for Credit 2.1 “Riparian Vegetation.” In general, removing invasive vegetation and replacing with native plants:

- Provides better aesthetics, noise reduction, and increased privacy once the planted areas have matured — all of which increase property values;
- Prevents damage to other vegetation you wish to maintain;
- Results in lower maintenance landscapes; and
- Creates greater fish and wildlife watching opportunities.

To the environment

In addition to those benefits associated with maintaining and restoring native vegetation described in Credit 2.1 “Riparian Vegetation,” this credit is intended to restore natural ecological functions. In general, removing invasive vegetation:

- Improves and restores habitat and species diversity. Invasive vegetation results in mono-cultures that out-compete native species.
- Improves food sources for native birds and animals. It has been shown that detritus feeding organisms may not be adapted to the leaf fall patterns or the chemical characteristics of leaves from non-native trees suggesting that riparian areas are most effective when comprised of native vegetation (Karr and Schlosser 1977).
- Restores more adaptable landscapes. Native plant species have adapted to local physical conditions such as soil, geology, and climate and therefore require less maintenance, are resistant to most pests and diseases, and require little or no irrigation or fertilizers, once established. Therefore, maintaining native plant species in riparian areas can help to maintain water quality and improves riparian vegetation functions such as stormwater retention, groundwater recharge, etc.
- Favors insect of local food value for species of concern (for example, insects eaten by juvenile salmon).
- Prevents degradation of adjacent healthy riparian areas.

Credit 2.3: Invasive Species

Points available

This credit offers up to 4 base points

Invasive Species	Base points
Remove invasive vegetation and re-plant cleared areas with native vegetation <u>over the entire property</u> ; continue to manage invasive species as part of regular landscape maintenance.	property > ½ acre - 4 points
	property ≤ ½ acre - 3 points
Remove invasive vegetation and re-plant cleared areas with native vegetation <u>in the riparian buffer</u> (area within 35 feet/10 m of OHWM).	2

How to proceed

Many of the resources below provide information on identifying invasive plants, techniques for their removal and the native species to use as replacement vegetation. In lake environments, removal of aquatic invasive species may require permits or other approvals from regulatory agencies. Check your proposed project with local, state/provincial or federal authorities before getting started.

You might also enlist the help of a local ecologist, botanist, landscape architect, horticulturist, or landscaper with experience in riparian planting for marine or freshwater shores, depending on where you are situated. Your municipal or county/regional district government may also be able to help with written information, expertise and even some funding for invasive removal. Similarly, many environmental organizations are involved with invasive management and native plant restoration; check with a local land trust or natural history society for ideas and help.

Include ongoing invasive species management as part of the regular landscape maintenance schedule or checklist (see Appendix A). Monitor your property for several years for signs of returning invasive vegetation and/or noxious weeds, and plan to remove them as needed. Remember that it is much easier to remove these species as they emerge rather than once they are established. Again, a qualified professional, your local government or local environmental group can advise on effective but environmentally friendly ways to manage particularly tenacious species. Suggest that your neighbors share in work parties to help each other, or suggest the same to your Homeowners or Neighborhood Association.

For more information

E-Flora BC. 2012. Electronic Atlas of the Flora of British Columbia:
www.geog.ubc.ca/biodiversity/eflora/index.shtml

Garry Oak Ecosystems Recovery Team - Invasive Species and Restoration:
www.goert.ca/publications_resources/invasive_species.php

Credit 2.3: Invasive Species

Green Seattle Partnership. 2012. Management Strategies for Invasive Plants:
<http://greenseattle.org/how-to-remove-invasive-plants>

Invasive Species Council of BC - Coastal Invasive Plant Committee: www.bcinvasives.ca and
www.coastalisc.com

USDA. 2012. National Invasive Species Information Center. U.S. Department of Agriculture
(USDA): www.invasivespeciesinfo.gov/plants/main.shtml

Washington Native Plant Society lists of native plants available: www.wnps.org

Washington State University Master Gardener Program – for help with choosing plants:
<http://mastergardener.wsu.edu/>

Washington Department of Fish and Wildlife. Aquatic Plant Removal or Control:
http://wdfw.wa.gov/licensing/aquatic_plant_removal/

Credit 2.4: Woody Material

Credit 2.4: Woody Material

To qualify for this credit, retain existing or add woody material along shores where it naturally occurs.

Woody material (often referred to as woody debris) includes downed trees, stumps, branches, leaves and other tree-sourced materials that wash up onto or fall naturally on a beach or into the water.



Credit: H. Rueggeberg (left), South Puget Salmon Enhancement Group (right)

In the marine environment, woody material that influences shore processes and shoreline features tends to be large, and is often referred to as “large woody debris” (LWD). On lake shores, woody debris tends to be of smaller dimensions, ranging from twigs to small logs and referred to as “small woody debris” (SWD). LWD typically occurs above the high tide line, whereas due to the absence of tides and strong currents, SWD may be submerged or partially submerged.

Where this credit applies

This credit applies to all types of shores, with particular significance on sediment-based shorelines. Adding woody material to a shoreline should provide or enhance habitat value; **installing logs or root wads solely to retain sediment or attenuate waves does not qualify under this credit.**

Benefits

To the homeowner

Woody material acts to anchor and stabilize beach sediments and vegetation, providing natural shoreline protection. This is particularly valuable in marine environments and to a lesser extent in freshwater environments.

Credit 2.4: Woody Material

To the environment

Woody material is a vital component of healthy shoreline ecosystems in both marine and lake settings. It creates habitat cover and complexity and provides a source of organic matter and food for aquatic insects, invertebrates and the organisms that feed on them. Woody material helps to accrete and sort sediments, creating spawning habitat for forage fish. It stabilizes banks and shorelines, supports the growth of native shore grasses and sedges and protects dune communities, thereby supporting the next generation of forests.

Points available

This credit offers up to 3 base points

Woody material	Base points
Where woody material already occurs along a minimum of 50% of the length of the shoreline, maintain and do not disturb a minimum 80% of that existing woody material; OR	3
Where woody material is diminished from natural conditions based on nearby reference beaches (see “How to proceed”), add woody material in a way that provides habitat value and is consistent with naturally occurring woody material in the area.	1 point per 10% of length of shoreline occupied by added woody material to a maximum 3 points

How to proceed

To apply for this credit, identify and map the distribution of existing woody material as part of the existing conditions plan in order to integrate it in the site design plan. In marine sites, LWD may be mapped on a per-piece basis. On lakes, it may be more feasible to show the zone or length of shoreline occupied by SWD.

Temporarily moving, saving, and re-installing natural woody material to facilitate a development project is allowed. Removing or relocating woody material may require permits or other approvals from regulatory agencies. Check your proposed project with local, state/provincial or federal



Large woody material added as part of a soft shore treatment
Credit: H. Rueggeberg

Credit 2.4: Woody Material

authorities before getting started.

Consult with a qualified professional such as a marine or freshwater biologist before introducing woody material to determine the most effective placement from a habitat perspective and to avoid creating hazards.

On marine sites, base the addition of LWD on nearby reference beaches when it comes to selecting material size, type and location—particularly with respect to elevation on the beach. LWD can be placed on the beach or semi buried, particularly if it is placed as part of a “soft shore” beach nourishment project (see Credit 1.5 “Soft Shore Protection or Enhancement”) or loosely on the upper and back beach areas, in wetlands, and along the shoreline of lakes. Stabilize LWD by mechanical means (anchors) only when recommended by a qualified professional and with approval by local authorities.

The *Marine Shoreline Design Guidelines* (Johannessen *et al.*, 2014) devotes an entire chapter to the use of LWD in shoreline protection and enhancement. (See “For more information” for where to find this useful reference.)

On lake shores, it is more difficult to try to replicate “natural” conditions due to the density to which SWD often occurs in nature; however, the addition of even a few logs or branches, particularly in conjunction with overhanging vegetation, can add significant habitat for fish and invertebrates. Consider dedicating a section of your shore as juvenile fish rearing habitat by planting emergent vegetation or adding clusters of branches along the high water mark.

For more information

Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman, 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington. 419 p.
wdfw.wa.gov/publications/01583/

King County. 2011. Large Woody Debris as an Ecological Function. Go to www.kingcounty.gov/environment/waterandland/shorelines.aspx and enter “large woody debris” in the search box.

Credit 2.5: Overwater Structures

To qualify for this credit, do not install new overwater structures at a project site, and remove any existing overwater structures. If overwater structures are necessary, design them to be Green Shores friendly.

Overwater structures include piers, ramps, floats, covered moorage, boat work sheds, and mooring pilings. Boats stored in cradles below the Ordinary High Water Mark or natural boundary (OHWM/NB) are also considered overwater structures. An overwater structure may include multiple elements such as a pier, ramp, and float.



Overwater structures Credit: H. Rueggeberg

Overwater and in-water structures can alter physical and biological processes that are critical to fish and aquatic life. In particular, light reduction or shading reduces the survival of aquatic plants that provide food and habitat for fish. Structures can also physically block migration and produce light/dark contrasts that affect fish movement; e.g., fish respond by moving into deeper water which increases the risk of predation.⁵

⁵ Washington State Legislature WAC 220-660-140: Residential and public recreational docks, piers, ramps, floats, watercraft lifts, and buoys in freshwater areas.
<http://app.leg.wa.gov/WAC/default.aspx?cite=220-660-140>

Credit 2.5: Overwater Structures

Where this credit applies

This credit applies to all types of shores, and to the construction, renovation or removal of overwater structures; however, constructing a new overwater structure is eligible for this credit *only* if:

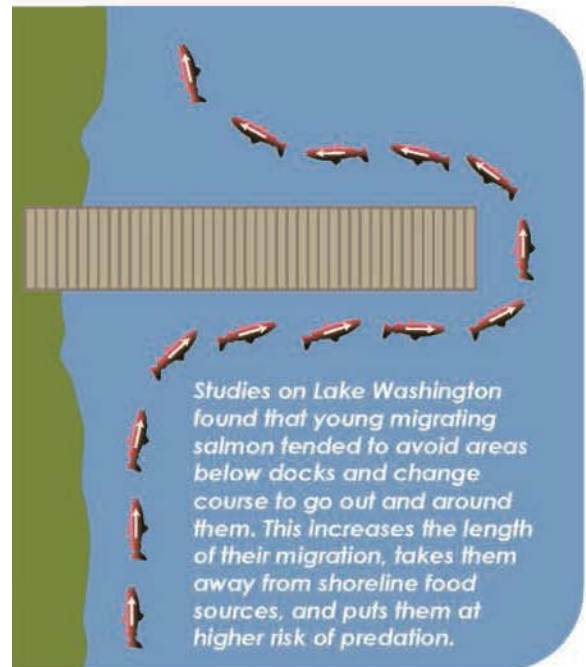
- a) it will be used for water dependent uses (e.g., boating needs and not living space); and
- b) there is no publicly accessible dock or pier within 500 ft (150 m).

Benefits

To the homeowner

Having no overwater structures, or having structures that are Green Shores designed, can result in several benefits:

- Cost savings: Green Shores-friendly structures (for example, grated construction) tend to be durable, and require little or no maintenance.
- Green Shore designs and construction methods are usually consistent with local regulations and codes, and therefore, the permitting process may be easier, shorter, and less costly (because, for example, detailed biological assessments and habitat mitigation may be avoided).
- Better natural aesthetics.
- Less scary to swim under because there is more underwater ambient light beneath such structures.



www.govlink.org/watersheds/8/action/greenshorelines/

To the environment

This credit:

- prevents the loss of nearshore ecological functions such as underwater natural ambient light and habitat area.
- minimizes the effects of overwater structures on underwater plant communities;

Credit 2.5: Overwater Structures

- minimize disruption of fish movement and migration; and
- decreases potential predation on juvenile salmon by reducing habitat for predators.

Points available

This credit offers up to 10 base points

Overwater structures		Base points
No OS: Existing overwater structures (OS) are removed and no new replacement overwater structures are installed. OR		10
No pre-existing OS and no new OS installed		8
"Best Practices" OS: If there is an existing overwater structure (OS) on your property, demonstrate that it is eligible for this credit (see "Where this credit applies" above) and meets the Best Practices outlined below (see "How to proceed"), or is being retrofitted as part of your project to meet the Best Practices outlined below (see "How to proceed").	Dock* \leq 6 ft wide and \leq 80 ft ² in area, with at least 30% functional grating**	1
	Pier* \leq 6 ft wide with at least 50% functional grating OR Ramp* $<$ 4 ft wide with 100% functional grating	1
	Additional grating coverage: - 80-100% functional grating of OS surfaces OR	2
	- 50%-79% functional grating of OS surfaces	1
	No lighting on OS, or diffuse lighting that is not directed downward to water or upward to sky	1
Shared OS: Share the use of an OS on your property or a neighboring property	OS shared with one neighbor (one OS per two properties)	1
	OS shared with two or more neighbors (one OS per three or more properties)	2

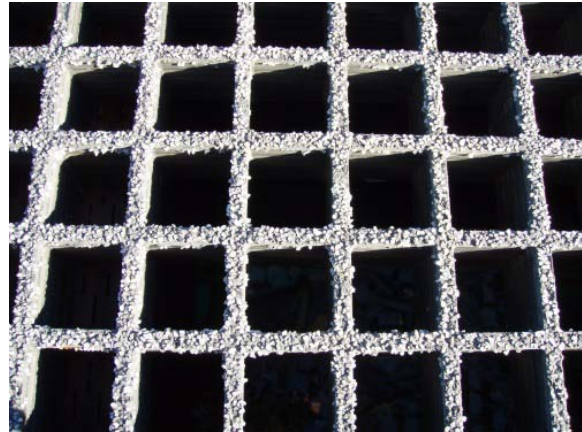
*Dock – a structure that is fixed to the shoreline and floating on the water

*Pier – a fixed, piling-supported structure

Credit 2.5: Overwater Structures

*Ramp – a structure that connects a pier or shoreline to a dock or float

**Functional grating - grating with an open area of at least 60%. If grating covers more than the minimum % deck surface area specified above, the grating's open area may be reduced to a minimum 40%.



Pier grating Credit: H. Rueggeberg

How to proceed

Not having an overwater structure is the simplest way to achieve points under this credit. Applicants are encouraged to use mooring buoys if boat moorage is needed, use a public dock if one is nearby, or share an existing dock with neighbors. Note that San Juan County in Washington State requires anyone seeking to build a dock to first attempt to create and sign a “Joint Use Agreement” with neighbors.

