

EXHIBIT C

SHORELINE RESTORATION PLAN

SAN JUAN COUNTY



Prepared for
San Juan County Community Development
and Planning Department

Prepared by
Herrera Environmental Consultants, Inc.



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CONTENTS

Executive Summary	viii
Purpose and Intent	1
Scope.....	1
Context	1
Shoreline Master Program.....	2
Best Available Science.....	2
San Juan County Marine Resources Committee.....	2
San Juan County Land Bank.....	3
San Juan Preservation Trust	3
Restoration Plan Objectives	3
Restoration Policies.....	4
Methods.....	5
Information Sources	5
Identification of Restoration Opportunities	5
Restoration Priorities	7
Restoration Projects by Management Area	8
Blakely Island Management Area.....	8
Overview	8
Restoration Opportunities	13
Habitat Benefits.....	13
Decatur Island Management Area	13
Overview	13
Restoration Opportunities	14
Habitat Benefits.....	14
Doe Bay Management Area	14
Overview	14
Restoration Opportunities	15
Habitat Benefits.....	16
East Sound Management Area	16
Overview	16
Restoration Opportunities	16
Habitat Benefits.....	17
Fisherman’s Bay Management Area.....	17
Overview	17
Restoration Opportunities	18
Habitat Benefits.....	18
Friday Harbor Management Area.....	19
Overview	19
Restoration Opportunities	19
Habitat Benefits.....	20
Mud Bay Management Area	20

Overview	20
Restoration Opportunities	20
Habitat Benefits	21
North Coast Eastsound Management Area	21
Overview	21
Restoration Opportunities	22
Habitat Benefits	22
Olga Management Area	22
Overview	22
Restoration Opportunities	23
Habitat Benefits	23
Private Lakes Management Area	24
Overview	24
Restoration Opportunities	24
Habitat Benefits	24
Public Lakes Management Area	24
Overview	24
Restoration Opportunities	25
Habitat Benefits	25
Roche Harbor Management Area	26
Overview	26
Restoration Opportunities	26
Habitat Benefits	27
San Juan Channel Management Area	27
Overview	27
Restoration Opportunities	27
Habitat Benefits	27
Shaw Island Management Area	28
Overview	28
Restoration Opportunities	28
Habitat Benefits	28
Spencer's Spit Management Area	29
Overview	29
Restoration Opportunities	30
Habitat Benefits	30
Strait of Juan de Fuca Management Area	30
Overview	30
Restoration Opportunities	31
Habitat Benefits	31
Stuart Island Management Area	31
Overview	31
Restoration Opportunities	32
Habitat Benefits	32
Turtleback Management Area	32
Overview	32
Restoration Opportunities	33

Habitat Benefits	33
Waldron Island Management Area	34
Overview	34
Restoration Opportunities	34
Habitat Benefits	34
West Sound Management Area	35
Overview	35
Restoration Opportunities	35
Habitat Benefits	36
Restoration Priorities	37
Soft Shore Protection/Structure Removal Blueprint for San Juan County Forage Fish Beaches	37
San Juan County Shoreline Modification Inventory Restoration Opportunities Report	37
Salmon Habitat Protection Blueprint for San Juan County, Washington	41
Strategic Salmon Recovery Planning in San Juan County Washington: The Pulling it All Together (PIAT) Project.....	42
Shoreforms Priorities for Protection and Restoration.....	43
Prioritized Salmon Recovery Activities for Landscape Regions	43
Create a Neighborhood Salmon Habitat Conservation Easement.....	46
Green Shores For Homes: Incentivizing Low Impact Shoreline Development	46
Remove Bulkheads on Private Property through Public Education.....	46
Restore Beaches along Shoreline Roadways.....	47
Remove Derelict Piles	47
Remove Groins on Private Property	49
Build upon Successful Existing Site-specific Restoration Projects	49
Vegetate Shoreline Road Rights-of-Way with Native Vegetation.....	49
Encourage Daylighting Natural Stream Outfalls	50
Encourage Reconfiguration of Piers, Docks, and Marinas to Accommodate Fish Habitat	50
Support Long-Term Habitat Protection in San Juan County.....	50
Monitor Restoration Projects	51
Community Resources for Restoration	52
Puget Sound Restoration Fund	52
Alliance for Puget Sound Shorelines	52
Salmon Recovery Funding Board	52
Aquatic Lands Enhancement Account	52
Washington Wildlife and Recreation Program.....	53
NOAA	53
Puget Sound Acquisition and Restoration Program.....	53
Estuary and Salmon Restoration Program	53
US Fish and Wildlife Service	54
Implementation and Monitoring	55
Timelines and Benchmarks	55

Funding	56
Monitoring Strategies	56
Data Gaps.....	57
Monitoring Results	57
Lakeshore Modifications.....	57
Tidal Flow Data.....	57
Climate Change.....	57
Weather	57
Sea Level Rise and Ocean Acidification	58
Tide Gates.....	58
Glossary	59
Literature Cited	62
APPENDIX A	68
APPENDIX B	78

TABLES

Table 1.	List of Planned Projects by Management Area Documented in the Habitat Work Schedule (2012).....	9
Table 2.	Top Ten Sites Ranked for Enhancement and Restoration in Soft Shore Protection/Structure Removal Blueprint for San Juan County Forage Fish Beaches.	39

FIGURES

Figure 1a.	Planned Projects by Management Area.	10
Figure 1b.	Planned Projects by Management Area.	11
Figure 1c.	Planned Projects by Management Area.	12
Figure 2.	Priority Fish Use Regions, San Juan County, Washington.	44
Figure 3.	Shoal Bay Forage Fish Restoration Project, Before and After Restoration, Lopez Island, Washington.	48
Figure 4a.	Completed Projects by Management Area	1
Figure 4b.	Completed Projects by Management Area	2
Figure 4c.	Completed Projects by Management Area	3

EXECUTIVE SUMMARY

This restoration plan serves as a guide for San Juan County to achieve county-wide improvements in ecological functions of degraded shoreline areas as required by WAC 173-26-201(2)(f). The plan identifies planned, site-specific, restoration projects identified in the Habitat Work Schedule, which is a mapping and project tracking tool that allows the public to see what habitat protection and restoration projects are planned statewide (Habitat Work Schedule 2012). The plan also provides suggestions for additional restoration opportunities not yet in the planning process. Also included are summaries of studies completed by Friends of the San Juans for the San Juan County lead Entity for Salmon Recovery that identify the highest priority opportunities for restoration and protection related to salmon recovery, restoration of modified shorelines, and restoration of forage fish spawning beaches.

The plan includes recommendations for land conservation through fee acquisitions or easements, and describes types of programmatic activities that would support shoreline restoration, such as vegetating shoreline road public rights-of-way with native vegetation, and homeowner education-based programs to restore modified shores and remove derelict structures. Although not discrete restoration projects, such strategies are included in this plan because the majority of shorelines in San Juan County are privately owned. Public outreach and incentive-based programs for private owners of shoreline could significantly leverage the County's efforts to restore shoreline ecological functions on the islands. Finally, this document describes partners and grant opportunities that could facilitate implementation of the restoration plan, and provides suggested implementation mechanisms for achieving restoration goals.

It is important to note that the majority of restoration projects identified in this plan are directed towards salmon recovery efforts, which is a regional priority articulated by the Puget Sound Salmon Recovery Plan and locally implemented by the San Juan County WRIA 2 Lead Entity.

The proposed, site-specific, restoration projects are grouped by management area, which is an established method of delineating shoreline areas set forth in the San Juan County Inventory and Shoreline Characterization Report (Herrera et al. 2013).

PURPOSE AND INTENT

The purpose of this restoration plan is to improve degraded areas of the shoreline environment of San Juan County over time by restoring shoreline ecological functions and processes. This plan will be accomplished through voluntary and incentive-based public and private programs to restore, enhance, and protect shoreline areas.

This plan serves as a guide for San Juan County to support and develop projects that are planned to improve ecological functions (physical, chemical, and biological) of degraded shoreline areas as required by WAC 173-26-201(2)(f). This plan:

- Identifies current planned restoration projects
- Suggests targets for shoreline habitat protection and conservation
- Summarizes existing studies that prioritize where future restoration can be most effective and should have highest priority
- Identifies programmatic restoration opportunities that could be applied to candidate shorelines within the county
- Suggests potential public education and outreach projects to encourage shoreline protection and restoration by individual shoreline owners

Scope

The scope of this plan is to identify restoration projects and programmatic opportunities to improve ecosystem functions along the marine and freshwater shorelines of San Juan County. In total, San Juan County has approximately 481 miles of marine and lacustrine shoreline, including 176 separate islands (up to 743 at low tide) and more marine shoreline (approximately 455 miles) than any other county in the contiguous United States (Herrera et al. 2013; San Juan County 2012a).

Shoreline areas included in this restoration plan are defined as all uplands within 200 feet of the shoreline edge and associated tidelands and wetlands, as defined landward by the mean higher high water mark (MHHW) for marine shorelines and the ordinary high water mark (OHWM) for fresh water shorelines, and nearshore waters to the County's in-water jurisdictional boundary.

Context

This plan relies on multiple strategies that use physical restoration, educational outreach, and acquisition to improve and protect shoreline functions and resources. This plan's success depends on the involvement of a number of government and non-profit organizations that are stewarding and restoring land in the San Juan Islands. They include, for example, Friends of the San Juans (Friends), San Juan Preservation Trust (SJPT), and the Puget Sound Nearshore

Ecosystem Restoration Project (PSNERP), tribes such as the Tulalip Tribes, the Lummi Tribe, and the Swinomish Tribe, the Skagit River System Cooperative, which provides natural resource management services to the Sauk-Suiattle Indian Tribe and the Swinomish Indian Tribal Community, in addition to the San Juan County Land Bank (Land Bank) and San Juan County Marine Resources Committee (San Juan MRC). It also depends on the efforts of public and private educational institutions such as the San Juan Islands Conservation District, the San Juan Nature Institute, and University of Washington Friday Harbor Labs.

The majority of shorelines in San Juan County are privately owned and are typically developed with single family residences. One of the largest stressors on the ecological health of the County is the cumulative impact of private development that alters important shoreline ecological functions. Thus, homeowner education on activities that would improve nearshore conditions is viewed as an essential strategy for maintaining and improving ecological conditions along the shoreline. Reduction and removal of such impacts will be more common and effective with an educated shoreline populace.

This plan also recommends preservation of habitat and ecological functions where possible to offset ecological losses from ongoing and future shoreline development. While protecting shorelines from future development does not directly restore habitats, preservation does help maintain no net loss. For example, where feeder bluffs with intact native vegetative canopy can be preserved, they will help maintain the supply of sediment along the shore, provide a native plant seed source, and supply large woody debris—all functions that can support adjacent shorelines.

Shoreline Master Program

The Washington Department of Ecology (Ecology) Shoreline Management Plan Guidelines (Ecology 2011) require the development of a shoreline restoration plan as part of the shoreline management plan (SMP) update process. This plan supports the goals, policies, and regulations of the County's SMP. Although the protective and mitigation provisions of the SMP are intended to achieve no net loss of ecological functions from new adverse impacts, this restoration plan will help ensure that the shoreline ecosystem functions within the County achieve no net loss with potential for improvement over time. As such, this plan serves as a technical companion to the County's SMP.

Best Available Science

The County issued its Best Available Science for Marine Fish and Wildlife Habitat Conservation Areas report for San Juan County, which describes San Juan County's diverse shoreline habitats and species, and the scientific basis for protecting these valued ecological resources (Herrera and The Watershed Company 2011). This plan is consistent with information presented in that report regarding the functions and habitats provided by shoreline and nearshore habitats.

San Juan County Marine Resources Committee

San Juan County is the Lead Entity for Water Resources Inventory Area (WRIA) 2 and has designated the San Juan MRC as the citizens committee for salmon recovery. The San Juan MRC is a local organization that supports resource conservation and coordinates with public

agencies and non-profit groups to conserve, protect, and restore ecosystem habitats and processes utilized by salmon in San Juan County (San Juan MRC 2012).

