

Summary Report for Use with Clallam County's Shoreline Master Program:

A Report to Inform SMP Planning

For EPA Project PC-00J298-01

**Protecting the Strait of Juan de Fuca Nearshore through Improved Understanding of Shoreline
Erosion and Deposition Processes, Ecosystem Services Valuation, and Community
Stewardship**



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Summary

This summary report is intended to be used along with the project study results to inform a more complete and effective implementation of the Shoreline Master Program (SMP). Full project reports may be found as appendices to this document.

Funded by the EPA through Washington Department of Fish & Wildlife, and coordinated by the Coastal Watershed Institute, the project studied beach and bluff sediment processes, forage and juvenile fish use, and ecosystem services values in the nearshore of the central Strait of Juan de Fuca. The study compared two drift cells, the Dungeness and the Elwha.

The Dungeness drift cell is essentially intact; the Elwha drift cell is affected by almost a century of disrupted sediment supply from two dams in the Elwha River and armoring of the feeder bluffs in the drift cell. Removal of the two dams and mobilization of 3.5 million cubic yards of sediment (about 20% of the estimated total) continues to rapidly transform the Elwha estuary and nearshore.

Shoreline Master Program-related key findings of the project results are summarized below, adapted from *Protecting the Strait of Juan de Fuca Nearshore through Shoreline Master Program Improvements, Bluff Development Buffers and Building Setbacks, Ecosystem Services Valuation, and Community Stewardship: Field Metrics Final Report*.

Forage fish and juvenile fish use:

- Surf smelt continue to spawn along the Freshwater Bay portion of the Elwha drift cell, and Dungeness Bluffs section of the Dungeness drift cell.
- Habitat for sand lance spawning has improved dramatically along the Freshwater Bay shoreline, and is beginning to appear along the Elwha bluffs shoreline.
- Additional long term monitoring is recommended to document future changes in beach substrate over time, and future forage fish spawning habitat function.
- The lower Elwha River is transitioning-the freshwater sections of the river are extending north and the habitat is becoming more complex.
- New estuarine areas of the Elwha River are growing to the north, and fish begin using these areas immediately after formation.

Bluff and beach sediment process characterization:

- Feeder bluffs erode variably, and erosion occurs in feet per year.
- Armoring feeder bluffs at best slows erosion by approximately half, but in many instances (ie, Port Angeles landfill) increases erosion along adjacent unarmored sections.
- Bluffs fronted with higher and wider beaches experience lower rates of erosion.
- In the Elwha drift cell, sediment delivery from dam removal should be optimized to nourish nearshore features that were formed/maintained by riverine sediment supply. Additional detailed analysis to define appropriate actions is a top priority.

Workshops:

- 16+ workshops and engaged over 600 community members, elected officials, and technical staff. Workshop locations ranged from Freshwater Bay to Dungeness, and focused on drift cell scale nearshore processes.

- Workshops are the best way to engage with and share substantive information to the community-but they must be on an ongoing basis. If the dialog stops, the benefit is lost.
- Landowner-related workshop recommendations included:
 - Protect the existing highly functioning shoreline of Freshwater Bay.
 - For Dungeness bluffs, focus resources on technical assistance for bluff landowners on proper bluff property management.
 - Provide assistance to landowners who face significant challenges of bluff recession of a feeder bluff. Financial assistance in the form of bluff front property acquisition, funding for house relocation, and technical assistance is a repeated strong request from landowners and local realtors.

Ecosystem Services Valuation (ESV):

- Clallam county ecosystem services annual value ranges from \$18 billion to \$52 billion a year.
- Nearshore values are \$103 million per year, and overall feeder bluffs provide ecosystem services ranging from \$99,369 to \$506,898 a year.
- Unarmored bluffs provide \$253,449-\$506,898 in ecosystem services annually.
- Elwha armored bluffs provide much lower ecosystem value for the nearshore, at a rate of \$28,215 to \$56,430.1

A bluff regression model will be available at a later date and will be appended to this summary report.

The information developed through this project supports the Shoreline Master Program update in its acknowledgement of the dynamic forces along the marine shoreline and its emphasis on the value of retaining feeder bluffs in an unarmored, minimally developed, naturally vegetated condition. Project results indicate that erosion rates are high enough to warrant a close examination of shoreline parcels located in the study area that may be developed.²

Project results also indicate that unarmored drift cells provide more ecosystem service value and more spawning substrate for sand lance and surf smelt, two fish important for the marine food web, specifically for Pacific salmon.³

Project Results as Tools for the Shoreline Master Program Update:

1. Sediment budget analysis provides more site-specific data at the reach scale and supports the SMP’s increase in buffer distance from the current (1976) SMP.
2. The erosion rates may be used to determine areas of particularly active feeder bluffs and to develop an appropriate management system.