Where an overwater structure is required, adhere to the following **Best Practices** in the design, construction, maintenance and renovation of overwater structures:

- Assess the nearshore and benthic habitat before starting to plan, so that the structure is located where no critical/sensitive habitat exists.
- Provide light penetration by using functional grating (grating with at least 60% open area) on all overwater structure surfaces.
- Minimize the size of overwater structures to only what is needed to serve the purpose and avoid impacting riparian, emergent or submerged vegetation.
- Floating components should not rest on the bottom substrate at any time.

Credit 2.5: Overwater Structures

- For piers and ramps, minimize disturbance of the bottom by using the minimum number and size/diameter of pilings required to achieve safety and stability.
- Use nontoxic materials for piles and other support elements (see Credit 3.4 “Creosote Materials Removal” for points).
- Minimize shading by orienting a structure in a north-south direction and positioning it a minimum of 7 ft (2.3 m) above benthic vegetation.
- Minimize overwater lighting and ensure that any lighting is not directed into the water, so as to not attract or confuse fish.
- Design structures to be retractable or removable when not in use (i.e., during the winter season).

On lake shores in Washington State, make sure that your overwater structure meets the requirements of Washington Administration Code (WAC) 220-660-140.

For more information

Adams A.M. 2002. Shoreline structures environmental design: a guide for structures along estuaries and large rivers. Fisheries and Oceans Canada, Vancouver B.C. and Environment Canada, Delta B.C. Go to www.stewardshipcentrebc.ca/the-resource-centre/ and enter “shoreline structures” in the search box.

B.C. Ministry of Environment and Fisheries and Oceans Canada. Standards and Best Practices for Instream Works - Wharf, Pier, Dock, Boathouse & Mooring. Go to www.gov.bc.ca/ener/ and enter “instreamworks docks” in the search box.

B.C. Factsheet - Marine Guide to Small Boat Moorage. Go to www.dfo-mpo.gc.ca/index-eng.htm and enter “small boat moorage” in the search box.

EnviroVision, Herrera Environmental, and Aquatic Habitat Guidelines Program. 2010. Protecting Nearshore Habitat and Functions in Puget Sound. wdfw.wa.gov/publications/00047/

Lake Sunapee Protective Association. Lake Friendly Dock Choices. www.lakesunapee.org/record_images/pdf/219.pdf

Seattle, City of. 2011. *Green Shorelines: Bulkhead alternatives for a healthier Lake Washington*. 34 pg. Go to www.seattle.gov/dpd/ and enter “Green Shorelines” in the search box.

Washington State Legislature WAC 220-660-140: Residential and public recreational docks, piers, ramps, floats, watercraft lifts, and buoys in freshwater areas. Effective July 1, 2015. <http://app.leg.wa.gov/WAC/default.aspx?cite=220-660-140>

Washington Dept. of Ecology. 2011. Shoreline Master Program (SMP) Handbook, Chapter 12: Piers, Docks, and other Structures. www.ecy.wa.gov/PROGRAMS/sea/shorelines/smp/handbook/index.html

WRIA 8: Lake Washington/Cedar/Sammamish Watershed - Docks and Shoreline Permits www.govlink.org/watersheds/8/action/greenshorelines

Credit 2.6: Access Design

Credit 2.6: Access Design

To qualify for this credit, design or re-design access to the shoreline from upland areas so that it avoids or minimizes environmental impacts on the shoreline area.



Access design Credit: N. Faghin

Shoreline owners typically want to get to the water's edge, whether by a foot path, stairs, a driveway, or a ramp for boat access. Accesses can have negative effects on shoreline environments by trampling and removing riparian vegetation (favoring the colonization by invasive species), "hardening" the upland-shoreline interface and damaging backshore, foreshore, and intertidal habitats.

Where this credit applies

This credit applies to any development project, particularly in the riparian area, on any type of shore, and in both marine and lake environments. The access being applied for must meet any applicable local codes with respect to safety, aesthetic, and/or environmental impact. For example, if the access involves stairs, landings, or decks there may be local laws regarding height above ground, handrail requirements, foot guards, etc.

Benefits

To the homeowner

Controlled access usually means lower construction and maintenance costs, and enhances the aesthetics and value of the property.

To the environment

Avoiding or minimizing the extent of accesses reduces permanent loss of riparian and foreshore habitats. Smaller accesses also may translate to lower levels of human activity, thereby causing fewer disturbances to other wildlife using the shoreline.

Points available

This credit offers up to 3 base points

Access design	Base points
Remove an existing shoreline access and replace it with native vegetation, or do not have/ build any access to the shore on your property. OR	3
Replace an existing access or, if there is no pre-existing access, build a new access that conforms to the 'Best Practices' (outlined below under "How to proceed").	1
Share your access with one or more neighbors such that there is only one access per two or more properties.	2

How to proceed

First ask "do I really need my own access to the shore? Is there a public access nearby that I can use, or could I share an existing access with one or more neighbors?"

If the answer is "no, I don't need my own access" you have just earned full points, saved the shoreline environment one more impact, and saved construction, approval, and maintenance costs and time.

If the answer is "yes," **follow these "best practices" for access design:**

- Ensure your access meets all local, state/provincial or federal regulatory codes with respect to safety, design and/or environmental impact (e.g., height above ground, handrails or guards, etc.).
- Assess the shoreline and backshore to determine the best place for getting to the water based on steepness, ground stability, soil softness, vegetation, drainage, environmental sensitivity, and habitat value. A rocky site is usually harder than sites with soft sediments. Choose sites that have been

Credit 2.6: Access Design

previously impacted since they have lower habitat value than an undisturbed site. Do your utmost to protect undisturbed areas.

- Provide for all needs in one access rather than multiple accesses.
- The access should be no wider than 4 ft (1.5 m).
- Size and align paths and stairways to address terrain (flat versus steep), to protect existing vegetation (particularly major trees, shrubs and rare plant groupings) and avoid hazardous areas such as ravines, bluffs, cliffs and embankments.
- Use permeable, non-toxic materials for the access surface. For lightly used paths, native soils may be adequate. For heavier use or where drainage is an issue, crushed aggregate (gravel) with a lightly compacted aggregate sub-base is preferred. Bark mulch and hog fuel are not recommended as trail surfaces because they produce leachates that can cause water quality problems. Asphalt and concrete are also not recommended as they leach contaminants in the short term, and are impermeable and accelerate run-off in the long run. If solid surfaces are necessary, install pervious pavers.
- Use raised walkways where required to avoid crushing ground cover.

For more information

Canada and BC Government. 1996. *Access Near Aquatic Areas. A Guide to Sensitive, Planning, Design and Management*. 82 pg . Go to www.stewardshipcentrebc.ca/the-resource-centre/ and enter “access” in the search box.

WRIA 8: Lake Washington/Cedar/Sammamish Watershed - Docks and Shoreline Permits www.govlink.org/watersheds/8/action/greenshorelines

Category 3: Water Quality

The Water Quality category encompasses actions that a shoreline landowner can take to reduce or eliminate the amount of sediment, chemical and organic pollutants that are discharged to lakes and marine waters directly or in surface runoff.

The runoff associated with rain events is typically referred to as “stormwater,” but it is important to recognize that the majority of surface runoff is from light, steady rainfall and not just occasional storms. Therefore, in this credit, we use the term “rainwater management” in addition to stormwater to refer to the runoff from regular rainfalls as well as bigger storms.

In this section:

[Credit 3.1: Site Disturbance](#)

[Credit 3.2: Reduce and Treat Runoff](#)

[Credit 3.3: Environmentally Friendly Building Products](#)

[Credit 3.4: Creosote Materials Removal](#)

[Credit 3.5: Herbicides, Pesticides, and Fertilizers](#)

[Credit 3.6: Onsite Sewage Treatment](#)

Credit 3.1: Site Disturbance

Credit 3.1: Site Disturbance

To qualify for this credit, minimize the amount of clearing, grading, and soil disturbance during construction on the site.



Credit: Sustainable Building Construction
sustainablebuildingconstruction.blogspot.ca/2011_08_01_archive.html

Where this credit applies

This credit applies to both whole site and shoreline/riparian development. It is particularly important for projects on sloping sites, sites with runoff from upland areas, sites with highly erodible materials, and bluff properties where slope failure risk is high.

Benefits

To the homeowner

Minimizing site disturbance benefits home owners by:

- Reducing the risk of soil erosion and the cost of erosion control measures during and after construction.
- Retaining valuable topsoil, which means less cost to buy and truck in expensive top soil to rebuild landscapes.

Credit 3.1: Site Disturbance

- Reducing future landscape installation costs.
- Reducing irrigation costs; existing native vegetation is often better suited to site conditions and typically do not require additional irrigation.
- Maintaining the intrinsic value of native trees and shrubs.
- Maintaining shade and wind breaks that can save on cooling and heating costs.

To the environment

Numerous studies have shown vegetation removal and run-off from upland areas to be the primary cause of degraded water quality, increased near-shore water temperatures and sedimentation, and smothering of nearshore flora and fauna. Minimizing disturbance of soil and vegetation prevents construction-related pollutants, particularly sediment, from reaching local fresh and marine waters.

Minimizing soil disturbance and compaction also:

- Helps to retain soil structure and pore space that allows movement of water and air; healthy native soils with good structure are more permeable than newly imported growing medium, and can help reduce surface water runoff.
- Retains beneficial biological components: worms, micro-organisms, and roots in existing soils.
- Avoids trucking of stripped material off site or bringing soil onsite, lowering costs and reducing greenhouse gas emissions.
- Avoids the release of greenhouse gases from organic soils when they are disturbed.

Points available

This credit offers up to 5 base points

Minimize site disturbance for <u>undeveloped</u> (greenfield) site:	Base points
Do not disturb soils and retain native vegetation over:	
• $\geq 70\%$ of the site area*	5
• 50-69% of the site area	3
• 30-49% of the site area	1
Minimize site disturbance for <u>previously developed</u> site:	Base points
Limit development to previously developed portions of the site as much as possible and if available, protect any remaining soils and vegetation** from disturbance over:	
• $\geq 60\%$ of the site area*	3

Credit 3.1: Site Disturbance

• 45-59% of the site area	2
• 20-44% of the site area	1

*Site area is defined as:

- the lot area if your project involves the whole lot; or
- the riparian buffer (see Glossary), if your project is restricted to the shoreline/riparian area.

See “How to proceed” below.

How to proceed

Minimize site disturbance during planning, design, and construction phases of a project by doing the following:

- Locate buildings and hardscape surfaces on previously impacted areas of the site such as clearings, existing building footprints, or on areas that were going to be cleared anyway (e.g., to remove invasive species such as Himalayan blackberry).
- Minimize the amount of excavation and earthworks needed by fitting the building or landscape design to the site topography rather than flatten the site to fit the building or landscape.
- During construction, protect vegetation and native soil areas from disturbance and compaction by surrounding them with a secure 4 ft. fence of high visibility material.
- Restrict construction vehicle traffic to designated driveways/accesses to reduce damage to soils and vegetation. On small sites, this may mean parking offsite on a nearby road edge. Encourage carpooling.
- Designate specific staging areas for materials (gravel, lumber, etc.) in previously disturbed areas.

To attain this credit:

1. Determine the applicable site area. If your project involves the whole lot, use the lot area defined by a property survey. If your project is just in the shoreline /riparian area, use the riparian buffer; the shoreline area that lies within the minimum riparian buffer/setback required by local regulations OR within 35 ft/10 m of the Ordinary High Water Mark (OHWM) (measured as the horizontal distance landward of the OHWM), whichever is greater. Calculate the site area by multiplying the shoreline length along the OHWM by 35 feet (10 m) or by the width of the buffer/setback requirement by local regulations.
2. Measure the portion of the site area where soil will be disturbed and vegetation removed to make way for the project.
3. Calculate the percent of the site that will remain undisturbed and use that percentage to determine applicable points based on the table above.

For more information

BC Ministry of Environment, 2012. *Develop with Care: Section Three - Site Development and Management*. www.env.gov.bc.ca/wld/documents/bmp/devwithcare/#

Low Impact Development Center (as of 2015) www.lowimpactdevelopment.org.

Low Impact Development Technical Guidance Manual for Puget Sound.
www.psp.wa.gov/LID_manual.php

Soils for Salmon (as of 2015) www.soilsforsalmon.org.

Soil Amendments (as of 2015) www.structuresoil.org Includes link to the Building Soil Manual.

Credit 3.2: Reduce and Treat Runoff

To qualify for this credit, minimize the amount of impervious surface area and use low impact development measures where feasible to further reduce the quantity and improve the quality of surface runoff.



Rain garden Credit: ShorelineAreaNews.com

The runoff associated with rain events is typically referred to as “stormwater” but it is important to recognize that the majority of surface runoff is from light, steady rainfall and not just occasional storms. Therefore, in this section, we use the term “rainwater management” in addition to stormwater to refer to the runoff from regular rainfalls as well as bigger storm.

Low impact development (LID) is an approach to site development and rainwater management that aims to mitigate the impacts of surface runoff to water bodies by:

- Reducing the amount of impervious surface area and thereby reducing the quantity of surface runoff; and
- Treating the runoff generated by any impervious areas that do occur by using measures such as absorbent landscape (deep, organic soils), rain gardens, green roofs and permeable paving.

Impervious surface area (ISA) is the area of a given lot or property that is covered by man-made surfaces that do not allow water to transmit or filter

Credit 3.2: Reduce and Treat Runoff

through them; instead, the water runs off the surface. Impervious surfaces include rooftops, roads, sidewalks, driveways, and parking lots that are covered by impenetrable materials such as shingles, asphalt, concrete, plastic, brick, and stone. The ISA is often referred to as the “built footprint” and as this credit emphasizes, a smaller built footprint is good for the environment and the pocketbook.

Effective impervious area (EIA) is the impervious surface area on a site that drains into a conveyance system (ditch or pipe) without any treatment to reduce flows or improve quality. The objective is to reduce EIA as much as possible. To reduce EIA, runoff can be directed to LID features such as absorbent landscaping (characterized by deeper, organic soils), rain gardens, green roofs, and permeable paving. The ultimate goal is to avoid using only pipes, culverts, and ditches that move rainwater offsite, and instead use “natural” drainage systems that slow, absorb, and filter water through vegetation and soil just as forests, wetlands, grasslands, and other natural ecosystems do.

Where this credit applies

This credit applies to any development that alters the amount of impervious surface on a site. This credit is particularly important for sloping sites, sites with runoff from upland areas, sites with highly erodible materials, bluff properties where slope failure risk is high, and sites that are adjacent or connected to water bodies that receive rainwater runoff.