San Juan County Land Bank

The Land Bank performs a role that is consistent with the projects and goals mentioned in this plan. In 1990, the Land Bank was created to preserve areas in the county that have environmental, agricultural, aesthetic, cultural, scientific, scenic, or low-intensity recreational value and to protect existing and future sources of potable water (San Juan County Land Bank 2012). Criteria in the Land Bank project selection process include: protection of an important conservation resource vulnerable to adverse change (such as development), effective use of the Land Bank's limited funds, and general public support.

The primary source of funding is derived from a 1 percent real estate excise tax paid by purchasers of property in the County. Additional funding sources include a conservation futures tax, private donations, grants, and interest income. The Land Bank has acquired a number of high-value properties in the County, and has been very successful at leveraging grants and partnerships to permanently protect and restore important shorelines.

San Juan Preservation Trust

The SJPT also functions to protect and restore land and has a role in the county that is consistent with the goals and criteria described in this plan. The SJPT was founded in 1979 after the Nature Conservancy discontinued its land acquisition projects in the San Juan Islands (SJPT 2012). The mission of the SJPT is to preserve and protect open spaces, scenic views, forests, agricultural lands, habitats, watersheds, riparian corridors, wetlands, and shorelines in the San Juan Archipelago. The SJPT has permanently protected more than 260 properties, 37 miles of shoreline, and 15,000 acres on 20 islands via acquisitions and conservation easements. In addition to acquiring properties and coordinating easements, the SJPT conducts property management, monitoring of its conservation properties, and restoration of damaged or neglected lands.

Restoration Plan Objectives

- Encourage and facilitate cooperative restoration programs between local, state, and federal public agencies, tribes, non-profit organizations, and landowners to address shorelines with impaired ecological functions and/or processes
- Restore and enhance shoreline ecological functions and processes, as well as shoreline features, through voluntary and incentive-based public and private programs
- Target restoration and enhancement toward improving habitat required to support the life cycles of priority and/or locally important wildlife species
- Ensure restoration and enhancement is consistent with and, where practicable, prioritized based on the biological recovery goals for Chinook salmon, forage fish, and other species and/or populations for which a recovery plan is available

- Seek funding for restoration, enhancements, easements or acquisitions using federal, state, county, grant, private donation, or other funding sources

Restoration Policies

The following policies will guide the County's restoration projects:

- **Policy 1.** Restoration and enhancement actions will improve shoreline ecological functions and processes and should be designed using principles of landscape and conservation ecology. The primary goal is to restore or enhance physical and biological ecosystem-wide processes that create and sustain shoreline habitat structure and functions.
- **Policy 2.** Encourage and facilitate cooperative shoreline restoration and enhancement programs between local, state, and federal agencies, tribes, non-profit organizations, and landowners to address shorelines with impaired ecological functions.
- **Policy 3.** Target restoration and enhancement projects that will support the life cycles of priority species, such as Chinook salmon and other species; locally important plant, fish and wildlife species; and other populations or habitats for which a prioritized restoration or recovery plan is available.
- **Policy 4.** Integrate restoration and enhancement with other natural resource management efforts such as the Puget Sound Salmon Recovery Plan as implemented by the San Juan County WRIA 2 Lead Entity.
- **Policy 5.** Include provisions for shoreline vegetation restoration, fish and wildlife habitat enhancement, and low impact development techniques in projects located within the shoreline through requirements for compensatory project mitigation and incentive-based restoration.
- **Policy 6.** Seek and support funding opportunities from state, federal, private, and other sources to implement restoration and enhancement projects.
- **Policy 7.** Encourage restoration and enhancement projects by developing project permitting and processing guidelines that will streamline their review.
- **Policy 8.** Avoid adverse impacts on existing saltwater critical areas, fish and wildlife habitat conservation areas, water quality, and water storage capacity in all shoreline restoration and enhancement projects.

METHODS

Information Sources

A variety of information sources were examined and used to develop this plan. Most important were databases of projects proposed, sponsored, and being implemented by local groups, including projects identified on the Habitat Work Schedule website (2012), which catalogs all of the past, present, and future projects funded by the Washington State Recreation and Conservation Office, the largest source of restoration funds in the Puget Sound region. In addition, recommended restoration and acquisition projects are defined for each management area based on the County's Shoreline Inventory and Characterization Report, which generally identifies areas with degraded habitat (Herrera et al. 2013). Finally, priorities identified in four studies completed by the Friends of the San Juans and partners that specifically address restoration and acquisition priorities for the County's shorelines were used to guide future project selection. These studies were focused on prioritizing restoration projects that would improve habitat for salmon and prey species; however, the recommended restoration activities would also benefit other aquatic species as well as waterfowl, shorebirds, and numerous terrestrial species that use County shorelines and the nearshore.

Identification of Restoration Opportunities

Restoration opportunities were identified for each management area from a list of restoration projects obtained from Habitat Work Schedule website, and from project sponsoring organizations. Many of the projects target habitat requirements of priority species, including juvenile Chinook salmon and forage fish (i.e., surf smelt, sand lance, etc.).

A project information table is provided only for projects that were on the 2012 Habitat Work Schedule or where project planning has occurred sufficient to supply sufficiently detailed information to complete the table.

Additional restoration projects are proposed based on the following site characteristics (as identified in the San Juan County Shoreline Inventory and Characterization Report [Herrera et al. 2013]):

- The site is degraded with respect to key species' habitats and presents an opportunity for restoration that will produce a net gain in shoreline ecological functions and habitat in the future.
- The site has overwater (e.g., piers and docks) or nearshore (e.g. shoreline armoring and groins) infrastructure where removal would likely lead to gains in habitat or improvements in physical processes.

Other important criteria considered in restoration site selection included:

- Site has or is adjacent to areas having specific, high-value, biological features such as mature coastal forest, intact marine riparian vegetation, beach and eelgrass (*Zostera marina*) habitats that support forage fish, and other important fish species, birds, and other wildlife.
- Site is integral to coastal geologic processes such as landslides and areas supporting long-shore drift and nearshore sediment supply.
- Site shoreline functions are at threat from further residential development or deforestation.
- Site either contains or is adjacent to a feeder bluff.
- Site would provide public access and shoreline recreational use.
- Site has cultural and historical significance.

Protection of existing shoreline functions via property or easement acquisition, and use of the County Open Space Tax Deferral Program are included as restoration strategies in this plan because many shoreline and upland areas in San Juan County are intact and function in a natural state. Property acquisition can be used as a process-based tactic to conserve and protect broader, self-sustaining, ecosystem processes that support valued nearshore habitat. For example, acquiring a property or easement that permanently protects a feeder bluff could prevent future degradation of an important sediment source for a forage fish spawning beach. Likewise, protection of a key strategic parcel may provide an important habitat connection that effectively increases the functions of adjacent restored or enhanced parcels, thereby adding more restoration value.

- **Property acquisition** – There are many properties throughout the County that are either under-developed or undeveloped. Acquiring such properties can provide habitat connectivity and ensure that they continue to provide key ecological functions. Property acquisition can also serve as the first step toward restoration projects.
- **Easement acquisition** – Placement of conservation easements can be an effective tool to protect key ecological areas, such as pocket estuaries, feeder bluffs, and forage fish spawning beaches. Placing conservation easements on strategically located properties can provide habitat continuity and ensure that those areas continue to provide key ecological functions.
- **Open Space Tax Deferral Program** - The Open Space Taxation Act, enacted in 1970, allows property owners to have land valued at its current use rather than its highest and best use. The Act states that it is in the best interest of the state to maintain, preserve, conserve, and otherwise continue in existence adequate open space lands to assure the use and enjoyment of natural resources and scenic beauty for the economic and social well-being of the state and its citizens. Lands suitable for this program include those where wetlands, beaches, or tidal marshes would be protected.

Since several privately owned parcels are located on valuable habitat (feeder bluffs, estuarine wetlands, etc.) in San Juan County, education is included as a key restoration opportunity. As property owners become more aware of the important roles of shoreline vegetation and natural geomorphic processes, it is hoped that more property owners will initiate private restoration projects.

- **Educational and incentive based programs** – Because development has occurred on valuable shoreline habitat by individual landowners throughout San Juan County, landowner education on the implications of their land-use activities is an essential strategy to ensure no net loss of ecological function. In addition, incentive based programs can be used to encourage protection and improvement of ecosystem functions and processes along shorelines of single-family waterfront homes.

The types of property owner restoration projects considered highest priority are identified within each management area discussion as well as within the *Programmatic Restoration Opportunities* section.

Restoration Priorities

Priorities for restoration were drawn from four studies completed by the Friends of the San Juans and project partners between 2006 and 2012 that recommend priorities for restoring forage fish spawning beaches, previously modified shorelines, and for improving salmon recovery. These include the following studies:

- Soft Shore Protection/Structure Removal Blueprint for San Juan County Forage Fish Beaches (Johannessen and MacLennan 2006a, 2006b)
- San Juan County Shoreline Modification Inventory Restoration Opportunities Report (Friends of the San Juans 2011)
- Salmon Habitat Protection Blueprint for San Juan County, Washington (Friends of the San Juans 2008). This project was completed with assistance from the San Juan County Land Bank and San Juan Preservation Trust.
- Strategic Salmon Recovery Planning in San Juan County Washington: The Pulling it All Together (PIAT) Project (Whitman et al. 2012)

These studies used field surveys and analytical methods to determine restoration priorities and make recommendations for sites that would provide the greatest gain towards improving critical habitats and shoreline ecological functions. Summaries of their findings are provided in this plan to inform users about already documented priorities for additional restoration and protection in the County. The information provided and the results of these studies can be effectively used as a basis for planning and prioritizing future projects.

RESTORATION PROJECTS BY MANAGEMENT AREA

Currently planned projects and discussions of additional suggested restoration, acquisition, and programmatic activities are organized by management areas. Management areas provide a scientific context for organizing restoration and protection projects by like environments. They also facilitate preparation of a coherent strategy for a given area. Management area boundaries are taken from the San Juan County Inventory and Shoreline Characterization Report (Herrera et al. 2013), which delineated them based upon Ecology guidance (Ecology 2011).

Table 1 identifies the islands and portions of islands included within each management area along with restoration projects for that management area. As stated in the *Identification of Restoration Opportunities* section above, restoration projects were identified for the following management area's; Mud Bay, North Coast Eastsound, Olga, Shaw Island, strait of Juan de Fuca, and West Sound from a list of restoration projects obtained from the Habitat Work Schedule website (Habitat Work Schedule 2012). Table 1 also shows the project funding source(s) and the schedule for completion if that information was available. Table 1 identifies a project description table (located in Appendix A) where additional information is provided. Figure 1 shows the management area boundaries and the general locations of these planned projects.

Other recommended restoration activities, not yet in the planning stage, are also proposed for future consideration within the management area discussions. These were identified based on the site characteristics identified in the *Identification of Restoration Opportunities* section above. Project description tables were not prepared for these suggested restoration opportunities because no planning has yet occurred.

Blakely Island Management Area

Overview

The Blakely Island Management Area comprises 73,215 feet (13.9 miles) of shoreline along Blakely Island and two smaller islands (Willow and Armitage Islands) (see Figure 1c). Slightly more than 1 percent of the shoreline is armored, largely concentrated around the northern and southern ends of the Blakely Island.

The management area contains several drift cells, including four located adjacent to the glacial drift terrace on the north side of the island. Two of these drift cells converge at an accretionary shoreform at the west end of the terrace. The other two form a tombolo at the northern tip of the island. There are also two small, convergent drift cells within Thatcher Bay and a divergence zone on the southeast side of the island.

Blakely Island's nearshore areas differ substantially in that the western, northern, and southern shorelines are characterized by narrow strips of eelgrass, while the eastern shoreline habitat is more conducive to kelp species, including bull kelp. Thatcher Bay on the western

Table 1. List of Planned Projects by Management Area Documented in the Habitat Work Schedule.