¹ *Adapted from* Protecting the Strait of Juan de Fuca Nearshore through Shoreline Master Program Improvements, Bluff Development Buffers and Building Setbacks, Ecosystem Services Valuation, and Community Stewardship: Field Metric Final Report. Shaffer, A., Nicole Harris, and Dave Parks. 2013.

² Protecting the Strait of Juan de Fuca Nearshore through Shoreline Master Program Improvements, Bluff Development Buffers and Building Setbacks, Ecosystem Services Valuation, and Community Stewardship: Field Metric Final Report. Shaffer, A., Nicole Harris, and Dave Parks. 2013.

³ Nature’s Value in Clallam County: Policy Implications of the Economic Value of Feeder Bluffs and 12 Other Ecosystems. Flores, L., Jen Harrison-Cox, David Batker. 2013.

3. Erosion rates calculated for the study emphasize the need for appropriate setbacks and vegetation management, particularly in the Green Point reach (Reach 6) and Angeles Point reach (Reach 7), where, respectively, approximately 40% and 66% of the shoreline may be developed⁴.
4. Forage fish habitat and spawning locations provide more specific data at the reach scale. Areas where sediment size, the presence of spawning forage fish, or the presence of eggs indicate a forage fish spawning area, should be protected from armoring, riparian vegetation removal, or other actions that affect sediment size and shading.
5. Regular, continual outreach and education focused on physical processes and reach/site-specific data offer landowners and the broader community an opportunity to understand the characteristics of the marine shoreline and best practices for safe, enjoyable uses of the shoreline. This effort must be ongoing; new owners often do not have the background needed to effectively manage their shoreline.
6. Ecosystem services valuation analysis may be used to track no net loss indicators of shoreline ecological functions at the reach scale.

Recommendations:

1. Use the project results as a reference when completing a project-level Shoreline Checklist and Statement of Exemption Form (Appendix 1).
2. Use the sediment budget analysis and erosion rate data to help determine an appropriate buffer and a vegetation management system.
3. Use the bluff profiles and erosion rates to help determine areas of particularly active feeder bluffs and managed accordingly.
4. Use the map of forage fish habitat and spawning locations to help identify priority areas that should be protected from armoring or other actions that affect sediment size and transport.
5. Reach out to the community to describe the dynamic nature of the marine shoreline and best practices for safe, enjoyable uses of the shoreline.
6. Use ESV analysis to track no net loss indicators that may be analyzed by area (such as riparian vegetation or impervious surface) or condition (such as closure of a shellfish bed).

⁴ Shoreline Inventory and Characterization Report for Portions of Clallam County Draining to the Strait of Juan de Fuca. 2012.

Suggested Uses for Project Results

<u>Element</u>	<u>Relevant to SMP</u>	<u>How used</u>	<u>Supplemental</u>	<u>Helpful</u>	<u>Changes Policy</u>
Ecosystem services valuation	Yes	Track no net loss indicators of shoreline ecological functions at reach level		x	
Forage fish spawning	Yes	Supports Shoreline Inventory and Characterization (ICR) & buffers		x	
Sediment/bluff study	Yes	Supports ICR & buffers			Indicates areas of increased sensitivity
Workshops	Yes	Communicate with landowners		x	

Shoreline Master Program and the concept of No Net Loss

The Shoreline Master Program Guidelines establish the standard of “no net loss” of shoreline ecological functions as the means of implementing that framework through shoreline master programs. WAC 173-26-186(8) directs that master programs “include policies and regulations designed to achieve no net loss of those ecological functions.”⁵

No net loss means the maintenance of the aggregate total of the County shoreline ecological functions over time. The no net loss standard requires that the impacts of shoreline use and/or development, whether permitted or exempt from permit requirements, be identified and mitigated on a project-by-project basis, so that as development occurs shoreline functions stay the same. No net loss also requires that the County and other entities implement restoration projects to improve ecological functions and processes since there may be some development impacts that cannot be fully mitigated.⁶

No net loss indicators for Clallam County shorelines were chosen to align with Puget Sound Partnership Action Agenda indicators and targets, and to meet the following criteria:

- Theoretically sound;
- Directly relevant to SMP management decisions;
- Measurable across the entire County (WRIAs 17-20) using available data.⁷

Success of the SMP and its no net loss component improves as more specific and timely information becomes available to make land use and stewardship decisions. The established baseline of ecosystem function described in the Inventory and Characterization Report, and the indicators identified to

⁵ WAC 173-26-186(8)

⁶ Clallam County Shoreline Master Program, Preliminary Draft, November 2012.

⁷ Clallam County Cumulative Impacts Analysis and No Net Loss Report, Draft, February 2013.

measure that function, provide Clallam County a base from which to monitor changes in the indicators and the state of ecosystem function at a reach and watershed scale.