Benefits

To the homeowner

Impervious surfaces (roofs, driveways, patios, walkways, etc.) generate runoff from all but the smallest rain events. Runoff is concentrated from these surfaces and discharged to storm drain systems and/or to nearby water bodies. These concentrated water flows can cause erosion and property damage, increasing maintenance and repair costs. On waterfront properties, particularly low and high bank shorelines, increased surface runoff can significantly increase the rate of shoreline erosion.

Managing rainwater runoff on-site can reap other benefits for homeowners.

- Reducing ISA can save money by reducing



Pervious pavers Credit:
belgardhardscapes.files.wordpress.com

Credit 3.2: Reduce and Treat Runoff

the amount of pavement, concrete and other surface materials required, while providing more opportunities for green space on your property.

- Less runoff production means less demand on local stormwater infrastructure, resulting in less wear and tear on existing pipes, less maintenance for culverts and ditches, and fewer costs for new infrastructure.
- If onsite rainwater management measures are designed properly, property owners may be able to avoid requirements to connect to local storm drain infrastructure, which can save them money. In fact, some local jurisdictions provide incentives for managing runoff onsite rather than using the storm drain system.
- Finally, areas that would traditionally be landscaped could possibly be designed as rain gardens or absorbent landscape with little additional cost. Properly designed permeable paving is a cost effective means to manage runoff in driveways and patios. Both measures provide attractive qualities that can add to property value.

To the environment

Minimizing runoff, and allowing any runoff that does occur to soak into the ground benefits both aquatic and terrestrial environments. Runoff concentrated from roads, driveways, parking areas, and rooftops picks up heavy metals, oil, chemical pollutants, particulates, and sediment that damage water quality. Minimizing the amount of runoff, and infiltrating the runoff that does occur through plants and soil filters out pollutants and helps to recharge groundwater. Reducing the ISA also helps maintain existing water flow paths that are critical to recharging groundwater, streams, and other receiving waters.

Rain gardens, absorbent landscapes, and green roofs function to intercept rainfall. The plants in these “green” rainwater management facilities return rainwater to the atmosphere through transpiration or infiltrate it into the soil. Absorbent landscapes can hold up to 20% of their volume in water and will filter far more. Rain gardens, absorbent landscapes, and green roofs also provide a diversity of habitats for birds, insects, and wildlife—even in urbanized areas.



Pervious parking area Credit: H. Rueggeberg

Credit 3.2: Reduce and Treat Runoff

Points available

This credit offers up to 6 base points plus up to 2 bonus points

Reduce and treat runoff from impervious surfaces				
	Lot area			Base points
	< ¼ acre	¼ - ½ acre	> ½ acre	
Impervious Surface Area (ISA)* as % of lot area	< 25%	< 15%	---	3
	25-35%	15-30%	10-15%	2
	36-45%	31-40%	16-25%	1
Effective Impervious Area (EIA)** as % of lot area	< 10%	< 5%	---	3
	10-20%	5-10%	< 5%	2
	>20-25%	>10-15%	5-10%	1
Bonus (available once any of the above conditions have been met)				Bonus points
Detain at least 1000 US gallons (3800 litres) of rainwater				1
Use detained rainwater for household and/or landscape use				1

*ISA includes all artificial hard surfaces, including those that use LID measures to reduce and/or treat runoff. The smaller the total ISA, the more points are available.

EIA is the ISA minus the area of surfaces that are treated with some LID measure such as a green roof, rain garden, permeable pavement or pavers, or absorbent landscape that receives drainage from a roof, deck or other impervious surface. Use the EIA Calculation Table later in this section to determine the EIA on your site. **If no ISA is treated, EIA = ISA.

How to proceed

Right from the start, incorporate LID techniques in the design of your project to reduce the ISA and EIA. Problems often arise when building and site design plans are completed only to discover that there is not enough room left on the site to manage rainwater. Remember, the smaller the total impervious area, the less expensive managing and treating runoff will be.

Techniques that you can use to minimize the ISA and EIA include:

- Design smaller buildings, build up rather than out (within local ordinance or bylaw requirements), and cluster buildings so that walls, services and construction space are shared.
- Minimize driveway length and width, install a “Hollywood” driveway (described later in this section), or share a driveway with neighboring properties. Reduce parking area where feasible.
- Maximize the areas of vegetation and absorbent landscapes. Create a rain garden to receive runoff from roofs, patios, and/or driveways.

Credit 3.2: Reduce and Treat Runoff

- Convert areas of existing or planned impervious paving to permeable paving products, ensuring their proper installation.
- Install a green roof wherever practical and suitable (you will likely need advice from a qualified design professional).

Discharge of runoff must be designed to adapt to site conditions, particularly where slope stability is an issue. Infiltrating runoff to ground near the top of bluffs and steep slopes may decrease the stability of these slopes. On these sites, drain water discharge, including drainage from rain gardens, green roofs and other LID facilities, away from erodible slopes. Lining rain gardens and installing underdrains and overflow drains to a collection system may be necessary. In some situations, flows may need to be hard piped to the



Green roof Credit: H. Rueggeberg

beach to avoid erosion and bank failure. Consult with a geotechnical engineer in these situations, or contact your local planning department to ensure that you are complying with any shoreline or hazard guidelines.

To achieve points for low ISA%:

1. Determine the size of the lot based on a property survey or from your site plan.
2. Measure the ISA including existing and proposed roof areas, driveways, parking areas, patios and paths.
3. Calculate the percent of the site that is covered by ISA.
4. From the Points Available table, see if you qualify for points based on your lot size and ISA%. If not, and you are planning a new project or renovation, determine if there are other design options that could be used to reduce the ISA on the site.

To achieve points for low EIA%:

1. In your design plan, delineate all existing and proposed impervious areas and show how water is drained from these surfaces, indicating the water flow path. If you are installing one or more LID features (rainwater management facilities), indicate what they are and where they are located on the design plan. Calculate the area of the ISAs that are draining to these facilities and enter this area in the applicable "Treated Area" section in the EIA Calculation Table below. Also show emergency overflow paths.

Credit 3.2: Reduce and Treat Runoff

EIA Calculation Table

	Insert m ² or ft ²	Comment
Lot area		From existing conditions or design plan
Impervious surface area (ISA)		ALL hard artificial surface areas
Treated area*		
Green roof		An engineered roof that is partially or completely covered with vegetation and a growing medium (enhanced soil) over a waterproof membrane; may also include additional layers such as a root barrier and drainage and irrigation systems.
Rain garden		A concave landscape area vegetated with plants that can withstand periodic inundation, which receives drainage from a roof, downspout or other adjacent impervious surface. Runoff is allowed to pond temporarily while infiltrating into deeply constructed soils below.
Pervious paving		A surface layer that allows rainfall to percolate into an underlying base where rainfall is either infiltrated to underlying soils (if they are porous enough) or removed by a subsurface drain. The surface component can be: porous asphalt or porous concrete; concrete or plastic grid structures filled with gravel or vegetated soil; or concrete modular pavers with gapped joints that allow water to percolate through. Note that pervious paving requires a properly designed underlying base adapted to site conditions.
Absorbent landscape		Area with enhanced soils (at least 12" depth and at least 10% organic content) that receives drainage from a roof, downspout or other adjacent impervious surface
Other (state method)		
Total treated area	= sum of above treated areas	
Effective impervious area (%)		= (ISA - Total Treated Area)/Lot Area x 100%

* This is the area of impervious surface treated by the LID feature, not the area of the feature itself (though for green roofs, the area treated and area of green roof are the same).

- Working with a qualified professional or using stormwater design guidelines provided by your local government, calculate the size of suitably designed rainwater management facilities needed to manage each ISA and indicate this on your design plan. A sufficient amount of land needs to be available to manage the runoff from each impervious area.
- Use the EIA Calculation Table on the next page to calculate the Total Treated Area and the EIA% for the site.

Credit 3.2: Reduce and Treat Runoff

4. From the Points Available table above, see if you qualify for points based on your lot size and EIA%. If not, and you are designing a new project or renovation, determine if there are other rainwater management options that could be used to reduce the EIA on the site.

Note that achieving a low EIA does not change your ISA - that remains constant.

For more information

Canada/B.C.

BC Ministry of Environment (2010). Stormwater Planning: A Guidebook for British Columbia. <http://bc.waterbalance.ca/resources/guidance-documents/> or www.toolkit.bc.ca/resource/stormwater-planning-guidebook-british-columbia

BC Ministry of Environment, 2012. *Develop with Care: Section Three - Site Development and Management*. www.env.gov.bc.ca/wld/documents/bmp/devwithcare/#

B.C. Factsheet - Marine Guide to Stormwater Runoff www.dfo-mpo.gc.ca/Library/281621.pdf

Partnership for Water Sustainability in BC - Rainwater Management. <http://waterbucket.ca/rm/?sid=18&id=236&type=single>

United States

Bakeman, S., D. Gariepy, D. Howie, J. Killelea, F. Labib, and E. Obrien, 2012. Stormwater Management Manual for Western Washington, Washington State Dept. of Ecology, Olympia, WA. 1039 p. www.ecy.wa.gov/programs/wq/stormwater/manual.html

Low Impact Development Centre (as of 2015). www.lowimpactdevelopment.org

Portland Sustainable Stormwater (as of 2015) www.portlandonline.com/bes/index.cfm?c=34598

Puget Sound Action Team and Washington State University. 2005. Low Impact Development Technical Guidance Manual for Puget Sound. www.psp.wa.gov/LID_manual.php

San Juan County Conservation District. Low Impact Development Best Management Practices <http://sanjuanislandscd.org/water-2/lid-bmp/>

Seattle Stormwater Manual www.seattle.gov/dpd/codesrules/codes/stormwater/default.htm

Soils for Salmon. www.soilsforsalmon.org

Washington State University. Rain Garden Handbook for Western WA Homeowners: <http://raingarden.wsu.edu/>

Washington State Department of Ecology Stormwater webpage: www.ecy.wa.gov/programs/wq/stormwater/index.html.

Water Environment Research Foundation LID BMP Cost Calculator www.werf.org/bmpcost

Credit 3.3: Environmentally Friendly Building Products

Credit 3.3: Environmentally Friendly Building Products

To qualify for this credit, avoid using toxic chemicals or chemically treated wood in the construction and maintenance of overwater structures, or landscaping structures in riparian areas.

Where this credit applies

This credit applies to whole site and shoreline/riparian development in marine and lake environments. It applies particularly to any projects that may involve the use of treated wood in overwater structures (docks, piers, etc.) and landscaping in the riparian buffer.

Benefits

To the homeowner

Using naturally preserved wood products (cedar, redwood) and green alternative materials (e.g. “glass” wood, recycled plastic wood) have several benefits to home owners. There is no exposure to chemicals and absorption from skin contact when using alternative materials. Plastic wood is coloured throughout and therefore does not require routine staining, which reduces maintenance costs. Similarly, allowing cedar and redwood products to age naturally reduces ongoing maintenance.



Treated wood BMP logo Credit: Western Wood Preservers Institute

To the environment

Avoiding the application of stains and paints and using untreated lumber for overwater structures and in riparian areas reduces the risk of chemical contamination to local aquatic ecosystems. Treatment chemicals can leach from wood when in contact with water and harm aquatic organisms. For example, dissolved copper has been shown to decrease the performance of salmon’s sense organs, particularly olfactory (smell) function, which can impact juvenile salmon’s ability to avoid larger, predatory fish. Treated wood can also create hazards during combustion or where loose wood dust particles or other fine toxic residues are produced.

Credit 3.3: Environmentally Friendly Building Products

Points available

This credit offers up to 4 base points.

Environmentally friendly building products	Base points
Use untreated building materials for posts and pilings in docks and piers	1
Use untreated materials for other structural elements (beams, struts, etc.) in docks and piers	1
Use untreated materials for wharf and pier decking surfaces and landscaping elements that are in the riparian buffer	1
Do not use paints or stains on overwater structures - leave surfaces to weather naturally	1

How to proceed

To achieve this credit:

- Use natural rather than treated wood products whenever possible.
- If treated wood has to be used, look for the treated wood BMP logo (see previous page) or a certificate of compliance issued and signed by an independent treated-wood inspection agency.⁶ Do all cutting in an upland area well away from any drainages, to reduce the risk of the saw dust entering the aquatic ecosystem.
- Use decking materials that will not require toxic finishes and cleaning agents; no matter how careful you are in their application, some will end up in the water. Metal, fiberglass or plastic grating, recycled plastic lumber and naturally rot-resistant wood can help avoid these problems.
- If you have or install wood decking, let it age rather than paint or stain it, as these materials flake off and can harm aquatic organisms. Use colour impregnated plastic wood where decking colour is desired.

Wood such as western red cedar and redwood have natural properties that help them resist rot. New technologies have also been used to reduce the ability of wood to absorb water, thereby reducing its rate of decomposition. These include coating wood in glass fibers (glass wood) and treating wood with acetic acid to create a water barrier. Alternative products to wood such as pre-cast concrete or aluminum that do not leach chemicals can also be considered. All of these products can be used for structural elements. Plastic wood (made from recycled plastic) can be used for decking and cladding (it is not suitable for use as a

⁶ See the BMP guide published by the Western Wood Preservers Institute (listed under “For more information”) to learn more about certified treated wood.

Credit 3.3: Environmentally Friendly Building Products

structural element). Recycled plastic wood is commercially available in a variety of colours that does not require staining.

Note that in freshwater in Washington State, under the Washington Administrative Code (WAC) 220-660-140:

- Treated wood should not be used for the decking of overwater structures.
- Treated wood may be used for structural elements, but any elements subject to abrasion by vessels, floats, etc. must incorporate design features that minimize abrasion of the wood.
- Use of creosote or pentachlorophenol pilings is prohibited; new and replacement pilings can be steel, concrete, recycled plastic, untreated wood or WDFW-approved treated wood.

Similar regulations may apply to marine and freshwater environments in other jurisdictions; check with local government agencies before proceeding with your project.

Common wood preservatives:

Creosote		Banned as a consumer preservative; very limited commercial applications.
Penta	Pentachlorophenol	Banned as a consumer herbicide; very limited commercial applications; not to be used for fresh or saltwater immersion.
CCA	Chromated copper arsenate	Banned for residential use due to arsenic content; limited commercial use.
ACZA	Ammoniacal copper zinc arsenate	Penetrates Douglas fir better than other preservatives.
ACQ	Alkaline copper quaternary	Water-based; considered a 'greener' alternative to CCA.