Management Area	Island or Portions of Island Found in Management Area	Planned Projects	Project Description Table Identifier in Appendix A	Sponsor / Funding Source(s)	Timeline
Decatur Island	Decatur Island	No HWS Projects	NA	NA	NA
Doe Bay	Orcas Island	No HWS Projects	NA	NA	NA
East Sound	Orcas Island	No HWS Projects	NA	NA	NA
Mud Bay	Lopez Island	Mud Bay Bulkhead Removal	A1	NA	DORMANT
North Coast Eastsound	Orcas Island	Buckhorn Road Beach Acquisition	A2	NA	DORMANT
Olga	Orcas Island	Pickett Springs Salt Marsh Recreation	A3	NA	DORMANT
Private Lakes	San Juan, Orcas, Blakely and Lopez Islands	Although there are no projects in the Habitat Work Schedule for this management area, there have been citizen led projects to revegetate areas adjacent to Hummel Lake on Lopez Island.	NA	NA	NA
Public Lakes	Orcas and San Juan Islands	No HWS Projects	No HWS Projects	NA	NA
San Juan Channel	San Juan Island	No HWS Projects	NA	NA	NA
Shaw Island	Shaw Island	Shaw Landing Creosote Bulkhead Removal	A4	NA	DORMANT
Shaw Island	Shaw Island	Blind Bay Forage Fish Habitat Restoration	A5	NA	DORMANT
Spencer's Spit	Lopez Island	No HWS Projects	NA	NA	NA
Strait of Juan de Fuca	San Juan Island and Lopez Island	False Bay Riparian Enhancement	A6	SJC Land Bank UW Friday Harbor Labs San Juan Islands Conservation District	Feasibility complete, hydrogeologic assessment ongoing.
Stuart Island	Stuart Island	No HWS Projects	NA	NA	NA
West Sound	Orcas Island	Deer Harbor Bridge Replacement	A7	ESRP SJC Public Works	Completion of project in 2017
		Deer Harbor Estuary Restoration	A7	SRFB SJC Land Bank	Completion of project in 2017
		Deer Harbor Wood Waste Removal	A8	NA	DORMANT

Figure 1a. Planned Projects by Management Area.

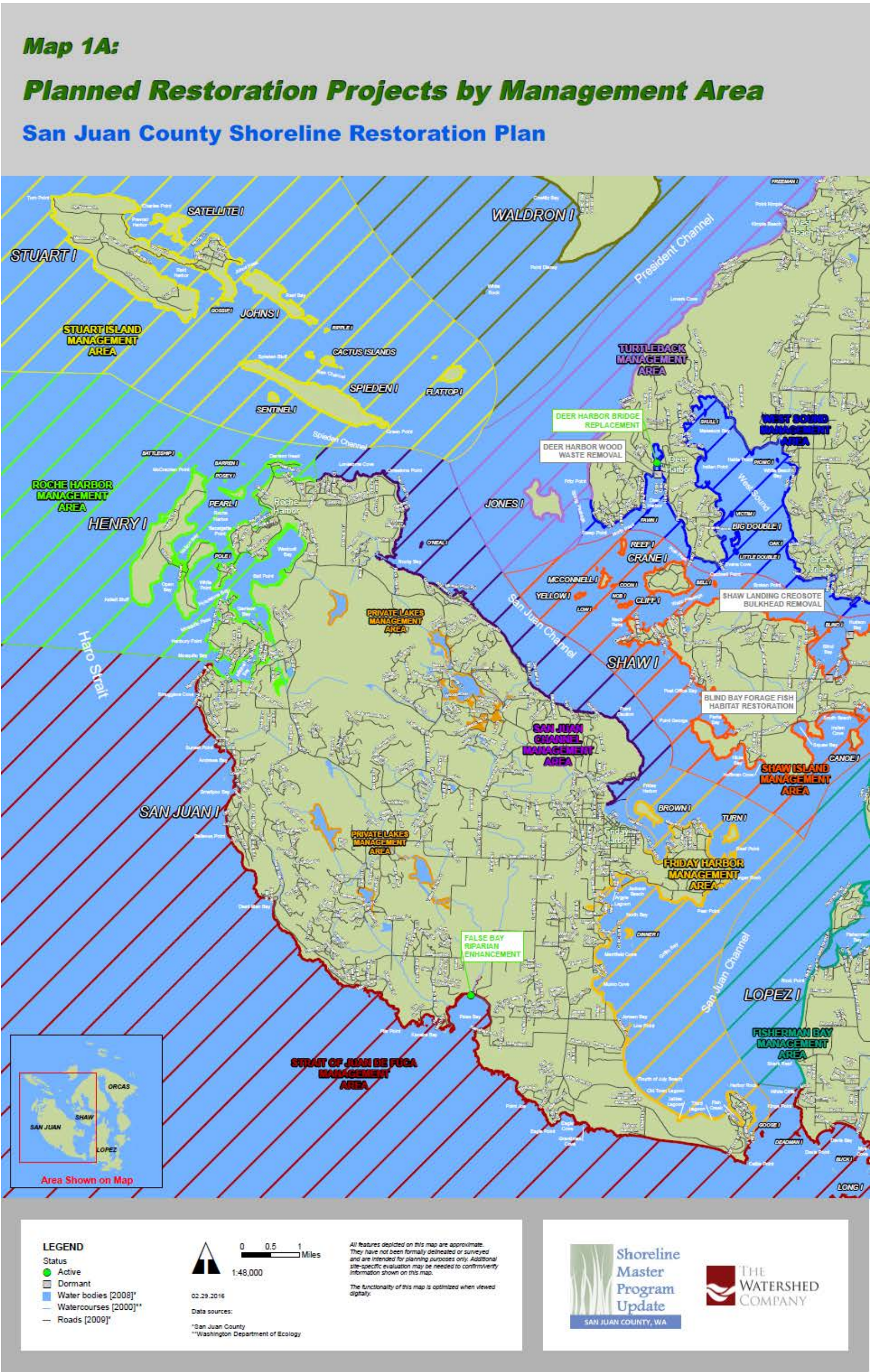


Figure 1b.Planned Projects by Management Area.

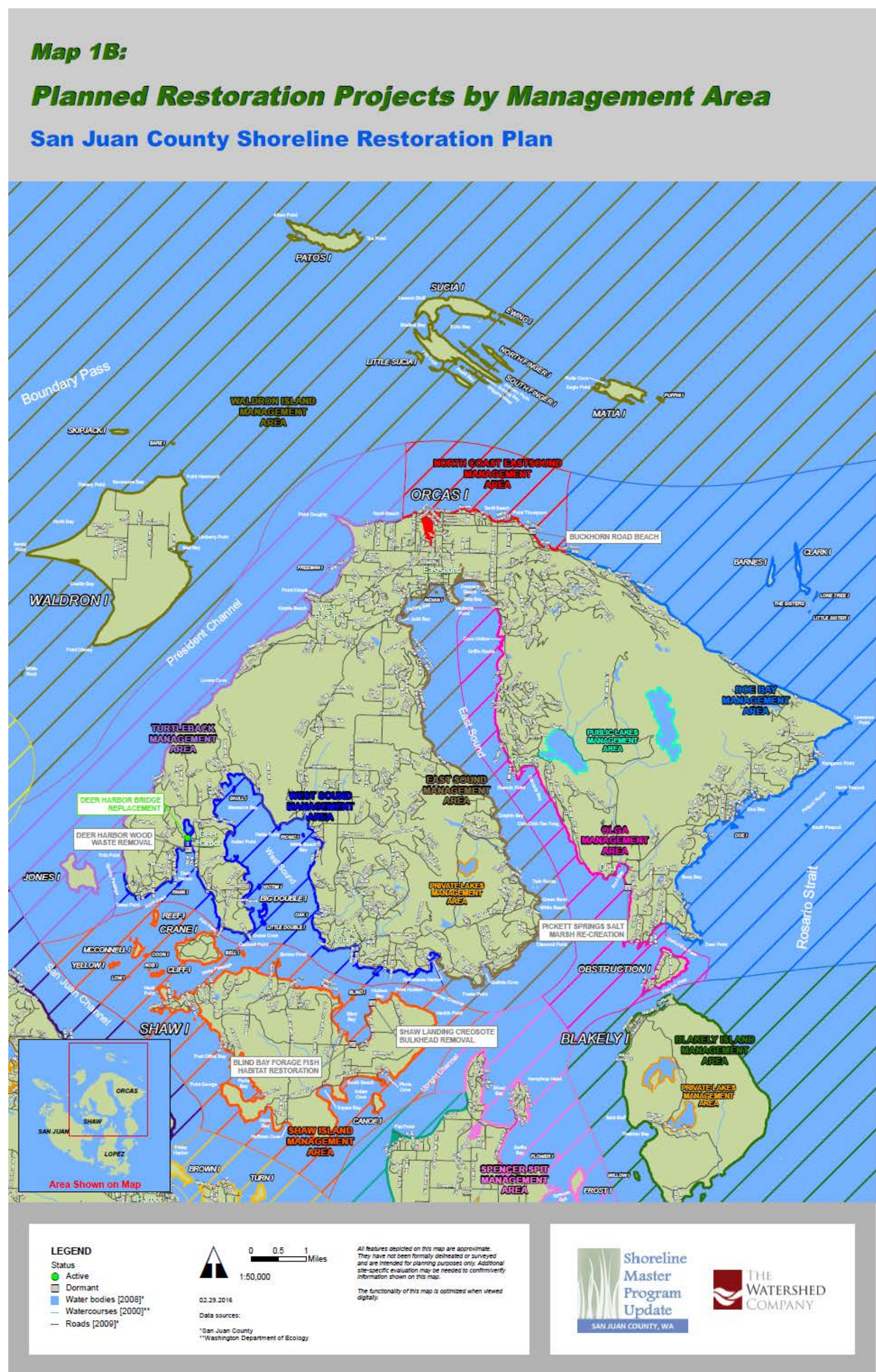
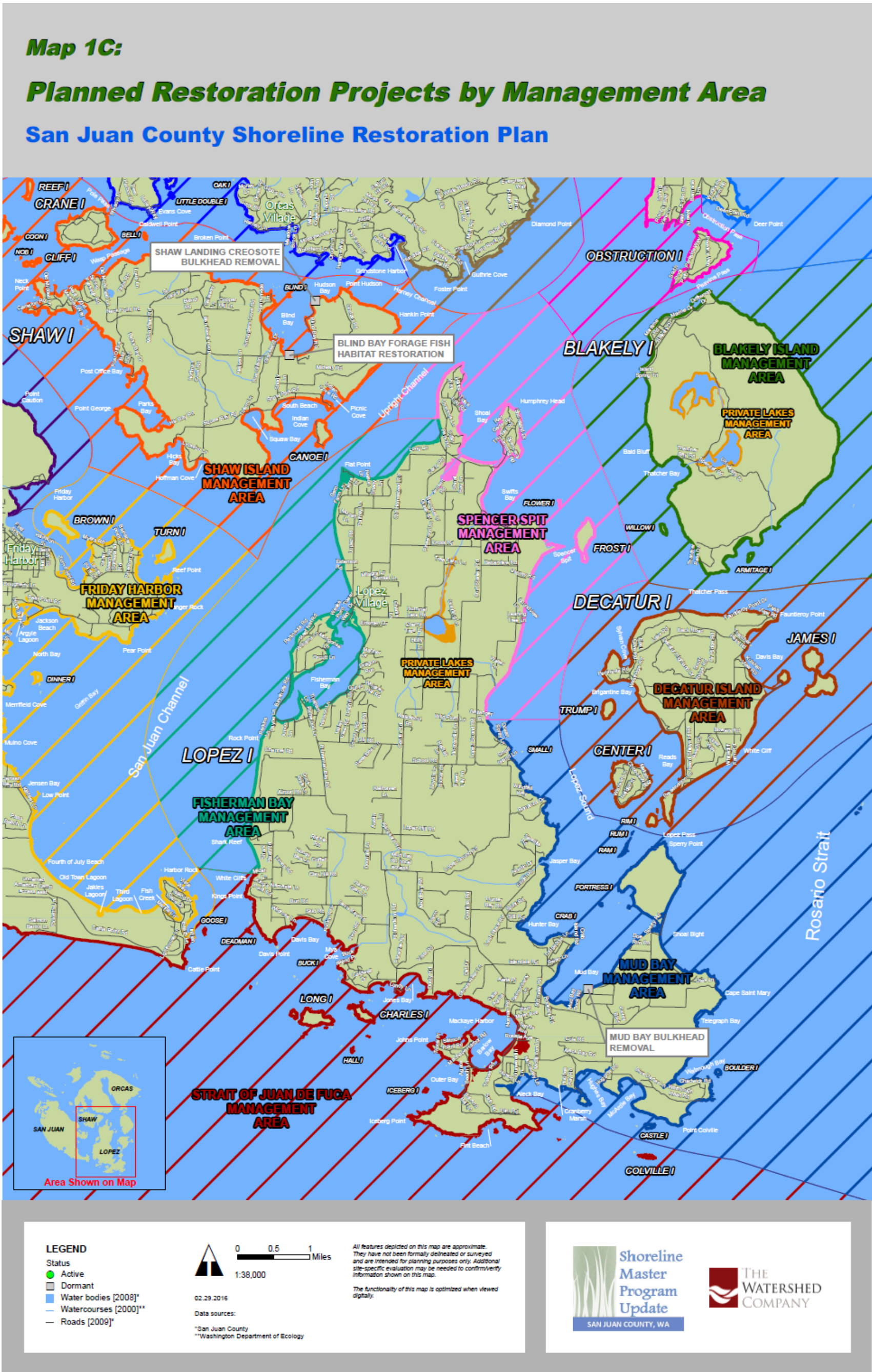


Figure 1c. Planned Projects by Management Area.



shoreline provides estuarine habitat, and may be an important rearing area for salmonids due to the influence of freshwater input from upstream Horseshoe and Spencer Lakes, and the presence of pocket beaches.