Along the marine and freshwater shorelines of Clallam County, elements of habitat, water quality, and hydrology were identified as no net loss indicators.

Components, Attributes, and Indicators of Shoreline Ecological Functions (shaded cells have no defined indicator)⁸

Function Category	Habitat		Water Quality		Hydrology	
Component	Marine	Freshwater	Marine	Freshwater	Marine	Freshwater
Attribute/Indicator	Extent and condition of feeder bluff	Status of salmon stocks	Status of shellfish beds (closures)	Amount of impervious surface	Number of tidal barriers	Area of undeveloped floodplain/channel migration zone
	Area of kelp/eelgrass beds	Condition of riparian vegetation				
	Condition of riparian vegetation					

Value to SMP Update: Shoreline Checklist and Statement of Exemption Form & Project Study Results

The Shoreline Checklist and Statement of Exemption Form was developed to help Clallam County demonstrate consistency with the policies and regulation of the SMP. It is to be completed in the early stages of a development project, and is designed to help identify and track the implications of a shoreline use or development on ecological functions and processes.⁹ The checklist will be more effective when used in concert with the results of this project. Project results will provide important background when analyzing information presented in the shoreline checklist, and in monitoring the indicators.

In both the ‘Rapid’ and ‘Detailed’ sections of the checklist, the erosion rates, location of active erosion areas, and forage fish spawning sites will offer extra background as a project is developed. Extra attention should be paid to areas with documented higher erosion rates.

As a reach-level monitoring tool, the information provided on the checklist may be used in concert with ESV study results to assess changes in ecosystem services values. ESV values offer a way to monitor the economic implications of changes in the indicators such as impervious surface, canopy cover and shoreline vegetation, shoreline armoring, and landslide/erosion activity.

⁸ Clallam County Cumulative Impacts Analysis and No Net Loss Report, Draft, February 2013. Table 2.1.

⁹ Shoreline Checklist & Statement of Exemption Form for Ensuring Consistency with SMP Policies and Regulations and No Net Loss Policy. 2013

Bluff Erosion Rates

Documented bluff erosion rates and the contrast between armored and unarmored sections of the erosion rates in the study area drift cells provide an opportunity to emphasize to landowners, decision makers, and planners the need to understand the specific location and to ***provide an appropriate buffer to account for bluff erosion rates.*** The erosion rate in an actively eroding section of the drift cell may indicate a setback and buffer that reflects more active bluff processes and greater sediment transport rates. Even within a functional, unarmored section of a feeder bluff, erosion rates vary, and in some locations are higher than originally estimated.¹⁰

Two reaches identified in the Clallam County Inventory and Characterization report are included in the project study area. They are the Green Point reach, extending west from the base of Dungeness Spit 11.4 miles to the Port Angeles city limits; and Angeles Point, extending west from the City of Port Angeles' western city limit, 7.3 miles to just south of Observatory Point. In these reaches, respectively, approximately 40% and 66% of the shoreline has the potential for new residential development under current zoning rules¹¹. The erosion rates identified for these reaches emphasize the need for appropriate setbacks and vegetation management. Specific information may be used to determine an appropriate buffer and a vegetation management system.

Value to SMP update

More specific bluff erosion rate information for the SMP provides key information to landowners, restoration planners, decision makers, and those who issue permits. Any project development should proceed accordingly, taking into account the dynamic processes of bluffs in the study area and the need to protect the ecosystem processes, the landowners' safety, and their investment.

Tracking the no net loss indicator 'extent and condition of feeder bluff' with specific erosion rate data will mean that no net loss indicators are more easily identified and the gain or loss of function can be more specifically quantified.

Forage fish and long-term fish use

Sand lance and surf smelt eggs were more abundant in the intact drift cells of the study area, highlighting the importance of retaining the integrity of the drift cells, and restoring drift cell function where appropriate. The relationship of the spawning areas to sediment size and location within the drift cell require an awareness of the spawning and rearing areas when making land use decisions. In response to removal of the Elwha and Glines Canyon dams in the Elwha river, its estuary and nearshore are rapidly changing.

Value to SMP update

Identifying the preferences of forage fish for specific grain sizes and locations offers landowners, restoration planners, decision makers, and those who issue permits a guide to sensitive locations and

¹⁰ Protecting the Strait of Juan de Fuca Nearshore through Shoreline Master Program Improvements, Bluff Development Buffers and Building Setbacks, Ecosystem Services Valuation, and Community Stewardship: Field Metric Final Report. Shaffer, A., Nicole Harris, and Dave Parks. 2013.