For more information

BC Ministry of Transportation and Infrastructure. 2013. Guidelines for Use of Treated Wood in and Around Aquatic Environments and Disposal of Treated Wood. 6p. Go to www.th.gov.bc.ca/publications/repopubs.htm and enter "treated wood" in the search box.

NOAA. 2009. The Use of Treated Wood Products in Aquatic Environments: Guidelines for West Coast NOAA Fisheries Staff. Go to www.westcoast.fisheries.noaa.gov and enter "treated wood products" in the search box.

Credit 3.3: Environmentally Friendly Building Products

Seattle, City of. 2011. *Green Shorelines: Bulkhead alternatives for a healthier Lake Washington*. 34 pg. (See section on “Building better docks”). Go to www.seattle.gov/dpd/ and enter “green shorelines” in the search box.

Washington State Legislature WAC 220-660-140: Residential and public recreational docks, piers, ramps, floats, watercraft lifts, and buoys in freshwater areas. Effective July 1, 2015.
<http://app.leg.wa.gov/WAC/default.aspx?cite=220-660-140>

Western Wood Preservers Institute. 2012. Treated Wood in Aquatic Environments. 36 p. and Best Management Practices for the Use of Treated Wood in Aquatic and Wetland Environments. 36 p. www.wwpinstitute.org/aquatics.html (The BMP guide is aimed primarily at treated wood manufacturers and commercial installers, but provides useful information about the different types of treated wood and their appropriate application.)

Credit 3.4: Creosote Materials Removal

To qualify for this credit, remove and dispose of creosote-treated materials (pilings, retaining structures, beach debris).



Removing creosote material Credit: Washington State Department of Natural Resources

Where this credit applies

This credit applies to any site with functional or derelict creosote-treated pilings, as well as sites with significant amounts of creosoted beach debris.

Benefits

To the homeowner

Creosote contains many toxic chemicals that impact human health, particularly compounds called polycyclic aromatic hydrocarbons (PAHs) that are known to be carcinogenic and cause birth defects. Removal of creosoted wood reduces the risk of exposure, reduces odours and the production of “tar balls” on the shoreline.

Credit 3.4: Creosote Materials Removal

To the environment

Treatment of wood with creosote was a common method of wood preservation in the past; however, creosote is composed of many chemicals that are toxic to marine and freshwater organisms, as well as to humans. Removal of creosote from aquatic environments has been identified in Canada and the United States as a high-priority issue. Particular focus has been given to removal of derelict pilings—one of the primary sources of debris found on beaches and human exposure to creosote.

Overall, the removal of creosoted materials:

- Restores and improves habitat quality.
- Reduces the risk of bio-accumulation of PAH's in the food chain.
- Increases the survival rate of species living in close proximity to pilings, especially of larval forms of some aquatic species.
- Reduces contaminants in sediments and suspended in the water column.

Points available

This credit offers up to 4 base points.

Creosote Materials Removal	Base points
Removal of one standing creosoted piling OR Removal of a minimum 400 lb (180 kg) of loose creosoted material	2
Removal of every additional standing creosoted piling OR every additional 200 lb (90 kg) of creosoted materials	0.5 point up to a maximum of 2 points

How to proceed

Achieving this credit requires identifying whether you have any creosoted material on your property or adjacent beach, whether it can be safely removed and where it can be safely disposed. Removing and disposing of creosote materials may require permits or other approvals from regulatory agencies. Check your proposed project with local, state/provincial or federal authorities before getting started.

Steps to take include:

1. Survey your beach and property to identify any creosote-treated wood, beach debris, or remnants from piling projects.
2. Assess the condition of the creosoted material: is it readily accessible, or is it buried in sand or gravel such that extensive digging may be necessary? How much is there and will it need machinery to be removed?

Credit 3.4: Creosote Materials Removal

3. If there is a large amount and/or heavy equipment is needed to remove it, contact your local government or local environmental authority; they may be able to tell you the best way of removing it, or have a removal program themselves. You may need a permit to work on the beach.
4. Take care to control erosion and sediment migration while removing buried creosote debris or remnants of piling projects.
5. Determine disposal options. Creosoted material is considered hazardous waste in both Canada and the United States, and must be disposed at a hazardous waste facility. Your local government or environmental authority can tell you where to take this material, or alternatively, where it can be safely used.

For more information

Fisheries and Oceans Canada. *Guidelines to Protect Fish and Fish Habitat from Treated Wood Used in Aquatic Environments in the Pacific Region*. Go to www.dfo-mpo.gc.ca and enter “treated wood” in the search box.

Washington State Dept. of Natural Resources Aquatic Restoration Program.

Go to www.dnr.wa.gov/ResearchScience/Topics/AquaticClean-UpRestoration/Pages/aqr_restoration_program.aspx and click on Creosote Removal Program.

Washington State Dept. of Natural Resources. *Marine Debris Fact Sheet: Creosote-Treated Wood*. http://water.epa.gov/type/oceb/marinedebris/upload/marine_debris_factsht_creosote-treating_wood.pdf

Holeman, M., B. Lyons, L. Kaufman, N. Rice, 2007. Creosote Beach Log Removal and Assessment of Leaching into Beach Sediments in Puget Sound. Puget Sound Georgia Basin Conference Proceedings. Available online:

http://depts.washington.edu/uwconf/psgb/proceedings/papers/p9_holman.pdf

Credit 3.5: Herbicides, Pesticides, and Fertilizers

Credit 3.5: Herbicides, Pesticides, and Fertilizers

To qualify for this credit, do not use synthetic/inorganic herbicides, pesticides, or fertilizers in routine landscape maintenance.



Beneficial insects Credit: Washington State University (<http://pep.wsu.edu/pestsense>)

For the purposes of this document, “cosmetic use” is defined as used for non-essential purposes; i.e. purely aesthetic function.

Where this credit applies

This credit applies to any type of project that involves landscape establishment and maintenance, particularly in riparian areas.

Benefits

Using a natural landscape maintenance approach improves the longevity and health of plants, reduces the risk of chemical contamination of marine and freshwater ecosystems, and reduces the amount of chemical products at home that can come in contact with people.

To the homeowner

Pesticide exposure has been linked to several types of cancer, as well as hormone disruption. Young children are at greater risk due to their undeveloped immune systems, more permeable skin and behaviours (i.e. playing on lawns and putting objects in their mouths). Avoiding the use of synthetic products reduces

Credit 3.5: Herbicides, Pesticides, and Fertilizers

the risk of contact with chemicals that may be hazardous to the health of you and your loved ones.

To the environment

Pesticide and herbicide use contributes to the cumulative chemical impact on the natural environment. Spray application often results in non-targeted plants, insects, and aquatic organisms being exposed to harmful chemicals. Once released into the environment, these chemicals are washed into receiving waters and impact aquatic organisms and get into the food chain. Using natural products and biological control methods avoids these chemicals being released into the environment.

Synthetic fertilizers are produced from petroleum products (nitrogen content) or mined from the ground (phosphate and potassium content). Both sources of material have negative effects on the environment in terms of greenhouse gas production and impacts to mined landscapes.

Commercially available fertilizers are often quickly released when wet and therefore, can easily end up in runoff that is discharged to aquatic habitats. Excessive nutrients in aquatic ecosystems result in significant algal blooms or other ecological disturbances. Algal blooms foul beaches and result in fish kills. The excessive use of synthetic fertilizer also leads to the sterilization of soil microflora, and reduces the availability of natural and trace minerals in the soil that are essential for plant health.

In addition, nitrogen inputs to local waters contributes to localized ocean acidification. Excess nitrogen fuels phytoplankton blooms that release carbon dioxide into the water column as they decompose, increasing the acidity of local waters. This is particularly harmful to the growth of clam and oyster larvae.

Using natural soil building practices (mulching) and natural sources of nutrients (organic fertilizers) will result in healthier soils and plants in the long term, reduce the risk of nutrient enrichment of aquatic environments, and help to reduce greenhouse gas production.

Irrigation Note: Excessive irrigation of landscape areas can result in nutrient and pollution transport to receiving waters and in some cases, cause erosion of sensitive bluffs by increasing groundwater seepage. Avoid irrigation on landscapes that drain towards bluffs and steep slopes. When in doubt, contact your local planning department to ensure that you are complying with local waterfront, slope, or hazard land codes or guidelines.

Credit 3.5: Herbicides, Pesticides, and Fertilizers

Points available

This credit offers 2 base points

Herbicides, Pesticides, and Fertilizers	Base points
Manage landscaping without the use of synthetic pesticides, herbicides and fertilizers.	2

How to proceed

Complete the Landscape Maintenance Checklist in Appendix A to show that landscaping is being managed without the use of synthetic herbicides, pesticides, or fertilizers. Use these chemicals only in the case of severe infestations, as deemed necessary by a certified professional. Where that is the case, make sure to follow the label instructions and to comply with local bylaws or regulations regarding the use of pesticides and herbicides.

In some jurisdictions, the use of chemical pesticides, herbicides, and fertilizers is prohibited within a certain distance of a water body; for example, 50 feet in the City of Seattle. In others, the use of these substances for *cosmetic* purposes is prohibited. Many retailers have information on what products can be used to comply with local pesticide bylaws. In both Washington State and BC, non-cosmetic use for control of pest outbreaks and widespread invasive species must follow an Integrated Pest Management Plan⁷ using trained personnel. Information sources on alternative methods for managing pests, weeds and invasive plant species, along with IPM methods, are listed in the “For more information” section.

The following steps will help to achieve this credit:

- Landscape with native plants or hardy non-native plants that require minimal chemical application, if any. Avoid plants with known susceptibility to disease or those that require high nutrient or chemical inputs to survive in existing soils. Do not use plants identified on local or regional invasive plant lists.



Landscape aeration as a lawn and garden best practice Credit: Kitchen Food Garden (kitchenfoodgarden.com)

⁷ *Integrated pest management (IPM)* combines biological, cultural, physical and chemical tools to manage pests in a way that minimizes economic, health, and environmental risks. IPM is site-specific in nature, with individual tactics determined by the particular crop, pest and environment scenario. The IPM approach places an emphasis on the reduction of pesticide use and the implementation of preventative and alternative control measures (Sustainable Sites Initiative, 2009). References for IPM in BC and Washington state are listed in the “For more information” section.

Credit 3.5: Herbicides, Pesticides, and Fertilizers

- Avoid or eliminate the use of herbicides to control weeds in lawns and gardens. Rely instead on regular hand-removal of weeds combined with adequate natural soil amendment. Manual removal of weeds can be supplemented with spot treatment using approved insecticidal soaps, vinegar-based compounds, and plain old boiling water.
- Eliminate use of synthetic quick release fertilizers. Use natural amendments that contain all natural ingredients (composted manure, blood meal, bone meal, kelp meal, tea, composted fish-waste, etc.) and no petrochemical or synthetic ingredients. Do not apply approved fertilizers at a rate that exceeds 1 lb nitrogen / 1,000 ft².
- Eliminate use of pesticides. Regular maintenance of plant health is the best approach to preventing pest problems. If pest populations cause a widespread and significant decline in plant health on your property, use Integrated Pest Management-approved biological controls. Never use the compounds listed below in shoreline areas.

Don't use these!

The following compounds pose high risk to salmon and other aquatic species, and must not be used in shoreline and riparian areas (from *Salmon-Safe Certification Standards for Residential Development* Draft 2.2).

1,3-dichloropropene 2,4-D Abmectin	Fenamiphos Fenpyroximate Fenbutatin-Oxide
Acephate Altacor Atrazine	Folpet Imidacloprid Iprodione
Bensulide Bentazon Bifenazate	Linuron Malathion Mancozeb
Bifenthrin Bromoxynil Carbaryl	Maneb Metolachlor Metribuzin
Carbofuran Carfentrazone-ethyl Chlorothalonil	Naled Norfl urazon Oryzalin
Chlorpyrifos Copper Sulfate ¹ Cyhalothrin	Oxyfluorfen Paraquat Dichloride Pendimethalin
Cypermethrin Diazinon Dicamba	Permethrin Phosmet
Dichlobenil Diclofop-methyl Difl ubenzuron	Prometryn Propargite Propiconazole
Dimethoate Disulfoton Diuron	Rimon Quintozene Rimon
Esfenvalerate Ethoprop Extoxazole Technical	Simazine Spinosyn Triclopyr
	Trifluralin Tebuthiuron Thiram

For more information

BC Environment. Pesticides and Pest Management.

www2.gov.bc.ca/gov/theme.page?id=9C0666DDF79681160264E5B0EC29ECFB

Salmon-Safe Certification Standards for Residential Development

www.salmonsafe.org/getcertified/residential-development

Credit 3.6: Onsite Sewage Treatment

Credit 3.6: Onsite Sewage Treatment

To qualify for this credit, ensure that your onsite sewage treatment system is functioning properly; develop and implement a Septic System Maintenance Plan that minimizes the release of pollutants to downstream receiving waters.

Onsite sewage systems, also known as septic systems, are particularly common in rural and cottage situations. Waterfront properties, which tend to be smaller and have wetter soils, pose extra challenges for septic systems. Soil conditions can make your system less efficient in treating wastewater and allow harmful pollutants to get into the water body you live beside. As a waterfront resident, please pay particular attention to your septic system.



*Credit: Conasauga River Alliance
(www.conasaugariver.org)*

Where this credit applies

This credit applies wherever waterfront properties are not served by a centralized sewage system and rely on onsite sewage treatment, and where those onsite sewage facilities are being installed, renovated or maintained.

Benefits

Faulty septic systems are extremely hazardous since improperly treated effluent can harm your health, and the health of your neighbors as well (for example, by getting into drinking water supplies) as well as the health of the environment.

To the homeowner

Untreated sewage can be the source of organic nutrients (particularly nitrogen and phosphates) that cause eutrophication (an overabundance of algal growth in aquatic systems). Aside from being unsightly, eutrophication of our shorelines prevents waterfront owners and users from swimming, fishing, and other recreational activities. In addition, many marine shorelines are closed to shellfish harvesting, and both freshwater and marine shores can be closed to swimming due to high coliform counts, which are usually associated with sewage outfalls or drainage from poorly managed septic systems. Needless to say, this has negative effects on property values.

Credit 3.6: Onsite Sewage Treatment

To the environment

An overabundance of algal growth depletes oxygen levels in the water, which can kill fish and other aquatic organisms. Sewage often contains other toxins such as oil and heavy metals. Proper onsite sewage treatment should prevent these nutrients and pollutants from entering the aquatic system.