Restoration Opportunities

The Blakely Island Management Area is largely undeveloped and contains a forested riparian zone that is largely intact. However, there are several opportunities to restore the ecological functioning of the nearshore environment.

In addition, it may be possible to restore the tombolo that defines the northern tip of Blakely Island. Currently there is a marina adjacent to a large open meadow, with associated shoreline that is armored.

Habitat Benefits

Existing habitat conditions in the Blakely Island Management Area generally function well due to the limited amount development throughout the management area. Re-establishment of eelgrass and marine riparian vegetation will improve the ecological functioning of Thatcher Bay for juvenile salmon.

Decatur Island Management Area

Overview

The Decatur Island Management Area comprises 103,625 feet (19.6 miles) of shoreline that encompasses all of Decatur Island and a collection of smaller islands that form a mini-archipelago bounded by Rosario Strait to the east, Thatcher Pass to the north and Lopez Sound to the south and west (see Figure 1c). The Decatur Island Management Area has three large secondary islands: James Island, which is a Washington State Park, and Center and Trump Islands, both of which are in private ownership and inhabited.

Drift on Decatur is dominated by the two large tombolos that define Decatur Head and the isthmus at Reads Bay. At Reads Bay, drift is convergent at the head of the bay. North of the bay, there is an area of divergence (with significant feeder bluffs) that feed the bay and areas further north. Likewise, there is a large feeder bluff complex at White Cliffs that feed both of the large tombolos. Some of these feeder bluffs have been armored. A small drift cell occurs in Davis Bay and feeds the other side of the tombolo at Decatur Head. There is also a short unidirectional drift cell on the southeast side of Center Island.

There are no mapped streams or lakes in this management area. The two primary shoreline-associated wetlands are formed in the tombolos that define Decatur Head and the isthmus on Reads Bay. The wetland complex adjacent to Reads Bay has been extensively ditched, though it is not currently in the County ditch database.

Shoreline development is primarily residential in nature, with several vacant properties. Armoring structures occupy slightly less than 3 percent of the shoreline. There are more mooring buoys (165) in the Decatur Island Management Area than any other management area in the County. Nearly all of the moorings are located in Davis Bay and Reads Bay. The

management area also has more pilings (92) than any other management area. There are also 37 overwater structures, which are mostly docks and piers. In addition to the docks and piers, there are three boat ramps, a groin, a jetty and two marinas. There is a minor amount of fill associated with residences on the tombolo of Decatur Head.

Restoration Opportunities

The restoration opportunities for the Decatur Island Management Area should focus on restoring the large wetland complex along Reads Bay. Wetland complexes of this size and connection to marine waters are two rare features in the County, despite their ecological value (see Beamer et al. 2003, 2005 for discussion on ecological value of similar wetland complexes). The wetland complex is large and undeveloped, but it has been extensively ditched (though this ditching is not currently recorded in the County ditch database, indicating that it is likely old and possibly abandoned). Ditching simplifies the landscape and can lead to trapping of ESA-protected fish species.

Improved management of mooring buoys is another management strategy that would improve habitat in this management area; there are more mooring buoys (165) than in any other management area in the County. A concerted effort to educate private landowners on the harmful effects of mooring buoys and the options available to mitigate the problem would potentially be effective. Options include new buoy configurations that greatly reduce impact on eelgrass and other macrophytes in the surrounding areas. Relocation of buoys outside of eelgrass will also reduce their environmental impacts. In some cases, mooring buoys are no longer needed and can be permanently removed (Whitman et al. 2012).

Habitat Benefits

Restoration of the wetland complex along Reads Bay would greatly benefit juvenile salmon, including ESA-listed Chinook salmon. Coastal wetlands provide juvenile salmon with feeding opportunities and cover from predators (Beamer et al. 2005). Wetland restoration would also likely improve water quality in Reads Bay and would benefit a variety of other species, including shorebirds.

Improved site location and management of mooring buoys would improve eelgrass habitat in the management area. Eelgrass provides critical habitat for a variety of species, including juvenile Dungeness crab, juvenile salmon, and Pacific herring. Several eelgrass beds are located in the management area, primarily along the eastern and southern shorelines of Decatur Island (Herrera et al. 2013). Reducing the harmful effects of poorly sited mooring buoys would greatly improve the ecological functioning of the management area.

Doe Bay Management Area

Overview

The Doe Bay Management Area includes 123,772 feet (23.4 miles) of shoreline along the east end of Orcas Island (see Figure 1b). The management area includes an uninhabited mini-archipelago of islands northeast of Orcas Island including Barnes Island, Clark Island, Lone Tree Island, and the Sisters. Peapod Rocks and Doe Island southeast of Orcas Island are also included in this management area.

April 05, 2016



There are no mapped drift cells in this management area (Herrera et al. 2013). Wave energy is high, but locally sourced. The exposure of the north shore is significant as there is open exposure to the Strait of Georgia, while the southern shore has exposure to the south via Rosario Strait.

There are 12 small, non-fish-bearing streams mapped in the management area (Wild Fish Conservancy 2012b). In addition, there are two fish-bearing streams. One drains to Doe Bay, but has been extensively ditched. The other is less altered, and drains to an embayment between Point Lawrence and Kangaroo Point.

Nearshore wetlands are rare, particularly on the steep north shore of the management area. Estuarine habitat is also rare in the management area, limited to Doe Bay and the coves between Kangaroo Point and Point Lawrence. Eelgrass has a patchy distribution along a narrow band that is close to the southern shoreline. The northern shoreline has a similar patchy distribution of kelp species. Both kelp and eelgrass also occur around the smaller islands in the management area. Relatively undisturbed forest cover along the shoreline provides habitat for bald eagles, which occur frequently near Deer point, between Doe Bay and Point Lawrence, and along the northern shoreline of Orcas Island.

Shoreline development is limited throughout the management area; the northern shore is extremely steep and largely uninhabited while the southern shoreline is less steep and sparsely populated. Approximately 1.4 percent of the management area is armored. Most of the armoring occurs on the pocket beaches that are common on the south shore. The bedrock that dominates the north shore of the management area lacks armoring.

Restoration Opportunities

There are relatively limited restoration opportunities for the north shore portion of the management area because most of the shoreline is undeveloped and inaccessible by land. Development is also sparse on the south shore and rarely is close to the shoreline. Despite the lack of shoreline development, bulkheading is present and generally unnecessary given that most of the shoreline is bedrock. It is most often along pocket beaches, which provide important habitat for a variety of salmon and forage fish species, particularly on a shoreline that is otherwise steep and comprised of bedrock. Bulkheading to protect infrastructure is not necessary in most cases where it has been used; in some cases bulkheads are used to protect large lawns (Herrera et al. 2013).

Therefore, restoration should focus on educating landowners about the negative environmental effects of shoreline armoring and the potential for restoration. This is especially important considering no mapped drift cells occur in the management area and pocket beaches will erode over time. Educational efforts could be specifically targeted to landowners with pocket beaches to address their concerns about bulkhead removal, and the potential (or lack thereof) for erosion and property loss. Educational materials could focus on additional actions associated with bulkhead removal (such as beach nourishment) that not only improve shoreline habitat but dissipate wave energy, and naturally reduce shoreline erosion. Furthermore, educational material could also provide information on marine riparian vegetation and the role it plays in providing terrestrial food sources for juvenile salmon, improved conditions for forage fish spawning success, and shoreline stabilization.

Habitat Benefits

Reducing bulkheading and shoreline armoring along the southern half of the management area, especially pocket beaches, would provide numerous habitat benefits. As is the case with most bulkhead removal projects, properly placed beach nourishment along the restored shoreline would increase the amount of habitat available for forage fish in the management area and protect upland areas. Restoration of marine riparian vegetation would also improve conditions for forage fish spawning success and provide additional sources of prey for juvenile salmon (Brennan and Culverwell 2004; Brennan et al. 2004).

East Sound Management Area

Overview

The East Sound Management Area comprises 92,573 feet (17.5 miles) of shoreline that extends from Grindstone Harbor to the east end of Ship Bay in central Orcas Island (see Figure 1b). This management area includes the main waterfront of the town of Eastsound. It also includes Indian Island and number of similar small, uninhabited rocky islets less than a few hundred feet offshore of the mainland throughout East Sound.

There are three drift cells in this management area (Herrera et al. 2013). The largest and most active is the drift cell (and feeder bluffs) that feed Crescent Beach. There are also drift cells that feed barrier beaches in Judd Cove and in the Eastsound Shores area. Wave energy is generally modest and derived entirely from local wind-waves, though these can be significant near the town of Eastsound owing to the significant southern fetch there. Tidal currents are also modest (generally less than 1 knot).

A number of small streams are located within the management area, including streams draining to Grindstone Harbor, East Sound, Guthrie Cove, and Judd Cove. The large stream that feeds Grindstone Harbor and the stream that drains to Judd Cove are both documented to have fish present (Herrera et al. 2013). A small stream entering East Sound from Martin Lake supports coastal cutthroat trout. Crescent Beach is a known forage fish spawning beach. Nearshore waters at this beach and along the shoreline from Judd Cove to Coon Hollow are also critical habitat for Pacific herring spawning.

In addition to the streams, there are two wetland complexes at the head of East Sound. One is called the Eastsound Swale, and is associated with Fishing Bay and the heart of the Eastsound commercial district. Much of it has been filled and its habitat highly modified (US Coast and Geodetic Survey 1889b). The other wetland complex is associated with Crescent Beach, and remains largely intact, although its historic tidal exchange with East Sound has been significantly reduced by the construction of Crescent Beach Road (see discussion under *Restoration Opportunities* below).

Restoration Opportunities

The village of Eastsound was one of the first places in the County to be settled. Because early development often occurred without regard to environmental consequences, most of the restoration opportunities lie close to the village. Crescent Beach, just east of the village center, is backed by a largely intact and protected wetland complex. However, there are a

couple of residential structures and Crescent Beach Road that separate and disconnect this wetland complex from East Sound. Restoring predevelopment-level nearshore processes to this area by removing the existing residence and its associated infrastructure (such as the septic system) would improve habitat and water quality. Removing Crescent Beach Road and its associated culvert would also afford substantial improvement by restoring the historic exchange of salt and fresh water as well as habitat connectivity; factors that make this such an ecologically rich area. There are few estuarine wetlands in the County that are this size that could be completely restored, as is the case here. As such, this project should be a very high priority. Although this project has been identified by the Friends of the San Juans and others as important, there is no on-going project development at this time.