¹¹ Shoreline Inventory and Characterization Report for Portions of Clallam County Draining to the Strait of Juan de Fuca. 2012.

appropriate management actions to protect the areas. Particularly in the Elwha drift cell, where the pace of change has accelerated, conditions conducive to forage fish spawning should be considered when a development proposal is submitted. Examples of such conditions include areas where new sediment deposition may offer an opportunity for forage fish spawning.

Public Outreach Workshops

Landowner and public workshops describing forage fish study results, sediment processes, preliminary bluff regression rates, and management options were held in 2012 and 2013. Two community workshops and a presentation to the Strait Ecosystem Recovery Network summarized the ecosystem services valuation study on December 2013.

Landowners and the general public attended workshops in the Elwha and Dungeness drift cells to learn about shoreline processes and habitat and forage fish values in their neighborhoods. The outreach effort helped landowners to understand the ecosystem processes that occur on their property, and methods for protecting these processes and biological resources that currently exist within their drift cell.

The information presented was site-specific and immediately relevant, enabling landowners to glean important information about bluff erosion processes, forage fish spawning requirements, and a landowner's role in protecting these elements of the shoreline while still enjoying its amenities.

Value to SMP update

Members of the public understand nearshore processes and the need to manage upland development to protect them. Landowners attending the workshops and field trips can incorporate the specific, relevant information into their daily activities and land management decisions. For example, workshop participants learned that in some areas the bluffs are made of easily erodible materials and naturally erode. This surprised some new landowners, whose experience elsewhere in the US had led them to think that the bluffs were composed of granite. Landowners learned that their decisions about vegetation management could affect bluff processes, habitat values, and the safety of their structures.

Bluff processes, species' habitat needs, and the associated values, provided workshop participants with insights into their role as landowners and stewards in helping to foster a healthy system that provides for their enjoyment and safety. Landowners gained an enhanced understanding of the need for safe setback distances and appropriate vegetation management in order to encourage bluff/beach stability and protect their investment. They also gained a greater awareness of the requirements of the natural systems in which their property is located.

Ecosystem Services Valuation

Ecosystem services were valued for the nearshore of the study area across 12 land cover types. A primary value for the nearshore was also calculated. Two key links between the SMP update and the ecosystem services valuation are the appreciation of natural capital over time, and the understanding

that natural capital provides important services without the need for expensive built infrastructure.¹² Natural systems provide important services such as flood and erosion protection which can reduce society's reliance on expensive engineered solutions to these challenges.

Within the SMP, physical and biological processes identified along the shoreline are important for habitat, storm buffering, water filtering, and other elements of a functioning ecosystem.

The ecosystem services valuation illustrated the services and economic values provided by the nearshore ecosystem, and some of the costs incurred to the public when the system becomes compromised. Two examples of costs incurred by taxpayers for the loss of ecosystem services are located in the study area. Ediz Hook, once a sand spit protecting the deep harbor of Port Angeles, was formed and sustained by sediment from the Elwha River and bluffs to the river's east. In-river dams and bluff armoring drastically reduced the sediment supply; Ediz Hook must now be artificially nourished at substantial cost. Beach nourishment projects at Ediz Hook began in the mid-1960's; the City of Port Angeles spends up to \$1 million/year to protect Ediz Hook, and the 2011 beach nourishment project conducted by the Army Corps of Engineers cost \$636,000.¹³

Port Angeles landfill, located in the Elwha drift cell/Observatory Point reach, has also suffered due to sediment starvation. Hard armoring solutions thus far have been unsatisfactory in both protecting the landfill and erosional effects downdrift of the armoring. Costs continue to mount as stakeholders seek a solution to keep the landfill wall from collapsing and dumping its contents into the Strait. Protection of the landfill from bluff erosion is estimated to cost taxpayers \$2000/foot/year.¹⁴

Value to SMP update

In addition to underscoring the value of the ecosystem services supplied by the nearshore, ESV values may be used to track no net loss indicators. Changes in the indicators can be quantified and evaluated at the reach scale. Areal extent, land cover type, and condition of an indicator may be monitored using an ESV analysis.

¹² Nature's Value in Clallam County: Policy Implications of the Economic Value of Feeder Bluffs and 12 Other Ecosystems. Flores, L., Jen Harrison-Cox, David Batker. 2013.

¹³ 'Feeder Bluff- Structural Value' p. 52 *in* Nature's Value in Clallam County: Policy Implications of the Economic Value of Feeder Bluffs and 12 Other Ecosystems. Flores, L., Jen Harrison-Cox, David Batker. 2013.

¹⁴ 'Port Angeles Landfill: An Assessment of Ecosystem Services' p. 37 *in* Nature's Value in Clallam County: Policy Implications of the Economic Value of Feeder Bluffs and 12 Other Ecosystems. Flores, L., Jen Harrison-Cox, David Batker. 2013.

Appendices

[Appendix 1: Shoreline Checklist and Statement of Exemption Form](#)

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