Points available

This credit offers 2 base points plus 1 bonus point

Onsite Sewage Treatment	Base points
For an <u>existing on-site sewage treatment system</u>: provide recent inspection documentation signed by a qualified inspector. Indicate the location of any existing sewage treatment structures on the existing conditions plan. OR For a <u>new or replacement on-site sewage treatment system</u>: provide design and installation documentation approved by the local authority. Indicate the location of any new or replacement sewage treatment structures on the site design plan.	2
Bonus points	
Prepare and follow a septic system maintenance plan or checklist	1

How to proceed

New systems: Installation of new or upgraded onsite sewage systems (OSS) is regulated by health authorities on both sides of the US/Canada border. In Washington State, state law requires OSSs to be designed by a licensed designer and approved by county health authorities. In BC, new or upgraded OSSs must be designed and installed by a professional engineer or registered onsite wastewater practitioner to meet the provincial Sewerage Systems Regulation, and approved by the local health authority. In both places, the authorized installer will provide you with an as-constructed drawing of the system components and a maintenance plan.

To apply for the credit for new systems, submit the installation and maintenance documentation approved by the applicable inspector or authority.

Existing systems: Confirming that an existing OSS meets current standards typically requires an inspection by a qualified professional. In Washington State, San Juan County requires homeowners to have their systems inspected annually for systems within designated sensitive areas (such as shellfish growing areas), and every three years for all other systems. Inspections can be completed by a San Juan Co. licensed wastewater inspectors or certified homeowner. To become a certified homeowner entails attending a county-sponsored inspection and

Credit 3.6: Onsite Sewage Treatment

maintenance workshop, a four-hour session offered each year throughout the county.

To apply for the credit for existing systems, submit the inspection documentation signed by the applicable inspector. In BC, inspections may be conducted by a person approved by the Association of Professional Engineers and Geoscientists of BC (APEGBC) or the Applied Science Technologists and Technicians of BC (ASTTBC).

For the bonus point, a maintenance plan for a septic or other onsite sewage system must address the following:

- Location of the tank, tank inlet, and drainage field on the property relative to all other buildings and activity areas (part of the site plan described earlier in this guide in the “Existing Conditions Plan” and “Site Design Plan” sections).
- The type of sewage system: gravity, pressure distribution, mound, sand filter, or other type.
- The date of the last inspection of the system by an authorized inspector, and by whom.
- The latest date when the septic tank and pump tank (if applicable) were pumped out.
- Annual inspection by you for septic system failure; look for soggy areas over the drain field, sewage smell in vicinity of tank and field, slow drainage from sinks, toilets back up, etc.
- Who to call in the case of signs of failure.

Also take note of best management practices in your maintenance plan, such as:

- Avoid pouring or flushing into the septic system: for example, oil, grease, disinfectants (kills the bacteria in the system), solvents, paints, caustic cleaners, cigarette butts, sanitary supplies, diapers, condoms, tissue, napkins, tea leaves, coffee grinds, and fats. These can all plug a septic tank or drain field.
- Protect the system from physical damage; for example, do not park over the drain field, bury it under landscaping or plastic (it has to breathe), plant trees or large shrubs over or nearby (roots can damage the field).
- Do not use septic system additives.
- Do not allow roof or perimeter drains or other surface water sources to discharge on or near the OSS.
- Do not overload the system with too much water; for example, from a running toilet or leaky faucet.

Credit 3.6: Onsite Sewage Treatment

- Do not irrigate or water on or near the OSS.
- Do not install a garburator.

For more information

BC Health. Maintenance and Operation of Sewage Disposal Systems.
www.healthlinkbc.ca/healthfiles/hfile21.stm

Regional District of Nanaimo “SepticSmart” program - www.rdn.bc.ca/cms.asp?wpID=1159

San Juan County On-site System Operation and Maintenance Program
<http://sanjuanco.com/health/ehswaste.aspx>

Washington State Regulations - Chapter 246-272A WAC: On-site sewage systems
<http://apps.leg.wa.gov/wac/default.aspx?cite=246-272a>

Category 4: Shore Stewardship

The Shoreline Stewardship category encompasses actions that shoreline landowners can take that support not only their own interests, but also public interests, whether they encompass environmental, recreational, educational, or aesthetic values.

In this section:

Credit 4.1: Shoreline Collaboration

Credit 4.2: Public Information and Education

Credit 4.3: Conservation Easement or Covenant

Credit 4.4: Shoreline Stewardship Participation

Credit 4.1: Shoreline Collaboration

To qualify for this credit, work with neighboring waterfront property owners to design and build common shoreline structures or enhancement measures.

Shoreline features and processes invariably extend across property boundaries. Hence, it is often difficult to address shoreline issues—erosion, deposition, habitat restoration, etc.—solely within the boundaries of one property. Dealing with them in a “whole system” manner enhances the effectiveness of any measures taken.



Together neighbors turned this (left) to this (right) Credit: Coastal Geologic Services Inc.

Where this credit applies

This credit applies to shoreline protection or enhancement projects that neighboring property owners could work together and address collectively, such as:

- Removal of bulkheads that extend across two or more properties (Credit 1.3).
- Removal of groins that are shared or multiple groins on two or more properties (Credit 1.4).
- Soft shore protection or enhancement measures that extend across properties (Credit 1.5).
- Riparian vegetation landscaping that share a common landscaping plan for more than 75% of the riparian buffer across properties (Credit 2.1).
- Stormwater management and drainage works that provide a common, shared service, including sharing of impervious surfaces such as driveways or walkways (Credit 3.2).
- Onsite sewage treatment; for example, common septic fields or small plant systems (Credit 3.7).

Note that sharing overwater structures (common piers, docks, etc.) and shoreline accesses are already recognized and awarded points under Credits 2.5

Credit 4.1: Shoreline Collaboration

and 2.6 respectively, so you cannot apply for ‘collaborating’ on these types of projects under this credit as well.

You can apply for points under this credit whether or not your neighbors are applying for their own Green Shores for Homes rating; obtaining points under this credit is independent for each applicant.

Benefits

To the homeowner

Shoreline measures may be more effective from a protective, cost, recreational or aesthetic perspective if conducted over several properties, rather than just a single property. Homeowners can also realize economies of scale in collaborating with one another; for example, hiring common experts, sharing and paying for one design versus many designs (which may or may not be compatible), buying supplies and materials in larger quantities at discount, disturbing less ground collectively, etc.

To the environment

Since shoreline features typically extend across property boundaries, dealing with them in a “whole system” manner enhances the effectiveness of any measures taken to protect property or enhance natural features along the shoreline. In most cases, the greater the number of adjacent properties involved, the greater the portion of the natural system that can be preserved and enhanced.

Points available

This credit offers up to 8 base points.

Shoreline Collaboration	Base points
Collaborate with one other (separate)* waterfront property owner.	4
Collaborate with two (separate)* waterfront property owners.	6
Collaborate with three or more (separate)* waterfront property owners.	8

***The collaborating parties must be different owners; i.e., not one owner for two or more properties.**

How to proceed

Collaboration starts with talking with your neighbors about common concerns, ideas, and solutions. In setting up a collaborative shoreline project, think about:

- Communication methods: Agree upon how you wish to communicate with one another for different aspects of the project; for example, meetings, email, phone calls, etc. At all times, allow the viewpoints and perspectives of

Credit 4.1: Shoreline Collaboration

all members to be considered in decision-making. Perhaps designate a team member as responsible for overseeing the collaborative communication process.

- **Common goals:** Determine the goals (both short- and long-term) that everyone can agree on to guide your project.
- **Targets:** Agree on a timeline and specific measurables for achieving your goals.
- **Responsibilities:** Identify the major tasks and who will be the lead on each task. For example, who will be in charge of contacting prospective contractors and getting quotes that all can review? Who will be the main contact for the contractor chosen? Who will oversee the actual site activities? Who will be the treasurer, keeping the books, collecting funds from each team member, etc.?
- **Maintenance:** Agree on a maintenance plan, if applicable, with associated assigned responsibilities and financial contributions.

Make sure to document the collaborative effort in order to achieve this credit, including:

- **Project team members:** name, address, roles, etc.
- **Summary of the communication methods, management process, and responsibilities, etc.:** Provide a record or log of major milestones.
- **Collaborative construction and maintenance plans.**

A collaborative process may take longer than “going it alone” and may require some compromise, but the overall benefits in terms of reduced costs per individual, environmental protection, and a better end product often outweigh these disadvantages. Plus, you and your neighbors may develop a greater sense of community. In addition, collective projects may be considered to provide a higher level of public benefit, and could be eligible for funding or tax credit programs through local, state/provincial or federal agencies. Check with your local government.

Credit 4.2: Public Information and Education

Credit 4.2: Public Information and Education

To qualify for this credit, provide opportunities to learn about the Green Shores measures taken on your property.

The intent of this credit is to promote understanding and uptake of Green Shores practices by waterfront property owners, developers, contractors, the professional community, and the general public.



Credit: H. Rueggeberg

Where this credit applies

This credit applies to any shoreline development activities that can be demonstrated to the public.

Benefits

To the homeowner

Providing opportunities to learn about a Green Shores project displays your commitment to “doing the right thing” when it comes to your shoreline, and encourages other property owners, especially those “on the fence” to do the same. If they are your neighbors, getting them informed and involved increases the effectiveness of shoreline protection and restoration projects.

To the environment

Impacts to shoreline ecosystems from waterfront development are not always well recognized by planners, developers, and property owners. Communication of Green Shores approaches to the professional community and the public is essential in order to build awareness of shoreline development issues and develop knowledge and expertise to address these issues.

Credit 4.2: Public Information and Education

Points available

This credit offers up to 2 base points.

Public Information and Education	Base points
Provide one public education measure regarding your shoreline project	1
Provide two or more public education measures regarding your shoreline project	2

How to proceed

Examples of public information opportunities include (note that these actions are neither mutually exclusive nor exhaustive— be creative!):

- Signs or posters on the property boundary explaining the Green Shores process and product and why it is good for the shoreline environment. This includes using a sign template offered by your local agency.
- Scheduled public tours and onsite demonstrations.
- Articles in newspapers and magazines.
- Public and school presentations.
- Documentation of the Green Shores approach on the Green Shores website and optionally, the local government’s website and/or the owner’s website.
- Volunteer advisory services, where the Green Shores property owner provides advice to other waterfront owners.
- Creation or participation in a shoreline stewardship program for waterfront owners.

You may choose to design and carry out these information actions yourself, or you could collaborate with—or allow your local government, contractor, service providers, or a local business, community or environmental organization—to use your project for educational purposes. Any information provided through posters, written materials, or electronically should, at a minimum:

- Describe the site values, shoreline ecological and physical processes.
- How the site design works with these features.
- How one or more Green Shores credits have been addressed.
- Be available for at least one year.
- Be creative with photos (especially before and after) and graphics. Invite neighbors to join you in your efforts.

Credit 4.3: Conservation Easement or Covenant

Credit 4.3: Conservation Easement or Covenant

To qualify for this credit, establish a conservation covenant or easement on a waterfront property, or a portion thereof, that protects natural features of the shoreline.

A conservation covenant (Canada) or conservation easement (United States) is a voluntary, legally binding agreement between a landowner and a covenant/easement holder in which the landowner promises to steward the land in ways that are specified in the covenant. A covenant/easement holder may be a government or a non-government organization that is recognized under applicable federal, provincial or state legislation as being able to hold covenants such as a land trust or nature conservancy. The covenant holder enforces the provisions of the covenant/easement if the owner does not abide by its terms.



Credit: H. Rueggeberg

A special attribute of a conservation covenant or easement in both Canada and the US is that it is registered on the title of the property, ensuring that it binds all current and future owners of the land. In this way, the protection that the covenant bestows is permanent and “runs with the land.”

Where this credit applies

This credit applies to any waterfront property. A land owner may establish a conservation covenant or easement on all or a portion of their property at any time if they and a covenant holder agree that the ecological values of that property should be preserved.

Benefits

To the homeowner

Conservation covenants/easements are of greatest interest to landowners who wish to preserve the ecological values of their properties regardless of who may own it in the future. In some jurisdictions, a conservation covenant may make the property eligible for reduced property taxes; for example, under the Public Benefit Rating System in King and San Juan Counties, Washington, and the Natural Area Protection Tax Exemption Program in the Islands Trust Area in BC. (See the “For more information” section below for details.)

Credit 4.3: Conservation Easement or Covenant

In Canada, conservation covenants on ecologically sensitive lands may also qualify as “ecological gifts” under the federal *Income Tax Act*, and be eligible for income tax credits (deductions from taxable income). Similarly, landowners in the US who donate a “qualifying” conservation easement to a qualified land protection organization under the *Internal Revenue Code* may be eligible for a federal income tax deduction equal to the value of their donation. In both countries, the value of the covenant or easement donation, as determined by a qualified appraiser, equals the difference between the fair market value of the property before and after the covenant/easement takes effect.

To the environment

The main benefit is permanent protection of key ecological features and functions of the shoreline and restrictions on activities that could harm them. Private lands often contain ecological, cultural, heritage, aesthetic and recreational values that are highly significant. Conservation covenants/easements offer a cost effective alternative to outright purchase of lands for the purposes of protecting these values. They allow landowners and conservation organizations to play an important role in the protection of ecologically significant lands that are important to us all.

Points available

This credit offers up to 6 base points.

Conservation Easement or Covenant	Base points	
	Mandatory (required by local jurisdiction)	Voluntary
Place a conservation easement or covenant on a minimum 60 ft (20 m) wide buffer* along 100% of your shoreline	3	6
Place a conservation easement or covenant on a minimum 30 ft (10 m) wide buffer along 100% of your shoreline	2	4
Place a conservation easement or covenant on a minimum 30 ft (10 m) wide buffer along 75% of your shoreline	1	2

*Buffer is measured perpendicular inland from the ordinary high water mark or natural boundary.

Credit 4.3: Conservation Easement or Covenant

How to proceed

In some US jurisdictions, a covenant is mandatory on all shoreline vegetation and plantings under their respective Shoreline Master Plans. These mandatory covenants are still recognized under this credit but with fewer points than covenants that are entered into voluntarily.

For a voluntary covenant, if your waterfront property has ecological values, decide whether you are willing to put restrictions on your property on a permanent basis in the interest of preserving natural shoreline features. For instance, a conservation covenant usually places restrictions on future development of a property, and thereby may reduce the property's market value or saleability. To fully understand the costs and implications, seek advice from an organization that holds conservation covenants or easements, other landowners who already have covenants/easements on their properties, and/or a lawyer who is experienced with conservation covenants/easements.