Habitat Benefits

Restoration of the estuarine wetland complex near Crescent Beach would greatly benefit juvenile salmon, including ESA-listed Chinook salmon (Beamer et al. 2005). Estuarine wetlands provide juvenile salmon with feeding opportunities and cover from predators. Wetland restoration would also likely improve water quality in East Sound and would benefit a variety of other species, including shorebirds.

Fisherman's Bay Management Area

Overview

The Fisherman's Bay Management Area comprises 73,685 feet (14.0 miles) of shoreline that extends from the transition of sediment to bedrock at Kings Point in the south to Odlin County Park in the north. It includes Fisherman Bay, which borders Lopez Village (see Figure 1c).

Glacial sediment dominates the geology of this management area, resulting in a series of drift cells along the shoreline. The largest drift cell extends from the southern limit of the management area to the tip of the spit that protects Fisherman Bay. A set of divergent drift cells define the shoreline between Fisherman Bay and Flat Point. Another set of divergent drift cells are present between Flat Point and Odlin County Park.

Wetlands and fringing salt marshes are extensive along the margins of Fisherman Bay. The northern portion of the stream network that drains to the bay is ditched. There is also a wetland complex at Flat Point. There also once was a wetland complex in present-day Odlin County Park, which is now ditched and culverted. There are no mapped streams in the management area.

Fisherman's Bay contains extensive estuarine habitat. The shoreline vegetation is comprised partly by a narrow band of eelgrass that appears continuous from the northern extent of the management area near Odlin Park to White Cliffs at the southern extent. With the exception of the prominent Fisherman Bay and associated spit, the shoreline generally lacks pocket beaches or estuarine habitat that would support fish rearing and migration. However, eelgrass, beach wrack, and a relatively unbroken forested riparian buffer likely contribute to suitable habitat conditions for important species and their prey items.

Fisherman Bay is a great natural harbor and, as a result, the management area has the largest number of mooring buoys (164) anywhere in the County, aside from the Decatur Island

Management Area, which has only one more. In addition, there are five groins in this management area, more than elsewhere in the County. This is likely due to the large quantity of glacial sediment and drift cells present in the management area.

Restoration Opportunities

Fisherman Bay has numerous minor impairments to nearshore functions. These include ditching (concentration) of upland freshwater sources to the bay, fill, armoring and bulkheading, overwater structures and a very large number of mooring buoys and pilings, some of which are likely not in current use. Because this all occurs within a confined area, and a considerable amount of land is publically owned, a feasibility study could be undertaken to identify opportunities to improve this potentially great natural resource.

In addition, Fisherman Bay suffers from water quality degradation, accumulation of fine sediments, and a dramatic decline in Chinook salmon and eelgrass abundance.

Improving tidal circulation through Fisherman Bay is a critical component in restoring the ecological functioning of Fisherman Bay. Potential modifications to the county road along the tombolo at the south end of the bay, including installing a bridge, an elevated road or causeway, box culverts, or surge channels to improve the hydrodynamics and geomorphic processes have been and are subject to study. It is anticipated that a bridge or causeway and associated increases in tidal circulation that could occur in Fisherman Bay would help remove fine sediments accumulated in the bay, improve dissolved oxygen levels during the summer, promote the re-establishment of eelgrass throughout the bay, and improve habitat conditions for juvenile salmon, including ESA-listed Chinook salmon.

Odlin County Park could also be a target for restoration. Historic maps indicate that the meadow area and parking lot in the center of the park were once a sloping marsh (US Coast and Geodetic Survey 1889c). A tide gate is also located in the park that restricts tidal circulation into the former salt marsh. Restoration of this area would improve habitat for shorebird populations and provide rearing habitat for migrating salmonids.

Habitat Benefits

Development and wetland removal along Fisherman Bay has degraded what was historically a very productive estuary. Improving water quality to the bay, increasing tidal circulation through the bay, and restoration of armored shorelines would greatly improve the ecological functioning of the bay. Suggested restoration activities would improve sediment transport through the bay, as well as increase potential forage fish rearing and spawning habitat, juvenile salmon habitat, eelgrass re-establishment, and marine riparian habitat in the management area. Restoration of Fisherman Bay would likely benefit a variety of other species; over 70 seabird and waterfowl species have recently been documented in the bay, including marbled murrelet (Habitat Work Schedule 2012).

Friday Harbor Management Area

Overview

The Friday Harbor Management Area comprises 127,845 feet (24.2 miles) of shoreline that encompasses unincorporated portions of Friday Harbor and Griffin Bay on San Juan Island, extending southwards to Cattle Point. The management area includes Brown Island, Turn Island, and Dinner Island, as well as several small, uninhabited islets, primarily around Reef Point (see Figure 1a).

Several drift cells have been mapped in this management area. The largest drift cell provides sediment to a series of barrier lagoons on the isthmus associated with Cattle Point. Drift is from east to west. There is a second smaller drift cell that originates from the same short, but significant, feeder bluff that terminates in the bedrock of Cattle Point. In addition, Cattle Point has a drift cell near Goose Island. There are a series of small drift cells associated with pocket beaches between Turn Point and Argyle Lagoon. Brown and Turn islands also have small drift cells on the southern shoreline.

There are 10 small streams mapped in this management area. None are documented as fish bearing. These streams have numerous culverts in the shoreline management zone, particularly in the northern portion of the management area. There are several natural lagoons at the south end of Griffin Bay, which are largely intact features. Also included in this management area is Argyle Lagoon, which is adjacent to a former gravel pit.

Eelgrass is documented along much of the Griffin Bay shoreline off San Juan Channel. The northern portions of the management area including North Bay, Merrifield Cove, and Mulno Cove shorelines are relatively developed and are characterized by highly disturbed riparian vegetation. Thus, significant forest vegetation is generally lacking from these areas, but forests are prominent along the San Juan Island National Historic Park shoreline.

Restoration Opportunities

The largest and most obvious restoration opportunity in the Friday Harbor Management Area is the restoration of Argyle Lagoon, which is owned and managed as a natural area by the University of Washington (2012). The lagoon is a natural feature, as it is present in historic maps predating most development (US Coast and Geodetic Survey 1897). However, there has been significant alteration to the area near the former gravel pit and associated infrastructure, including Jackson Beach Road along the southeast portion of the lagoon.

Numerous opportunities exist to restore the shorelines in the Friday Harbor management area to a more natural state. Several privately owned residential properties are identified by the Friends of the San Juans (Johannessen and MacLennan 2006a, 2006b; Friends of the San Juans 2011) as having shoreline armoring that could be replaced with soft shore stabilization. In addition, Friends has restored an historic feeder bluff and drift cell along the southeast shore of Brown Island (see Table B3 in Appendix B). A focus on educating landowners about the negative environmental effects of shoreline armoring and the potential for restoration could be very effective in this management area. Educational materials could provide alternatives to armoring (such as beach nourishment) that not only would improve shoreline habitat, but

also dissipate wave energy, and naturally reduce shoreline erosion. Furthermore, educational material could also provide information on marine riparian vegetation and the role it plays in providing terrestrial food sources for juvenile salmon, improving conditions for forage fish spawning success, and providing shoreline stabilization.

Habitat Benefits

Restoration of Argyle Lagoon would provide numerous habitat benefits for juvenile salmon, including ESA-listed Chinook salmon, although there is currently no project planned for this area. The removal of Jackson Beach Road and associated fill could increase tidal circulation through the lagoon, improving habitat for forage fish spawning and a variety of other species, including shorebirds.

Reducing bulkheading and shoreline armoring would provide numerous habitat benefits. As is the case with most bulkhead removal projects, properly placed beach nourishment along the restored shoreline would increase the amount of habitat available for forage fish in the management area. Restoration of marine riparian vegetation would also improve conditions for forage fish spawning success and provide additional sources of prey for juvenile salmon (Brennan and Culverwell 2004; Brennan et al. 2004).

Mud Bay Management Area

Overview

The Mud Bay Management Area comprises 149,919 feet (28.4 miles) of shoreline that encompasses the southeastern end of Lopez Island, including Boulder Island and Castle Island, and numerous small bedrock islets in Mud Bay (see Figure 1c).

The Mud Bay Management Area is extremely diverse, even by County standards. The shoreline varies from sediment-rich shorelines (such as at the southeast end of Mud Bay) that are similar to those found in Puget Sound, to steep, plunging bedrock shorelines comprised entirely of basalt. Much of the shoreline is a mix of these shoreline types; pocket beaches are common. Where sediment exists, which is primarily in Mud Bay, there are several drift cells, two of which converge at the head of Mud Bay, and the large tombolo that connects Skull Island and Sperry Point to Lopez Island.

There are several large marsh complexes in this management area. The two largest are associated with the head of Mud Bay, and the large tombolo associated with Skull Island and Sperry Point. Other smaller marsh complexes occur at the head of Watmough Bay, Aleck Bay, and Hunter Bay, as well as at a small inlet on Skull Island. The smaller marsh complexes are relatively intact, while the two larger marshes are developed at their periphery with a relatively small amount of hydrologic alteration. There is only one mapped stream in the management area. It is unnamed and discharges to Jasper Bay.

Restoration Opportunities

The tombolo associated with Skull and Sperry Point is an excellent target for restoration. Development is relatively sparse, but sizeable areas have been armored and filled. An

investigation could be undertaken to maintain access to Skull Island, while restoring predevelopment-level natural processes and improving existing habitat.

Two projects to improve nearshore functions within the Mud Bay management area were begun in 2005; however, these projects are now dormant (Habitat Work Schedule 2012). While these projects are not currently active, their completion would provide important habitat benefits. The first would remove riprap along the county road and the existing wood bulkheads on private property in Mud Bay (see Table A1 in Appendix A). The removal of these features would restore natural beach processes of Mud Bay. The Friends of the San Juans completed a feasibility analysis for this project in 2007 (Habitat Work Schedule 2012). The second project would redesign the existing beach access including the removal of a cement wall and rockery in Aleck Bay. The beach stairway was recently reconstructed by a private landowner (T. Whitman, personal communication, December 3, 2012). Other planned components to this project, including installation of a cobble and pebble berm along the upper-most beach surrounding the beach access, anchored driftwood to direct wave energy around the beach access, and the establishment of riparian vegetation at the top of the bank to provide additional habitat benefit could still be completed.

Habitat Benefits

These suggested restoration activities would increase potential forage fish spawning habitat, juvenile salmon rearing habitat, and salmonid prey species habitat as well as help restore natural geomorphic processes that are currently limiting habitat functions.

North Coast Eastsound Management Area

Overview

The North Coast Eastsound Management Area is the smallest management area with 23,249 feet (4.4 miles) of relatively highly developed shoreline on the north end of Orcas Island (see Figure 1b).

The geology of the management area is dominated by glacial outwash, providing sediment for several beaches, including North Beach and Terrill Beach. Three relatively long drift cells have been delineated in this management area. Two of these converge near the center of the management area, while the third begins at the east end of the management area and transports sediment to near Point Thompson.

There are four mapped streams in the management area; none of these streams are fish bearing. These streams are often associated with ditches and culverts, indicating that they may be a result of human activities. The nearshore freshwater runoff network is disturbed in many areas and sometimes piped, altering the natural hydrology of the management area.

There are several nearshore marshes in the management area, which are unusual in the County. In particular, a large marsh complex exists at the southeast end of Terrill Beach. This area meets the definition of pocket estuary (Beamer et al. 2003, 2005), a key habitat type for juvenile salmonids. There is also a large wetland located at the end of North Beach Road, west of the airport, that is extensively ditched.

Restoration Opportunities

The Terrill Beach marsh pocket estuary should be a focal point of restoration in this management area. Pocket estuaries are key habitat elements in the life history of Chinook salmon (Beamer et al. 2003, 2005) and they are extremely rare in the County, mostly because of the unusual geology of the islands. In particular, Terrill Beach is directly across the Strait of Georgia from the mouth of the Fraser River a source for large numbers of juvenile salmonids. Therefore, protection and restoration of these marshes should be a high priority County-wide. While the lowermost portions of the marsh are largely intact, marine riparian vegetation and the adjacent upland vegetation are largely missing. The uppermost portions of the stream channels that feed the marsh have also been heavily altered by human activities. Anecdotal accounts suggest there are periodic alterations to the connection of the marsh with the Strait (such as restoring beach dunes after large storm events to re-disconnect the pocket estuary). There are also disruptions to the tributaries to this marsh including ditched and culverted portions of the drainage that extend to Mt Baker Road and beyond. San Juan County Public Works has recently completed a project to enhance previously ditched wetlands on the Land Bank's Stonebridge-Terrill Preserve (located to the south of the pocket estuary) as mitigation for the Mt Baker Road improvement project. This mitigation project will improve the habitat functions within a significant portion of this system.

In addition to the Terrill Beach marsh, the large wetland west of the airport could also be improved. Removal of ditches in the contiguous wetland west of the airport could improve the hydrology, and thereby the ecological functions of the wetland. However, there is currently no project planned for this site.

A currently dormant project entailing the acquisition a property located on the north shore that would add approximately 0.53 acres of shoreline habitat, including 212 feet of pebble beach and tidelands (Buckhorn Road Beach Acquisition: Habitat Work Schedule 2012). An existing structure (boathouse deck) would be removed. Public access to the beach would be included as part of the project. If completed the property would become the Buckhorn Preserve (see Table A2 in Appendix A).

Habitat Benefits

The suggested improvements to the Terrill Beach marsh would improve riparian habitat, and allow the marsh to act as an estuary rather than a freshwater marsh. This would improve habitat for juvenile salmon, including ESA-listed Chinook salmon, and their prey.

The Buckhorn Road Beach Acquisition project would protect over 0.5-acre of shoreline habitat and provide for public access to a high quality beach. Public access to shoreline on Orcas Island is severely lacking; this project would notably help remedy that situation.

Olga Management Area

Overview

The Olga Management Area comprises 79,431 linear feet (15.0 miles) of shoreline and encompasses nearly all of the east shore of East Sound from Ship Bay to Obstruction Pass (see Figure 1b). The management area includes the towns of Olga and Rosario, which are

April 05, 2016



dominated by low-density residential development. The management area also includes Obstruction Island, which is sparsely developed.

The Olga Management Area has three drift cells on the Orcas Island mainland. These are relatively long drift cells, all of which terminate in Rosario Bay, Buck Bay, and the center of Obstruction Pass. Obstruction Island also has a divergence with two short drift cells emanating from it on the northwest side of the island. There is another small drift cell on the northeast side of the island.

The Olga Management Area is home to Cascade Creek, the largest (by perennial volumetric flow rate) stream in the County. Cascade Creek outlets in two locations; one is at Cascade Lake, a large, jurisdictional lake within Moran State Park that is controlled by a dam and discharges to Cascade Bay in Rosario. The mainstem of Cascade Creek discharges just east of the town of Olga into Buck Bay. The stream is habitat for many species of anadromous fish. San Juan County Public Works recently completed a restoration project on Cascade Creek, in which a culvert was replaced with a bridge on Point Lawrence Road that has substantially improved habitat conditions at the mouth of the creek (Habitat Work Schedule 2012).

In addition to Cascade Creek, there are eight other small streams (Wild Fish Conservancy 2012b). The largest of these streams drains the northeast side of Olga to East Sound. Two of the other streams are partially ditched. One is located near Griffin Rocks and the other drains to Obstruction Pass.

The largest wetlands (both historic and existing) are located surrounding Buck Bay, associated with Cascade Creek and the unnamed, but mapped stream mentioned above. Wetland complexes also exist in association with the ditched streams mentioned above.

Restoration Opportunities

Pickett Springs salt marsh is located on Pickett Springs Creek, a Type 3 stream that is culverted in two places near its confluence with Eastsound (Wild Fish Conservancy 2012b) (see Table A3 in Appendix A). One of the culverts is located under EJ Young Road. Both culverts restrict creek flow, resulting in two freshwater ponds. Replacement of the culverts with bridges or appropriately-sized box culverts would substantially improve habitat conditions at the mouth of the creek, including re-creation of a salt marsh. In addition, the existing ponds would be regraded to allow the tidal prism to extend further upstream, increasing the area of salt marsh habitat created. This project is currently considered dormant.

Habitat Benefits

Restoration of the Pickett Springs salt marsh would provide numerous habitat benefits for juvenile salmon, including ESA-listed Chinook salmon, and their prey sources. Removal of the outdated culverts would also improve access for salmonids to access the unnamed stream. Salt marsh restoration would also likely improve water quality in East Sound and benefit a variety of other species, including waterfowl and seabirds.

Private Lakes Management Area

Overview

The Private Lakes Management Area has 93,772 feet (17.8 miles) of shoreline that includes all of the privately held lakes in the County that are greater than 20 acres in size (see Figures 1a, 1b, and 1c). This includes: Sportsman Lake, Horseshoe Lake, Spencer Lake, Zylstra Lake, Roche Harbor Lake (also known as Briggs Pond), Hummel Lake, Martins Lake, Woods Lake, and Dream Lake.

The drainage basins are diverse among the Private Lakes. Some of the lakes have stream tributaries (such as Spencer Lake), while others have none (like Horseshoe Lake). There are several reservoirs (Roche Harbor Lake, Dream Lake, Woods Lake, and Martins Lake). These lakes are natural; however, the dams that regulate their discharge also affect sediment transport processes within the lakes. Many of the lakes have associated wetlands. Most are have no or relatively low level adjacent development.

No official County database exists for the shoreline modifications to lakes. Several of the rural lakes (Sportsman, Hummel, Dream, Martin's, and Spencer Lakes) have roads along their shorelines. All of the lakes have at least one overwater structure within them, with the exception of Martins Lake, Woods Lake, and Zylstra Lake. Spencer Lake has four overwater structures.

Restoration Opportunities

Several of the private lakes (Sportsman, Hummel, Dream, Martin's, and Spencer lakes) have roads along their shorelines and are actively managed. In most cases, areas adjacent to the roadway have been cleared, eliminating all riparian woody vegetation. In a few locations (e.g., Hummel and Dream lakes), fill has also been placed, altering the shoreline geomorphology. Removing the fill would have the largest habitat benefits, replacing lost shoreline habitat, but it would require costly relocation of the roadway. Revegetation, while not as beneficial as fill removal, would restore lost riparian habitat and would be relatively straightforward to implement considering that it can be done in the road right of way, which is typically under County control. There have been revegetation projects at Hummel Lake.

Habitat Benefits

Revegetation of roadways along private lakes would benefit habitat in the nearshore by providing improved food sources for trout, and increased shade that helps reduce summer water temperatures. Vegetated buffers also provide natural bank stabilization, reducing the need for fill and shoreline hardening.

Public Lakes Management Area

Overview

The Public Lakes Management Area contains 40,181 feet (7.6 miles) of shoreline that includes Cascade Lake and Mountain Lake on Orcas Island, and Trout Lake on San Juan Island (see Figures 1a and 1b). Cascade Lake and Mountain Lake are a part of Moran State Park (a small

portion of Cascade Lake is in private ownership), while Trout Lake is owned by the Town of Friday Harbor as a water-supply reservoir.

Mountain Lake and Cascade Lake each support cutthroat trout and kokanee populations. Cascade Lake contains rainbow trout and both lakes are also planted with sterile triploid trout to increase recreational fishing opportunities. Fish occurrence in Trout Lake is unknown. However, the water from this lake eventually drains into San Juan Valley Creek which provides suitable habitat for native populations of coho salmon.

No official County database exists for the shoreline modifications to lakes. However, an analysis of aerial photographs indicates that there are four overwater structures in Cascade Lake and a boat ramp at Mountain Lake. Cascade Lake has a road along its shoreline for more than one-third of a mile. Mountain Lake also has road beside it, but only for a few feet. Trout Lake is a reservoir and therefore has a dam at its outlet. Cascade and Mountain Lakes (both natural lakes) are also dammed.

Restoration Opportunities

Because these lakes are relatively undeveloped and high quality in both human and ecological perspectives, restoration opportunities are somewhat limited. However, Cascade Lake, like some of the rural lakes, does have a road along a significant length of its shoreline, some of which is on fill. This area is also not vegetated. Moving the road is likely prohibitively expensive, but restoration of a more intact riparian corridor may be possible.

For the undisturbed portions of the other lakes, it is likely that protection and conservation measures that sustain continuity across terrestrial (or upland) and aquatic habitats will be important for species and for protecting the long-term water quality of these lakes. Conservation of vegetated buffers and corridors between the lakes and other terrestrial and marine habitats should be a priority for future management.

Mountain Lake is currently on Ecology's 303(d) list of impaired waters based on a total polychlorinated biphenyls (PCB) concentration of 10 µg/kg measured in a sample of kokanee fillets collected in 2004 (Seiders et al. 2007). Further investigation should be undertaken to determine the origin of PCBs to Mountain Lake kokanee salmon.

Habitat Benefits

Existing habitat conditions in the Public Lakes Management Area generally function well due to the limited amount development throughout the management area. Revegetation of roadways along public lakes would provide many habitat benefits, including improved habitat for trout. Vegetated buffers also provide natural bank stabilization, which reduces the need for fill and shoreline hardening. Increased shading from shoreline vegetation also helps reduce water temperatures during the summer.

Roche Harbor Management Area

Overview

The Roche Harbor Management Area comprises 178,174 feet (33.7 miles) of shoreline that encompasses the shoreline between Davison Head (including the point) and Mitchell Bay (see Figure 1a). The management area includes several large bays (Westcott, Mitchell, Garrison, Open, etc.) and promontories (Bell Point, White Point, Bazalgette Point, etc.). The management area also includes many islands (Henry Island, Posey Island, Guss Island, Pearl Island, Pole Island, Barren Island, etc.) that are separated from the San Juan Island mainland and other islands by narrow passages. There are no major transportation facilities in this management area, although Roche Harbor marina is used by seaplanes and larger vessels.

There are 28 mapped drift cells in this management area. Many are only a few hundred feet long. They are most prevalent in the bays at the isthmuses associated the various tombolos in the management area.

Salt marshes are common in the management area. Significant intact salt marshes occur between Nelson Bay and Open Bay on Henry Island, between Mitchell and Garrison Bay on San Juan Island, the head of Garrison Bay, and the base of Davison Head. The marsh between the bays on Henry Island is one of the largest intact marsh complexes in the County. There are also numerous other smaller salt marshes that fringe the larger bays, but these habitat features are often altered.

There are fish bearing streams in the management area. One, Doe Creek, drains Roche Harbor Lake, and discharges to Westcott Bay while the other stream, Garrison Creek, drains to the head of Garrison Bay. There are seven other streams that are very small and not fish bearing, although one (that drains to Westcott Bay) could be if a barrier was removed.

Restoration Opportunities

Nearshore habitat such as areas protected from wave and tidal energy that maintain the conditions suitable for eelgrass growth and forage fish spawning are becoming impaired throughout the management area. These habitats have a high potential for adverse impacts from development and agriculture, including increased sediment mobilization (i.e., increased levels of turbidity and total suspended solids [TSS]) into the bays of the management area (Herrera and The Watershed Company 2011; Whitman et al. 2012). Elevated TSS levels in the water column attenuates light penetration and stresses aquatic macrophytes such as eelgrass (Herrera and The Watershed Company 2011). Identifying the specific sources of elevated TSS in Westcott Bay, and implementation of actions to reduce TSS, represent potential restoration opportunities due to the ecological significance of Westcott Bay as a historically prominent forage fish spawning area.

Garrison Creek is also a target for restoration; a restoration feasibility analysis is already underway (Wild Fish Conservancy 2012a). The stream has been culverted, deforested, and ditched along its periphery. Ideally, this project will create spawning and rearing habitat for all life stages of cutthroat, coho, and chum.

Acquiring and permanently protecting estuary shoreline habitat would provide major benefits to this management area.

Habitat Benefits

Eelgrass beds have disappeared from large areas of Westcott and Garrison Bay; monitoring is necessary to determine the cause of the disappearance of this important species, and to evaluate the effectiveness of the restoration efforts.

San Juan Channel Management Area

Overview

The San Juan Channel Management Area comprises 69,498 feet (13.2 miles) of shoreline that encompasses Friday Harbor in the south to just east of Davison Head on northeast side of San Juan Island, along the south edge of San Juan Channel (see Figure 1a). The management area also includes O'Neal Island.