If you want to go ahead with establishing a covenant on your property, identify an appropriate covenant holder (recipient) such as a local land trust organization or local government. Things to consider in finding an appropriate covenant holder include: whether the holder organization has conservation objectives that fit well with your objectives regarding the special features of your property; and whether the organization has a solid record and adequate human and financial resources to undertake covenant obligations, including long-term monitoring and enforcement.

Basic steps to take for you and your proposed covenant holder are:

- Identify the land (the entire property or portion thereof) to be protected under the covenant.
- Identify the characteristics of the land that are to be permanently protected - special natural features, important habitats, etc.
- Determine the stewardship practices that will best protect those characteristics; for example, leaving it alone, fencing, etc.
- Obtain legal and tax advice.
- Conduct an environmental assessment of the property to ensure it fits within the conservation objectives of the conservation organization and to disclose any outstanding liabilities connected with the land; for example, existing liens on the property, environmental contamination.
- Negotiate the terms and conditions of the conservation covenant/ easement. Examples of Green Shores-based provisions might include:
 - Permanently maintain a shoreline riparian buffer as well as acceptable and unacceptable activities in the buffer.

Credit 4.3: Conservation Easement or Covenant

- No shoreline structures (for example, bulkheads, seawalls, piers, docks, etc.) to be constructed except in accordance with the covenant.
- No subdivision of the property except in accordance with the covenant.
- Preserve specific shoreline features present on the property; for example, a bluff ecosystem, trees, etc.
- Preserve rain gardens on the property that manage site drainage so as to minimize impacts on the shore.
- No impervious surfaces to be constructed.
- Have a survey and/or appraisal completed, if necessary.
- Prepare a management plan and management agreement, where necessary.
- Prepare the conservation covenant document.
- Execute the covenant and register it on title.
- Over the long term, monitor the land as agreed in the conservation covenant.

For more information

Check with the local conservancy or land trust in your area - many have developed their own guides to conservation covenants and easements.

Canada/B.C.

Hillyer, Ann, Judy Atkins and Ben van Drimmelen. 2013. *Greening Your Title: a Guide to Best Practices for Conservation Covenants – 3rd edition*. West Coast Environmental Law. 209 p. <http://wcel.org/resources/publication/greening-your-title-guide-best-practices-conservation-covenant-3rd-edition>

Land Trust Alliance of BC. *Conservation Options: How you can leave a legacy for the future*. <http://ltabc.ca/resources/ltabc-publications>

Islands Trust Fund. Natural Area Protection Tax Exemption Program: www.islandstrustfund.bc.ca/initiatives/privateconservation/naptep.aspx

Federal Ecological Gifts Program: www.ec.gc.ca/pde-egp/default.asp?lang=En&n=FCD2A728-1

United States

King County Public Benefit Rating System and Timber Land Programs - www.kingcounty.gov/environment/stewardship/sustainable-structure/resource-protection-incentives.aspx

Byers, E. and K.M. Ponte. 2005. *The Conservation Easement Handbook 2nd Edition*. Land Trust Alliance, Washington DC. 555 p. Go to www.landtrustalliance.org and enter “easement handbook” in the search box.

Credit 4.4: Shoreline Stewardship Participation

Credit 4.4: Shoreline Stewardship Participation

To qualify for this credit, involve your project in an environmental program that benefits shoreline areas.

A variety of environmental stewardship programs that assist waterfront homeowners are run by local, provincial/state and national organizations, both government and non-government based. Some local governments and non-government group run “re-tree” programs to help plant areas lacking in tree cover. “Naturescape” programs assist landowners in adding habitat features in their yards and gardens. There may also be shoreline preservation and restoration programs that offer advice, materials and incentives for environmentally friendly shore landscaping.

Where this credit applies

This credit applies to any project on waterfront properties in marine and lake environments.

Benefits

To the homeowner

You can benefit from the advice and assistance (physical or financial) that sponsored programs offer, as well as increase the effectiveness of your actions by participating in concert with others.

To the environment

Participation in a shoreline program supports actions that take broader shoreline functions into consideration, and puts the activities in a single property into the appropriate ecological and biophysical context.

Points available

This credit offers 2 base points.

Shoreline Stewardship Participation	Base points
Integrate the project with an environmental program aimed at shoreline protection, restoration, or enhancement.	2

How to proceed

You can find out about applicable programs in your area by contacting your local government, who may offer such programs or suggest non-government organizations that can be of assistance. Some provincial, state or national organizations conduct programs on a local scale; visit the website of such

Credit 4.4: Shoreline Stewardship Participation

organizations to see if they have a program in the local area. Some examples are provided under “For more information” below.

Participation in shore stewardship programs will help keep your information current and provide you with “live links” to events, presentations and people who know and care about the shore.

For more information

Examples of government and non-government stewardship programs with a shoreline focus:

Washington State Dept. of Ecology - Citizen Guide: Shoreline Master Program (includes help to “find my local program”) www.ecy.wa.gov/programs/sea/shorelines/smp/citizen.html

Friends of the San Juans - Shoreline Stewardship Program
www.sanjuans.org/ShorelineStewardship.htm

Mayne Island (BC) Conservancy Society - Shoreline Care Program
<http://conservancyonmayne.com/shoreline.php>

Puget Sound Partnership www.psp.wa.gov/

Glossary

The following definitions are solely for the purpose of the *Green Shores for Homes Credits and Ratings Guide* and submittals. Note that many are adapted from the *Marine Shoreline Design Guidelines* (Johannessen et al., 2014).

Absorbent landscaping: Landscaping characterized by deeper, organic soils or in the case of forests, a thick duff cover. Soils in absorbent landscaping should have 10-25% organic content and minimum 300 mm (12 inches) depth. Absorbent landscapes incorporate herbaceous vegetation (shrubs, grasses with thick root mats) and trees.

Accretion: The gradual addition of sediment to a beach or to marsh surface as a result of deposition by flowing water or air. Accretion leads to the seaward building of the coastline or an increase in the elevation of a beach profile (the opposite of erosion) (Shipman 2008).

Armor/Armoring: Rigid, permanent design techniques used to stabilize shorelines and prevent erosion.

Backshore: The upper zone of a beach (or land above the Ordinary High Water Mark (OHWM) beyond the reach of normal waves and tides, landward of the beach face. The backshore is subject to periodic flooding by storms and extreme tides, and is often the site of dunes and back-barrier wetlands (Figure 1).

Bank or Bluff: A steep slope rising from the shore, generally formed by erosion and mass wasting of poorly consolidated material such as glacial or fluvial sediments. In marine systems, the term bluff is typically used in the Pacific Northwest for a steep sea cliff composed of unconsolidated sediment that has no to moderate amounts of vegetation. The term bank is typically used in the Northwest for lower elevation sea cliff with a well vegetated bank face.

Beach: The gently-sloping zone of unconsolidated sediment along the shore that is moved by waves, wind, and tidal currents. Width is measured cross-shore from the break in slope between the upper beach and the low-tide terrace and the waterward extent of the backshore.

Berm: A low shelf or narrow terrace on the backshore of a beach formed of material thrown up and deposited by storm waves.

Boulder-cobble beach: A beach made up of a mixture of boulder and cobble gravel sediment. Boulder: a specific size class of gravel sediment greater than 256 mm (10.1 in) in median diameter. Cobble: a specific size class of gravel sediment 64-256 mm (2.5-10.1 in) in median diameter.

Building - major: Refers primarily to a house or primary residential building on a property.

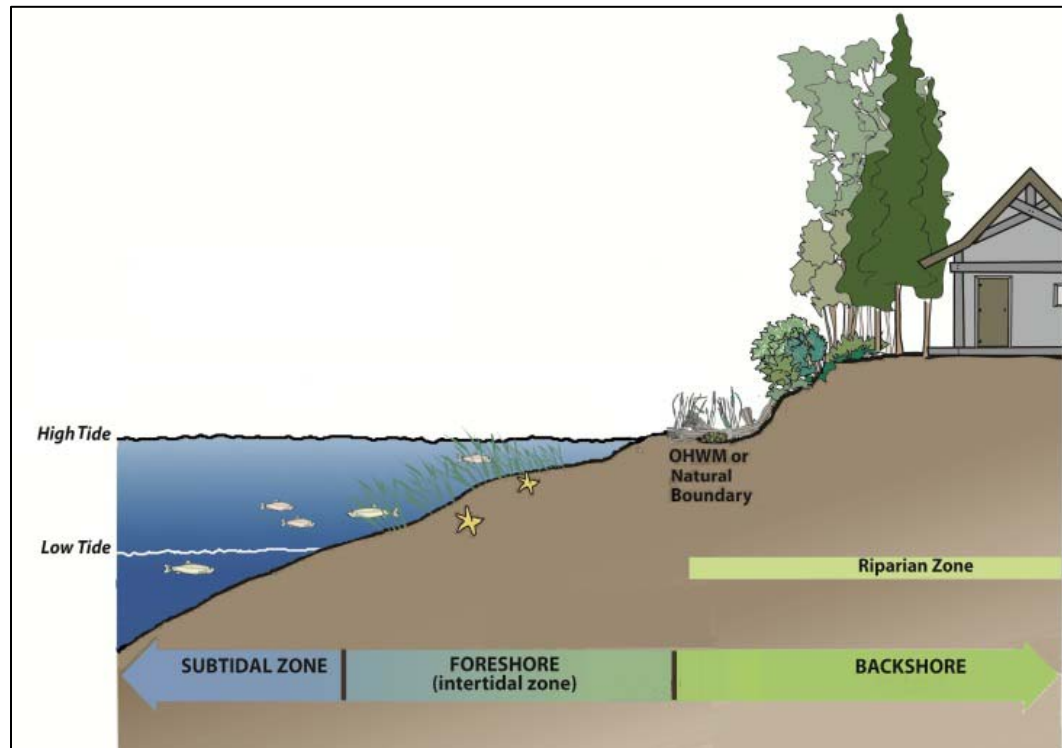


Figure 1: Parts of the shore—marine example Credit: Green Shores BC

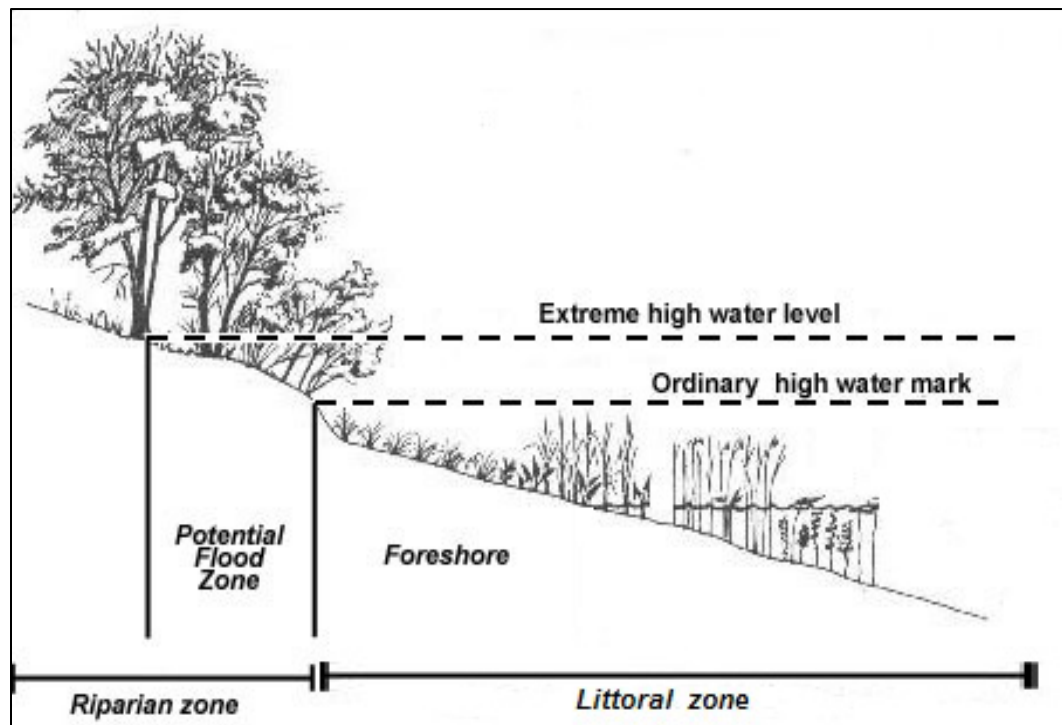


Figure2: Parts of the shore—lake example Credit: Fisheries and Oceans Canada

Glossary

Building - minor: Refers to secondary buildings on a property such as a garage, shed, gazebo, patio, deck, etc.

Bulkhead: A general term for shore armor structures that run parallel to the shore and designed to protect against wave attack or serve as a retaining wall. It includes seawalls, revetments, riprap, and gabions.

Climate change: Long-term changes in average temperature, precipitation and weather events such as storm frequency and intensity.

Diameter at breast height (DBH): A standard method of expressing the diameter of the trunk of a tree; commonly measured at 4.5 ft or 1.3 m from the ground.

Drift cell: The nearshore area that includes a sediment source, a transport zone and a deposition zone (Figures 3 and 4). The cell boundaries delineate the geographical area within which the budget of sediment is balanced, providing the framework for the quantitative analysis of coastal erosion and accretion. Drift cells repeat along the shore, sometimes with smaller cells nesting in larger cells.

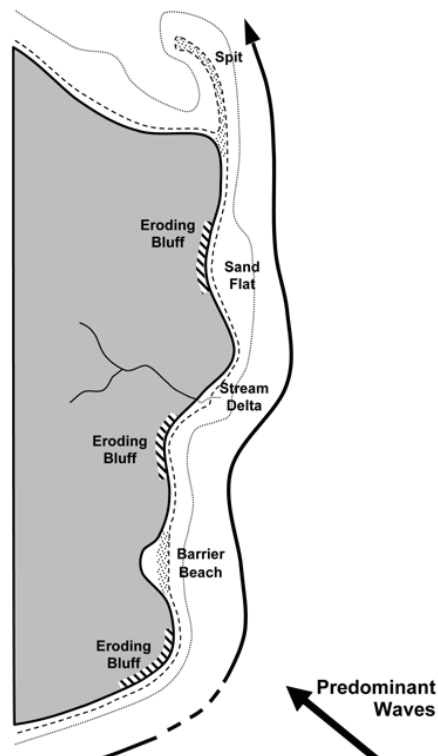


Figure 3: A typical drift cell extending from the eroding bluff at the bottom to the spit at the top. Credit: Shipman, 2008; p.11



Figure4: Example of a drift cell—Goose Spit near Comox B.C.