Most of the shoreline is steep with very little sediment in transport alongshore. The presence of sediment does increase to the north where thin deposits intersect the shoreline in a few places. There are no mapped drift cells in this management area.

There are many mapped streams in this management area. Salmon Creek drains Beaverton Valley north and west of the Town of Friday Harbor. It empties into Friday Harbor at the Friday Harbor Laboratories owned by the University of Washington. Another stream serves as an outlet for Sportsman Lake, a jurisdictional lake in the middle of the management. Neva Lake also has an outlet that drains to the southern side of Rocky Bay. There is a small mapped, unnamed stream that drains to the head of Rocky Bay and five other small ephemeral streams in the management area. Only one wetland is mapped in this management area, and is located at the head of Rocky Bay.

Restoration Opportunities

The relatively small amount of shoreline development in the management area, both past and present, limits restoration opportunities because most of the shoreline in its predevelopment state. However, conservation can be a focus here since the development pressure in this management area is more intense than elsewhere because of its proximity to Friday Harbor. Restoration opportunities should focus on acquiring shoreline habitat near the University of Washington's Friday Harbor Laboratories (FHL) Biological Reserve near the southern extent of the management area.

Habitat Benefits

Existing habitat conditions in the San Juan Channel Management Area generally function well for the geomorphic setting due to the limited amount development throughout the management area. As stated above, conservation and shoreline acquisition projects would reduce development pressure in the management area.

Shaw Island Management Area

Overview

The Shaw Island Management Area comprises 201,546 feet (38.2 miles) of shoreline that encompasses all of Shaw Island and a collection of smaller islands that form a mini-archipelago bounded by San Juan, Upright, and Harney channels; West Sound; and Deer Harbor (see Figure 1b). The largest of the secondary islands is Crane Island, which is inhabited. Other inhabited islands include: Coon Island, Bell Island, Cliff Island, and McConnell Island.

Pocket beaches and tombolos are extremely common on Shaw Island; marine sedimentary rock that comprises Shaw Island is much more erodible than its igneous counterparts on the major islands in the County.

There are five small drift cells mapped in this management area. Two are isolated drift cells, which essentially are associated with large pocket beaches. One occurs along South Beach with significant feeder bluffs at the west end, while the other small drift cell is associated with the west side isthmus that connects Broken Point to the Shaw Island mainland. The other three drift cells occur in Blind Bay.

Restoration Opportunities

Localized development, including road construction and deforestation, may have historical and ongoing (current) impacts on water quality and beach formation. Where development like this has occurred in close proximity to Blind Bay, impacts likely affect forage fish habitat. Because Blind Bay is an important forage fish spawning area, re-establishment of vegetative and beach structure along the shoreline may be a restoration opportunity to improve forage fish habitat.

Bordering the Washington State Ferry landing on Shaw Island is a cove with a private community dock. This privately owned cove is populated by a dense eelgrass bed and the beach is flanked by rocky outcrops with a steep (10-foot high) backshore. A creosote-timber bulkhead was installed on the adjacent property to prevent erosion from ferry wakes and storm waves (Habitat Work Schedule 2012). There are no structures protected by the bulkhead and the creosote continues to pollute the cove, so removing the bulkhead is a restoration opportunity (see Table A4 in Appendix A).

Shoreline hardening, including riprap and groins, along Blind Bay Road presents another restoration opportunity in the Shaw Island Management Area (see Table A5 in Appendix A). Forage fish, including surf smelt, have been documented to spawn along the shoreline of Blind Bay near the project site. Removal of the riprap and groins along Blind Bay Road and the addition of beach nourishment will improve forage fish spawning habitat and provide protection of the road from erosion.

Habitat Benefits

These suggested restoration activities would increase potential forage fish spawning habitat and restore natural geomorphic processes at Blind Bay. In addition, juvenile salmon rearing

April 05, 2016



habitat and salmonid prey species habitat would also be enhanced. Removal of the creosote-timber bulkhead near the Washington State Ferry landing would benefit water and sediment quality, eelgrass, juvenile salmon, and a variety of benthic organisms.

Spencer's Spit Management Area

Overview

Spencer's Spit Management Area comprises 67,270 feet (12.7 miles) of shoreline that encompasses all of Upright Head, Humphrey Head, Frost Island, Flower Island, and the shorelines in between on the north end of Lopez Island (see Figure 1c). The southern extent of the management area is defined by the transition from sediment to bedrock in Lopez Sound.

The geology of the Spencer Spit Management Area is typified by sediment-rich shorelines interspersed with bedrock outcroppings. Upright Head, Humphrey Head, Frost Island, and Flower Island are all bedrock outcrops. There is a tombolo associated with Humphrey Head and an incomplete tombolo associated with Frost Island (Spencer Spit). Like all tombolos, sediment transport is convergent at the base of these features.

Extensive feeder bluffs exist to the south of Spencer Spit, though there is generally a lack of active sliding, probably a result of the relatively lack of wave energy. The other major feeder bluff, located at the promontory that separates Swift Bay from Spencer Spit, is more active, but still less active than White Cliffs on Decatur Island.

There are several large salt marsh complexes in this management area. There are marshes associated with the two tombolos (the tombolo at Humphrey Head and Spencer Spit) and also a large marsh complex at Port Stanley. These marshes vary in terms of alteration with Spencer Spit being largely intact, while the marsh at Port Stanley is ditched, and ringed by road fill. There are three mapped streams in the management area, the largest of which drains to the marsh and tide gate at Port Stanley. This stream also serves as the outlet for jurisdictional Hummel Lake. The other two streams are much smaller and both have been altered to some extent.

Shoal Bay and Swifts Bay contain estuarine habitat and eelgrass beds that are important to numerous priority species. The Friends of the San Juans recently completed two restoration projects at Shoal Bay; a creosote-timber bulkhead and concrete sidewalk were removed in 2009, and a large cement tide gate in the eastern corner of the bay was removed in 2010 (Habitat Work Schedule 2012). The removal of the concrete tide gate resulted in the reconnection of approximately five acres of coastal lagoon habitat, which is located in a conservation area. Both projects improved habitat conditions for forage fish, juvenile salmon, juvenile salmon prey sources, shellfish, and a variety of other species.

Eelgrass is documented throughout most of the management area shorelines with the most evident exception in waters adjacent to Humphrey Head and in Upright Channel. Lagoons at Spencer Spit, and in Shoal Bay and Swifts Bay, have valuable riparian habitat that provides transitional areas between upland and marine areas that benefits numerous birds, fish, and other species. Aerial photos indicate that riparian vegetation has been substantially disturbed

along segments of shoreline in Swifts and Shoal Bays, however, forest cover remains mostly intact along the shore. Preserved conditions are most evident around Spencer Spit State Park.

Restoration Opportunities

One of the largest opportunities for habitat improvement in this management area is the restoration of the stream and wetland complex at Port Stanley. Although a tide gate was replaced in 2011 that now allows for fish passage, the riparian areas fronting the wetland and stream remain highly disturbed and filled in places. The stream originating from Hummel Lake is also artificially simplified. Roads also confine and divide the habitat in this area.

Habitat Benefits

Restoration of the stream and wetland riparian areas would improve water quality by providing much needed shade as well as improve food sources for fish using the system, particularly those areas that are estuarine in nature.

Strait of Juan de Fuca Management Area

Overview

The Strait of Juan de Fuca Management Area is the largest management area in the County, with 304,647 feet (57.7 miles) of shoreline (see Figure 1a). The management area includes the southwest portion of Lopez Island and the southern shore of San Juan Island. It is bounded in the northwest by those shorelines that are protected by the Saanich Peninsula. To the southeast it is roughly divided where the shorelines become relatively protected by swell at the southeast end of Lopez Island. The management area is truncated on the southeast end of San Juan Island at Cattle Point, and it ends at the limit of bedrock on Lopez's western shore.

The geology of San Juan Island's western shore is dominated by bedrock but has numerous pocket beaches in areas where the bedrock is producing beach sediment or where glacial sediments are present. Three drift cells are mapped in this management area; two drift cells converge at the head of False Bay and another long drift cell is located in the National Park near Cattle Point on San Juan Island. There are no mapped drift cells in this management area on Lopez Island.

There are many large streams in this management area. Two of the largest streams discharge to False Bay. The largest stream, False Bay Creek (also known as San Juan Valley Creek), is extensively ditched in its lowest reaches. Aside from these two large streams, there are seven other small streams that drain from San Juan Island in this management area. There are also three small ditched streams that discharge to MacKaye Harbor and Barlow Bay in the Lopez portion of the management area.

In addition to the streams, there are two large, heavily altered, marsh complexes. False Bay is fringed by land that has been ditched and drained. While some wetland areas remain, it was likely a much larger marsh prior to development.

On Lopez Island at MacKaye Harbor, there is a large interconnected marsh in glacial drift connecting Aleck Bay, Outer Bay and MacKaye Harbor that has been ditched, drained, and

filled. Intact marsh sections remain, but the system is largely fragmented and much smaller than what was present prior to development.

The outer (western) coast of San Juan Island is mostly characterized by kelp forests. Eelgrass distribution is mostly limited to areas at the entrance of False Bay (a documented priority wetland), the shoreline from Eagle Cove to Cattle Point, and the vicinity of Sunset Point and Andrews Bay. Small isolated patches occur in areas along the shoreline between Andrews Bay and False Bay, and in small embayments of Lopez Island. Estuarine habitat is present in Davis Bay, MacKaye Harbor, and Outer Bay of Lopez Island.

Restoration Opportunities

The San Juan Islands Conservation District is evaluating marine riparian vegetation at the mouth of False Bay Creek and document creosote-treated wood in False Bay to determine if a removal project is warranted (see Table A6 in Appendix A).

A conceptual engineering design, requested by San Juan County Public Works, has been completed to replace the large riprap bulkhead supporting Agate Beach Road adjacent to MacKaye Harbor on Lopez Island with nourishment and engineered large wood debris (Herrera 2009a, 2009b). This project would restore habitat while also protecting the road.

Habitat Benefits

Improved riparian functions at False Bay would improve habitat in the bay for chum, coho, and cutthroat trout as well as juvenile Chinook salmon. An unknown amount of creosote-treated wood is present at the mouth of False Bay Creek. Removing this material would improve water and sediment quality in False Bay. It may also improve fish access to False Bay Creek.

Replacing the large riprap bulkhead supporting Agate Beach Road adjacent to MacKaye Harbor on Lopez Island with nourishment and engineered large wood debris would restore habitat while also protecting the road, and may result in portions of the beach made suitable for surf smelt spawning habitat.

Stuart Island Management Area

Overview

The Stuart Island Management Area comprises 190,029 feet (36.0 miles) of shoreline that includes all of Stuart Island and a collection of smaller islands that form a mini-archipelago bounded by Haro Strait to the west and north and Spieden Island to the south (see Figure 1a). The Stuart Island Management Area could be thought of as extension of the Gulf Islands, as they have more similarity to them in terms of lithology, climate and physical environment. Spieden Island, Johns Island, and Satellite Island are the three largest islands aside from Stuart Island in this management area. There are numerous smaller, named islands in this management area, but they are largely uninhabited.

The mapped drift cells in the Stuart Island Management Area are mostly converging drift cells associated with the heads of the major embayments (including Reid Harbor, Prevost Harbor and Johns Pass). There is also a drift along the south shore of Johns Island.

There are no mapped streams or lakes in this management area. Wetlands, where they exist are confined to steep valleys in the bedrock that define the islands. They are generally not associated with marine shorelines, except for where they are separated from marine waters by a pocket beach. The tombolo on the Stuart Island mainland at Johns Pass appears to have an associated marsh complex that has been extensively ditched (based on aerial photographic interpretation, although neither the wetland nor the ditch appears in County data).