Ecosystem function: The natural processes and structures through which we benefit from shore environments such as production of forage fish or wave attenuation. Functions are roughly synonymous with goods and services.

Emergent vegetation: Plants that thrive in partially submerged conditions in freshwater environments. Examples of emergent plants are cattails, bulrushes and sedges.

Erosion: The wearing away of land by natural forces; pertaining to a beach, the carrying away of beach material by wave action, tidal currents, littoral currents, or wind action (opposite of accretion). Erosion may be long-term (occurs over decadal or greater scales) and short-term (occurs at less than decadal scale due to individual storm events or seasonal variability).

Feeder (or eroding) bluff: A bluff usually composed of glacial sediment that serves as sediment source for beaches in a drift cell. In the marine environment, it is a coastal bluff with active erosion and/or mass wasting that supplies moderate volumes of sediment to the nearshore. The bluff face typically has vegetation indicative of disturbance with evidence of landslides and toe erosion.

Fetch: Open water distance over which a wind can blow unimpeded and form waves.

Foreshore: The area between high tide or Ordinary High Water Mark and low tide water levels in marine systems (Figure 1), or between seasonal high water and low water levels on lakes (Figure 2).

Greenfield: A site or property that has never been developed; i.e., no buildings or infrastructure.

Gravel-sand beach: A beach made up of a mixture of gravel (rock fragments of 2-64 mm (0.08 - 10 in) median diameter) and sand (loose grains of 0.0625-2mm (0.0025-0.08 in) median diameter).

Groin: Shore structures that extend across the shore perpendicular to the shoreline with the intent of retarding erosion of a beach by trapping and retaining littoral sediment. Groins tend to trap sediment on the updrift side while “starving” sediment from the downdrift side of the groin.

Impervious: Not capable of transmitting or filtering water; instead, water runs off the surface.

Impervious surface area (ISA): The area of a given lot or property that is covered by man-made structures such as rooftops, roads, sidewalks, driveways and parking lots that are covered by impenetrable materials such as shingles, asphalt, concrete, plastic, brick and stone. The ISA is often referred to as the built footprint.

Infrastructure: Structures that provide services for buildings or human activities. Major infrastructure refers to structures that provide essential services such as sewer, water lines, electrical, and cable services and roads. Minor infrastructure includes things such as driveways and walkways

Intertidal zone: In marine systems, the area between high tide and low tide levels (Figure 1).

Large woody debris (LWD): Large logs with or without root masses attached, and can also include separate root masses.

Littoral zone: A general term referring to the part of the sea or lake that is close to the shore (Figure 2).

Littoral, longshore or net shore drift: Interchangeable terms that refer to the forces of erosion, transport, and deposition that combine to create movement of sediment parallel to the shore. These forces include waves that approach the shore at an angle, and a longshore current of water moving along the shoreline in the direction of wave movement. In marine systems, tidal currents are also involved. Sediment moves in a series of angled “in and out” directions that, overall, moves in a “net” direction along the shore.

Low impact development (LID): Techniques and measures to reduce rainwater runoff, encourage rainwater infiltration into the ground, and remove any contaminants from runoff prior to flowing into receiving water bodies.

Monitoring: Observing the effect and/or effectiveness of an action to determine whether that action has a positive, negative or neutral effect on ecological or physical processes on the site. Monitoring can also indicate whether an action is having the desired effect, and whether any changes are required. Monitoring typically requires a record of “before” and “after” an activity is completed; it can also include project features or indicators that can be measured before and after construction.

Natural boundary: “The visible high water mark of any lake, stream, or other body of water where the presence and action of the water are so common and usual and so long continued in all ordinary years as to mark upon the soil of the bed of the lake, river stream, or other body of water a character distinct from that of the banks, both in vegetation and in the nature of the soil itself” (BC Land Act) (Figures 1 and 2).

Nearshore: A general term that encompasses the foreshore (intertidal) and shallow depth (subtidal) zones.

Ordinary high water mark (OHWM): The highest level reached by a body of water that has been maintained for a sufficient period of time to leave evidence on the landscape (Figures 1 and 2). That evidence is “indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving,

changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.” (Federal Regulations 33 CFR 328.3(e)), Figure 2. In both marine and freshwater systems, the natural boundary or OHWM is usually the point at which natural vegetation shifts from hydrophytic (water-dependent) species to terrestrial species. This document uses OHWM most of the time, but this term is interchangeable with the term Natural Boundary.

Overhanging vegetation: Vegetation that extends at least a foot out over the water and provides shade for most of the day (unlike upright riparian vegetation that may throw a shadow only at certain times of day). Trees such as alder, native maples and willows and tall shrubs such as oceanspray and red-osier dogwood can become excellent overhanging species.

Overwater structure: Any built structure that extends over water such as a dock, pier or deck; can be on pilings or floating.

Permeable or pervious: Able to transmit or filter water.

Return wall: A section of bulkhead that extends towards land, typically from the end of a bulkhead, and ties into the bank or backshore.

Revetment: A hard armor technique using stone placed on a sloping bank to protect against waves or currents.

Riparian: Reference to the area immediately next to water that acts as an interface between water and land. The riparian area/zone is the transitional zone between the upland and aquatic environment where riparian vegetation is located (Figures 1 and 2).

Riparian buffer (RB): The shoreline area that lies within the minimum riparian buffer OR setback required by the local jurisdiction OR within 35 ft/10 m of the OHWM (measured as the horizontal distance landward of the OHWM), whichever is greater.

Runup: The rush of waves up the face of a beach or structure produced by breaking waves. The maximum vertical height of water above still water level is the measure of runup.

Sea level rise (SLR): The increase in sea level attributed to the effects of climate change.

Seawall: A shoreline armoring technique utilizing vertical or near vertical reinforced concrete or rock wall. Also referred to as a vertical bulkhead.

Setback: Distance of the nearest major building or infrastructure from the OHWM, or on bluff sites, measured from the bluff crest or break in slope landward.

Glossary

Soft shore protection: Shore protection design which entails the use of indigenous materials such as gravel, sand, logs, and root masses in designs that have some degree of flexibility, mimicking natural processes.

Shore or shoreline protection structure: Any bulkhead, groin or other built structure used to protect a shoreline from erosions.

Storm surge: A rise of water associated with the influence of low pressure weather systems, wind setup, and wave setup.

Subtidal zone In marine systems, the area below low tide level but still relatively shallow and close to shore, typically to a depth of about 35 feet/10 m (Figure 1).

Wrack or beach wrack: Organic material such as kelp and sea grass and other flotsam (plastic, glass, metal debris) that are cast up onto the beach by surf, tides, and wind. The “wrack line” usually marks the high tide line for that day. The organic portions of wrack provide food and habitat to many species that inhabit the shoreline, including insects and birds. Wrack also provides an incubator to grasses and other plants which grow along the shoreline and help to anchor dunes.

Appendices

In this section:

Appendix A: Landscape Maintenance Checklist

Appendix B: Decision Tree, Marine Shoreline Design Guidelines

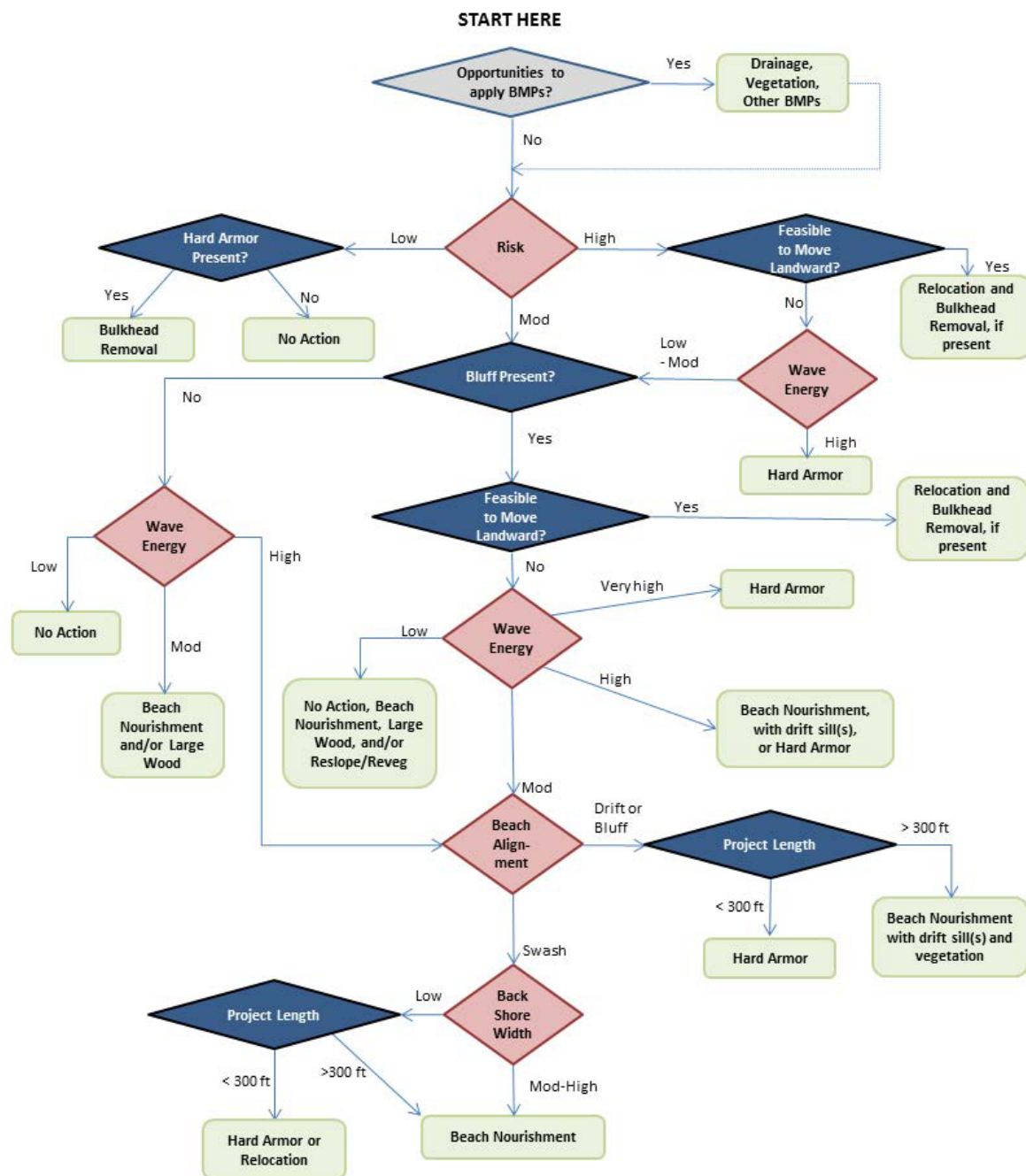
Appendix C-1: Plants for Lake Shorelines

Appendix C-2: Plants for Marine Shorelines

Appendix A: Landscape Maintenance Checklist

	Maintaining Trees, Shrubs & Lawns	Additional Information
Gardening Best Practices	<p>Indicate which of the following Maintenance Best Practices you use:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Aerate (core) lawn areas annually. <input type="checkbox"/> Let grass clippings fall in place. <input type="checkbox"/> Dry out plants between watering. <input type="checkbox"/> Apply 1-2 inches of composted mulch to planted areas annually. <input type="checkbox"/> Hand weed planter beds/pots. <input type="checkbox"/> Relocate or replace plants requiring high maintenance/water inputs (i.e.: use plants adapted to your garden's climate and soils) <input type="checkbox"/> Fertilize only when required. 	<p>Aeration of turf reduces compaction and increases air, nutrient and water movement into the soil. By increasing water infiltration, runoff and erosion can be reduced. Letting grass clippings fall in place cycles nutrients. Drying out plants between watering promotes healthy rooting. Relocating plants to sites with optimal conditions for that species can help reduce maintenance inputs (right plant - right place). Also, plants that are adapted to your garden's conditions (i.e.: native plants) reduce watering and general maintenance needs.</p>
Product Selection	<p>Indicate which of the following Maintenance Products you use (or plan to use):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Local organic fertilizers (compost, composted manure, etc.) <input type="checkbox"/> Organic 'processed' fertilizers (bone meal, fish compost, blood meal, etc.) <input type="checkbox"/> Slow Release Nitrogen fertilizers. <input type="checkbox"/> Electric, cordless electric or push-reel (non-gas powered) mower. 	<p>Avoiding the use of chemical or synthetic fertilizers can dramatically reduce the amount of nutrients delivered to shorelines and receiving water bodies. It also reduces demand for non-renewable resources that are used to manufacture synthetic fertilizers. Using human-powered tool helps improve urban air quality and reduces noise pollution.</p>
	Pest Management	Additional Information
Gardening Best Practices	<p>Indicate which of the following Pest Management Best Practices you use (or plan to use):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Hand removal or pruning out of pests and disease. <input type="checkbox"/> Pest traps (slug traps, or tanglefoot on tree trunks, etc.). <input type="checkbox"/> Barriers to pest movement (copper strips to stop slugs; mesh netting for birds, etc.). 	<p>Simple gardening techniques can go a long way to reducing pest problems in the average garden. Spending time in your yard to identify pests or disease occurrences early, and then remove them manually before they become an infestation is often the least expensive and most effective strategy for pest management.</p>
Product Selection	<p>Indicate which of the following Pest Control Products you use (or plan to use):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Horticultural oils, soaps or minerals (e.g., sulphur, baking soda, iron phosphate, horticultural oil, etc) <input type="checkbox"/> Bio-controls (i.e.: Bt, predatory nematodes, or beneficial insects, etc). <input type="checkbox"/> Botanicals (e.g., neem oil, pyrethrum, etc.) <i>NOTE: Use these pesticides only as a last resort!</i> 	<p>Avoiding the use of synthetic and poisonous substances in your garden reduces health risks to humans, and it also prevents the removal of beneficial insects. Typically, poisons and chemical sprays will kill not only the pest, but also insects that feed on the pests or insects that provide other 'services' to your garden (pollinators, spiders, ladybugs, etc).</p>

Appendix B: Decision Tree from Marine Shoreline Design Guidelines



Decision tree for identifying appropriate design techniques for a given site. Read top to bottom. (Johannessen, J., A. MacLennan, A. Blue, J. Waggoner, S. Williams, W. Gerstel, R. Barnard, R. Carman, and H. Shipman, 2014. *Marine Shoreline Design Guidelines*. Washington Department of Fish and Wildlife, Olympia, Washington. 419 p.
<http://wdfw.wa.gov/publications/01583/>

Appendix C-1: Plants for Lake Shorelines

The following is taken from *Green Shorelines: Bulkhead alternatives for a healthier Lake Washington (pg.18-19)*, published by the City of Seattle and available at www.seattle.gov/dpd/. For more information about appropriate shoreline plants, see the list of resources at the end of Appendix C-2.

Latin name	common name	exposure	moisture	height (ft.)
TREES				
<i>Abies procera</i>	noble fir	sun/part shade	dry/moist	200
<i>Acer circinatum</i>	vine maple	part shade/shade	dry/moist	25
<i>Acer macrophyllum</i>	bigleaf maple	sun/part shade	dry/moist	105
<i>Alnus rubra</i>	red alder	sun/part shade	moist/wet	70
<i>Betula papyrifera</i>	paper birch	sun	moist	80
<i>Crataegus douglasii</i>	black hawthorn	sun/part shade	dry/moist	25
<i>Crataegus suksdorfii</i>	Suksdorf's hawthorn	sun/part shade	dry/moist	20
<i>Fraxinus latifolia</i>	Oregon ash	sun/part shade	moist/wet	70
<i>Malus fusca</i>	Pacific crabapple	sun/part shade	dry/moist	40
<i>Picea sitchensis</i>	Sitka spruce	sun/part shade	dry/moist	200
<i>Populus balsamifera</i>	black cottonwood	sun	moist	100
<i>Populus tremuloides</i>	trembling aspen	sun	dry/moist	75
<i>Pseudotsuga menziesii</i>	Douglas fir	sun/part shade	dry/moist	200
<i>Rhamnus purshiana</i>	cascara	sun/part shade	dry/moist	30
<i>Salix</i> spp.	willow	sun/part shade	moist/wet	6-40
<i>Thuja plicata</i>	Western redcedar	part shade/shade	moist/wet	200
<i>Tsuga heterophylla</i>	Western hemlock	sun/part shade	dry/moist	180
GROUND COVER				
<i>Achlys triphylla</i>	vanilla leaf	part shade/shade	moist	1
<i>Allium cernuum</i>	nodding onion	sun	dry/moist	1
<i>Asarum caudatum</i>	wild ginger	part shade/shade	moist	0.5
<i>Camassia quamash</i>	common camas	sun/part shade	dry/moist	1
<i>Cornus canadensis</i>	bunchberry	part shade/shade	moist	0.5
<i>Fragaria chiloensis</i>	beach strawberry	sun/part shade	dry	1
<i>Mahonia nervosa</i>	low Oregon grape	sun/shade	dry/moist	2
<i>Maianthemum dilatatum</i>	false lily-of-the-valley	part shade/shade	dry/moist	1
<i>Vancouveria hexandra</i>	inside-out flower	part shade/shade	moist	1

Latin name	common name	exposure	moisture	height (ft.)
SHRUBS				
Amelanchier alnifolia	Saskatoon serviceberry	sun/shade	dry/moist	20
Andromeda polifolia	bog rosemary	sun/part shade	wet	1.5
Cornus stolonifera	red-osier dogwood	sun/shade	moist/wet	15
Corylus californica	beaked hazelnut	sun/shade	dry/moist	20
Gaultheria shallon	salal	part shade/shade	dry/moist	5
Holodiscus discolor	oceanspray	sun/shade	dry	15
Lonicera involucrata	black twinberry	sun/part shade	dry/wet	8
Mahonia aquifolium	tall Oregon grape	sun/shade	dry/moist	8
Philadelphus lewisii	mock-orange	sun/part shade	dry/moist	9
Physocarpus capitatus	Pacific ninebark	sun/shade	moist/wet	13
Rhododendron macrophyllum	Pacific rhododendron	part shade/shade	dry/moist	20
Ribes sanguineum	red-flowering currant	sun/part shade	dry/moist	6
Rosa gymnocarpa	bald-hip rose	sun/part shade	dry/moist	5
Rosa pisocarpa	cluster rose	sun/part shade	moist/wet	6
Rosa nutkana	nootka rose	sun/part shade	moist/wet	10
Rubus spectabilis	salmonberry	sun/shade	moist/wet	10
Salix scouleriana	Scouler willow	sun/part shade	moist/wet	25
Sambucus racemosa	red elderberry	sun/part shade	moist/wet	20
Sorbus sitchensis	Sitka mountain-ash	sun/part shade	moist	10
Spiraea douglasii*	spirea	sun/part shade	moist/wet	12
Symphoricarpos albus	snowberry	sun/shade	dry/moist	5
Vaccinium ovatum	evergreen huckleberry	part shade	dry	12
Viburnum edule	highbush cranberry	sun/part shade	moist/wet	12
PERENNIALS				
Aruncus sylvestris	goat's beard	sun/part shade	moist/wet	5
Aster subspicatus	Douglas' aster	sun/part shade	moist	2
Athyrium filix-femina	lady fern	sun/shade	moist/wet	4
Aquilegia formosa	Western columbine	sun/part shade	moist	2
Blechnum spicant	deer fern	part shade/shade	moist/wet	3
Carex canescens	grey sedge	sun/part shade	moist/wet	2
Dicentra formosa	Pacific bleeding heart	sun/part shade	moist/wet	1
Iris tenax	Oregon iris	sun/part shade	moist/wet	1
Lupinus polyphyllus	large-leaved lupine	sun	moist/wet	4
Mimulus guttatus	yellow monkey-flower	sun/shade	moist/wet	2
Polystichum munitum	sword fern	part shade/shade	moist	4
Sisyrinchium californicum	golden-eyed-grass	sun/part shade	moist/wet	1
Sisyrinchium idahoense	Idaho blue-eyed-grass	sun/part shade	moist/wet	2
Solidago canadensis	goldenrod	sun/part shade	dry/moist	4
Trillium ovatum	Western trillium	part shade/shade	moist/wet	1.5
EMERGENT AQUATIC PLANTS**				
Alisma plantago-aquatica	water-plantain	sun-part shade	wet	3
Carex kelloggii	Kellogg's sedge	sun/part shade	moist/wet	2
Carex obnupta	slough sedge	sun/part shade	moist/wet	3
Carex stipata	sawbeak sedge	sun/part shade	moist/wet	2
Sagittaria latifolia	arrowhead	sun/part shade	wet	3
Scirpus microcarpus	small-fruited bulrush	sun/part shade	wet	3
Scirpus acutus	hardstem bulrush	sun	wet	9
Typha latifolia*	cattail	sun/part shade	wet	8

Appendix C-2: Plants for Marine Shorelines

The following list is provided by Raincoast Applied Ecology, Vancouver, B.C. For more information about appropriate shoreline plants, see the list at the end of this section.



Recommended Native Trees, Shrubs, Grasses, and Forbs for Shoreline Sites in the Georgia Basin

Nick Page, Raincoast Applied Ecology (updated 2013)

Common Name	Scientific Name	Comments	Habitat ¹
Trees			
Douglas-fir	<i>Pseudotsuga menziesii</i>	Large tree for large sites only; prefers dry soils; fast growing once established	Marine riparian zone
Sitka spruce	<i>Picea sitchensis</i>	Large tree for large sites only; fast growing once established; some disease problems	Marine riparian zone
shore pine	<i>Pinus contorta</i>	Medium tree (<20 m); slow growing; dry sites with sandy soil	Marine riparian zone
red alder	<i>Alnus rubra</i>	Medium tree (<25 m); fast growing; not long lived.	Marine riparian zone
big-leaf maple	<i>Acer macrophyllum</i>	Large tree; fast growing once established; not long lived.	Marine riparian zone
Pacific willow	<i>Salix lucida</i>	Largest of the native willows (<25 m); too large for most bioengineering projects	Marine riparian zone
cascara	<i>Rhamnus purshiana</i>	Small tree with nice growth form and smooth, grey bark	Marine riparian zone
Hooker's willow	<i>Salix hookeriana</i>	Small tree willow with interesting leaves and catkins; relatively rare; good for bioengineering	Marine riparian zone
Douglas maple	<i>Acer douglasii</i>	Small tree; multiple stems; fast growing	Marine riparian zone
Scouler's willow	<i>Salix scouleriana</i>	Small tree willow (to 7 m); good for bioengineering	Marine riparian zone
Pacific crab apple	<i>Malus fusca</i>	Small tree (<10 m) or large shrub; thick-leaved; white spring flowers; small apple-like fruits	Marine riparian zone
Shrubs			
Nootka rose	<i>Rosa nutkana</i>	Good for shrub thickets; pink summer flowers and winter colour (hips); some wildlife value	Marine riparian zone
oceanspray	<i>Holodiscus discolor</i>	Tall shrub; tolerant of dry, coastal sites; relatively drab colour with subtle flowers	Marine riparian zone
red flowering currant	<i>Ribes sanguineum</i>	Medium shrub; excellent spring flower colour; some problems with disease; good for hummingbirds	Marine riparian zone
snowberry	<i>Symphoricarpos albus</i>	Medium shrub; good tolerance of dry sites; well developed roots; winter colour	Marine riparian zone
mock-orange	<i>Philadelphus lewisii</i>	Tall shrub; native to coastal sites in BC; good flower colour but otherwise subtle	Marine riparian zone
sweet gale	<i>Myrica californica</i>	Not native to Georgia Basin; evergreen shrub (to 7 m); slow growth; dense branches and leaves	Marine riparian zone
salal	<i>Gaultheria shallon</i>	Slow growing low shrub; difficult to establish; not recommended for active use areas	Marine riparian zone
Oregon-grape	<i>Mahonia nervosa</i>	Slow growing low shrub; difficult to establish; not recommended for most sites	Marine riparian zone
thimbleberry	<i>Rubus parviflorus</i>	Medium shrub; fast growth; white summer flowers; red thimble-like berries; better than salmonberry	Marine riparian zone
salmonberry	<i>Rubus spectabilis</i>	Medium shrub; fast growth; white summer flowers; no winter colour; berry producer	Marine riparian zone
Indian-plum	<i>Oemleria cerasiformis</i>	Medium shrub; early spring leaves and flowers; prefers moist sites	Marine riparian zone
black twinberry	<i>Lonicera involucrata</i>	Medium shrub; subtle yellow flowers; red-black berries; will grow from cuttings; straggly when older	Marine riparian zone
kinnikinnick	<i>Arctostaphylos uva-ursi</i>	Low shrub/groundcover; slow growing; evergreen with red berries; tolerant of dry sites	Marine riparian zone
Pacific ninebark	<i>Physocarpus capitatus</i>	Tall shrub (<4 m) with dense branches; white rounded flower clusters; open, moist beaches	Marine riparian zone
Grasses			
beach wild-rye grass	<i>Leymus mollis</i> ssp. <i>mollis</i>	Dominant native beach grass in BC; blue-green leaves; establishes from sprigs/rhizomes	upper beach
red fescue	<i>Festuca rubra</i>	Common native grass in upper beach meadows; clumping with taller flowers	Marine riparian zone
Forbs / Wildflowers			
entire-leaved gumweed	<i>Grindelia integrifolia</i>	Yellow, daisy-like flower with resinous heads; rubbery leaves; deep tap root; establishes from seeds	upper beach
large-leaved lupine	<i>Lupinus polyphyllus</i>	Large native lupine; purple flowers; tolerant of poor soils; to 1 m tall with flowers; can be "scruffy"	Marine riparian zone
seashore lupine	<i>Lupinus littoralis</i>	Low growing native beach lupine; light purple flowers; fuzzy leaves and stems; grows in sandy soils	upper beach
beach pea	<i>Lathyrus japonicus</i>	Often occurs with beach wild-rye; purple flowers; spreads through rhizomes; sandy sites	upper beach
silvery burweed	<i>Ambrosia chamissonis</i>	Clump or mound forming perennial; low, bisected silvery leaves; subtle flowers in late summer	upper beach
beach strawberry	<i>Rubus chiloensis</i>	Native strawberry; white flowers; spreads from runners; low groundcover; tolerant of poor soils	upper beach
sea-watch	<i>Angelica lucida</i>	Tall plant in the carrot family with white umbrella flowers and large seeds; common on moist beaches	upper beach
cow-parsnip	<i>Heracleum maximum</i>	Large native forb with tall, white umbrella flowers; sap causes dermatitis	Marine riparian zone
Cooley's hedge-nettle	<i>Stachys cooleyae</i>	Perennial from rhizomes; purple-red flowers; moist upper beach; good for hummingbirds	Marine riparian zone
common yarrow	<i>Achillea millefolium</i>	White, long-lived flower; common in beach meadows and estuaries	Marine riparian zone
wooly sunflower	<i>Eriophyllum lanatum</i>	yellow, daisy-like flower with silvery foliage; drought tolerant; native to coastal bluffs and meadows	Marine riparian zone

¹The marine riparian zone supports a mix of trees, shrubs, grasses and forbs. Disturbance from shoreline processes such as wave erosion is rare. The upper beach (which is lower or seaward of the marine riparian zone) is the zone of frequent (annual) disturbance from waves, high tides, wood debris, and salt spray. It only supports plants tolerant of this kind of disturbance, with beach wild-rye grass dominant on most sites. Woody plants do not grow in the upper beach.

Other sources of information about plants for marine and freshwater shores

Adams, M.A. 2002. *Shoreline Structures Environmental Design: a Guide for Structures along estuaries and large rivers*. Stewardship Series. www.stewardshipcentrebc.ca/bc-stewardship-series/ Contains a chapter on methods for successfully establishing vegetation and an illustrated Appendix of common riparian plants (mostly freshwater).

Washington State University Beach Watchers EZ-ID Guides - Shoreline Plants www.beachwatchers.wsu.edu/ezidweb/ Extensive and easy-to-use guide to marine shoreline plants.

Washington Native Plant Society www.wnps.org Information on where to purchase native plants in Washington State, plus so much more about using native plants at home.

BC Native Plant Society www.npsbc.ca/nativegardening.html Information on where to purchase native plants in British Columbia plus so much more about using native plants at home.

Washington State Department of Ecology. Slope Stabilization and Erosion Control - role of vegetation. www.ecy.wa.gov/programs/sea/pubs/93-30/using01.html and Plant Selection Guide www.ecy.wa.gov/programs/sea/pubs/93-30/table3.html. Guidance on plants particularly well suited to stabilizing shoreline banks and bluffs.



GREEN SHORES
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