In addition to Reid Harbor, estuarine habitats occur in Prevost Harbor and small pockets in the vicinity of Johns Pass and the northern shoreline of Johns Island. Diverse conditions allow for a mixture of eelgrass habitat (throughout Prevost Harbor, parts of Reid Harbor, and across shorelines of Stuart and Johns Islands), as well as bull kelp that occur around Spieden, Sentinel, and Cactus Islands, and intermittently around all of the main islands. Although the islands are generally well-vegetated and largely undisturbed, the shoreline on Johns Island along the pocket estuary in Johns Pass has been cleared of significant vegetation. This area may be important as it contains the only documented forage fish spawning habitat in this management area.

Restoration Opportunities

The management area has large undeveloped areas, making restoration opportunities sparse. However, the tombolo at Johns Pass on the Stuart Island mainland has a former marsh complex that has been heavily disturbed by ditching and possibly fill. Because development is sparse and is not constraining this area, it should be possible to restore natural function to these marshes.

Habitat Benefits

Existing habitat conditions in the Stuart Island Management Area generally function well due to the limited amount development throughout the management area. Restoration of the former marsh complex on the tombolo at Johns Pass would provide numerous habitat benefits, including improved juvenile salmon rearing habitat and improved habitat for a variety of shorebirds.

Turtleback Management Area

Overview

The Turtleback Management Area comprises 81,953 feet (15.5 miles) of shoreline that encompasses the sparsely populated northwest end of Orcas Island (see Figure 1a). The management area extends from the northeastern outskirts of Eastsound to just north of Steep Point. The management area includes Jones Island and Freeman Island, which are uninhabited state parks. It is bounded to the west by President Channel. There are no major transportation facilities in this management area.

There are three long drift cells in the northern portion of the management area. One is the remnant of the drift cell also included in the North Coast Eastsound Management Area. The other two have opposite orientation and constitute West Beach (in the south, with northward drift) and another embayment to the north (with southward drift).

There are seven small streams and very few wetlands in this management area. Ditching is extensive in the pocket beach areas of the north, where the few nearshore wetlands in the management area exist currently and historically. The largest stream discharges at West Beach, through a culvert. Further south, wetlands are small and runoff is generally unconfined due to the lack of upland development.

The management area does not contain estuarine habitats. However, pocket beach formations and associated nearshore wetlands, primarily along the northern half of the management area's shoreline, provide a key habitat type for Chinook and other salmon during their outmigration. Unique forest communities comprised of aspen stands occur along much of the rocky southern portion of the shoreline, an area that also contains significant rocky cliffs, and is commonly used by bald eagles. Eelgrass is common in the vicinity of North Beach at the eastern end of the management area and from Point Doughty south along pocket beaches. Kelp habitat is present near the outer extents of Points Doughty and Point Kimple and occurs sporadically along the rocky portion of shoreline farther south.

Restoration Opportunities

There is a relatively small amount of shoreline development due to the steep slopes common in the central and southern portions of the management area. Despite the lack of nearshore development, and given that most of the shoreline is bedrock, armoring of the shore is common. In some cases, though not all, the armoring merely protect a large lawn.

Due to the limited shoreline development in this management area, shoreline acquisition and protection is a priority. The Land Bank completed the purchase of a large parcel of land on President Channel in fall 2012, which includes 4,000 feet of undeveloped shoreline (see Table B16 in Appendix B). The property is in excellent condition with mature forest communities covering much of the property.

The stream mouth on West Beach has a culvert adjacent to the shoreline that presents an additional restoration opportunity. The culvert has locally modified transport of freshwater and sediment, and potentially restricts fish use further upstream. Because these resources are rare in the County, particularly on Orcas Island, removal or replacement of this culvert is an opportunity for restoration.

Habitat Benefits

The recent acquisition of the privately owned parcel on President Channel provides habitat continuity and ensure that the key ecological functions of the area remain protected from future development.

Waldron Island Management Area

Overview

The Waldron Island Management Area comprises 240,977 feet (45.6 miles) of shoreline that encompasses Waldron Island, the Sucia archipelago (as defined by the Sucia Islands, Patos Island, Matia Island, and Puffin Island) and assorted small outcroppings north of Orcas Island (see Figure 1b). With the exception of a few (typically isolated and seasonal) residences scattered on the outer islands, the only development in the management area is on Waldron Island. There are no major transportation facilities in this management area. There is a community dock at the south end of Cowlitz Bay that serves local vessel traffic.

There are four major drift cells in this management area. Two of these converge at Sandy Point. The other two diverge at a feeder bluff just south of Point Hammond.

There are no mapped streams or lakes in this management area. There are several large wetland complexes adjacent to the shoreline in Cowlitz Bay. They are typically (naturally) separated from marine waters by a beach berm, and are therefore classified as true lagoons, which are relatively rare in the Salish Sea. These types of lagoons are used extensively by shorebirds. Because of the high ecological value of these wetlands, they have been largely protected from future development by The Nature Conservancy.

Estuarine habitats are present in Cowlitz Bay and Mail Bay of Waldron Island, as well as the bays and coves surrounding the Sucia archipelago. These bays, as well as North Bay, contain eelgrass habitat that likely provides foraging and refuge opportunities for salmon and other species. The rocky shoreline along President Channel generally lacks eelgrass and is characterized by kelp. Marine riparian vegetation on the bluffs and back beaches is relatively intact overall on Waldron Island and throughout this management area, and provides habitat for bald eagles and peregrine falcons. A unique characteristic of the southern shoreline of Waldron Island is the presence of aspen stands from Point Disney to Mail Bay.

Restoration Opportunities

The small amount of development in the management area, both past and present, limits restoration opportunities because most of the shoreline is already in a relatively undegraded state. What little development there is often is properly set back from the shoreline. However, conservation could be used to add permanently protected lands to the large reserves that already exist. Also, there may be opportunities to remove mooring buoys and pilings that are no longer being used, and to replace antiquated mooring buoys with newer eelgrass-friendly designs.

Habitat Benefits

Removal or replacement of mooring buoys could benefit eelgrass communities in some cases. Acquiring and permanently protecting pocket estuaries, lagoons, and salt marshes would provide a variety of habitat benefits, including rearing areas for juvenile salmon, spawning habitat for forage fish, establishment of eelgrass beds, and habitat for waterfowl and seabirds.

West Sound Management Area

Overview

The West Sound Management Area comprises 134,521 feet (25.5 miles) of shoreline that extends from just west of Steep Point to Grindstone Harbor (see Figure 1b). The shoreline is extremely complex and includes all of West Sound and Deer Harbor. The management area also includes numerous islets within West Sound and Deer Harbor, including Fawn Island, Big Double Island, Little Double Island, Picnic Island, Skull Rock, Victim Island, and Oak Island. Some of these islands are inhabited. The area is bordered to the south by a network of passages, dominated by Harney Channel in the east. The primary ferry terminal for Orcas Island is located in Orcas Village. There is also a large bridge with significant fill across the Deer Harbor estuary near the village of Deer Harbor.

There are several mapped drift cells in the management area, most of which are associated with converging drift cells within embayments and at tombolos. Converging drift cells occur at a tombolo in Harney Channel and in White Fish Bay. There are also isolated drift cells on the east side of Deer Harbor, in Massacre Bay, and just east of Orcas Village.

There are nine small, mostly ephemeral, streams that drain to the east side of West Sound. In addition to these streams, there are number of other smaller ephemeral streams that generally drain to embayments throughout the management area. The most notable of these smaller tributary streams drains to Deer Harbor and forms a somewhat large pocket estuary there. Similar but smaller features occur near the community of West Sound, an embayment about two-thirds of a mile north of Pole Pass, just west of Orcas Island, and in Grindstone Harbor. An incomplete tombolo at Double Cove also has a marsh associated with it, but this is the extent of estuarine marshes in this management area.

Estuarine habitats include all of West Sound, Deer Harbor, and Grindstone Harbor. Eelgrass is generally limited to small pocket beaches and along the eastern shoreline of Deer Harbor extending to Pole Pass. Kelp communities occur in only a few locations, namely Caldwell Point and in the vicinity of Fawn Island in Deer Harbor. There is considerable variation in the level of disturbance to marine riparian vegetation throughout the management area. Conditions range from undisturbed forest with overhanging vegetation, to landscaped lawns abutting many of the pocket beaches. Nearshore habitat near White Beach Bay may be important transitional areas for coho and chum salmon.

Restoration Opportunities

There are numerous opportunities to restore freshwater streams discharging to the nearshore environment throughout the management area; however, probably the most significant opportunity is related to the artificial constriction at the Channel Road Bridge in Deer Harbor (Habitat Work Schedule 2012) (see Table A7 in Appendix A). Deer Harbor is a large, classic pocket estuary, which is relatively rare in the County. The Deer Harbor estuary is also the largest estuary on Orcas Island (Habitat Work Schedule 2012). The bridge and associated fill clearly restricts tidal and freshwater exchange, resulting in fine sediment accumulation and poor water quality conditions in the estuary. Opening the constriction will reinitiate predevelopment-level physical processes, expanding habitat opportunities for both juvenile

salmon, forage fish, shellfish, and shorebirds. As part of the replacement of the Deer Harbor bridge replacement project, the County is widening the mouth of the pocket estuary. The project is currently scheduled to be complete in 2017.

Historic wood waste is also a problem in Deer Harbor (Habitat Work Schedule 2012) (see Table A8 in Appendix A). During the 1960s and 1970s, a sawmill operated in Deer Harbor, leaving an estimated 2,000 cubic yards of wood waste on the shoreline. The wood waste is estimated to be between 12 and 18 inches in depth on the shoreline. Oysters are raised in the vicinity of the site, but no shellfish have been observed in areas affected by the wood waste. A sawdust burner was also located on the site; the wood waste and sediment at the site should be tested for dioxin.

Habitat Benefits

Construction of a new Channel Road Bridge and removal of the existing bridge abutments and sill is expected to restore natural geomorphic processes, including improved tidal circulation, to Cayou Lagoon within the Deer Harbor estuary. This will promote flushing of fine sediments built up in the lagoon, improve water quality, and improve habitat conditions for juvenile salmon, shellfish, and shorebirds. Restoration of marine riparian vegetation along Deer Harbor and Cayou Lagoon would also improve habitat conditions for species that utilize terrestrial prey sources derived from marine riparian vegetation (Brennan and Culverwell 2004; Brennan et al. 2004).

RESTORATION PRIORITIES

Priorities for restoration are summarized from four studies completed for and by the Friends of the San Juans between 2006 and 2012 that recommend priorities for restoring forage fish spawning beaches, previously modified shorelines, and salmon recovery. The studies present site-specific opportunities as well as programmatic approaches that identify characteristic areas as best candidates for restoration and protection. The recommendations address marine shoreline only, and are heavily weighted towards restoration of shoreline structure and functions that benefit salmonids and their prey; however, most of the recommended priority activities additionally benefit other aquatic species as well as waterfowl, shorebirds, and many terrestrial species that use shorelines and the nearshore. Brief summaries of these studies are provided here. Detailed information on methods used and more complete results are available from the original study documents. Each of these studies can be accessed at: <http://www.sanjuans.org/maps.htm> under the heading *Recent Projects and Reports*.

Soft Shore Protection/Structure Removal Blueprint for San Juan County Forage Fish Beaches

The *Soft Shore Protection/Structure Removal Blueprint for San Juan County Forage Fish Beaches* (Johannessen and MacLennan 2006a, 2006b) identifies potential forage fish spawning habitat that occurs in areas with modified shores and prioritizes them for bulkhead removal and soft shore restoration. Prioritization is applied to 51 sites located on Lopez (13 sites), Orcas (16 sites), Shaw Island (7 sites), and San Juan (15 sites). Of these sites, 31 are located on residential parcels, 1 is adjacent to a County-owned beach, and 19 are located adjacent to County-owned roads. Overall, over 80,071 square feet of intertidal habitat and 37,573 square feet of backshore habitat located in potential or documented forage fish spawning habitat are identified for restoration. The top 10 sites selected as having the highest priority are shown in Table 2, which also provides both recommended restoration actions as well as potential enhancement activities. Of these top 10 recommended projects, 1 has been completed, and 3 have been partially completed to date (see Project Status in table). Note that the inventory work completed for this project was updated in the more recent *San Juan County Shoreline Modification Inventory Restoration Opportunities Report* (Friends of the San Juans 2011); however, the priority sites identified in this report remain important sites for restoration projects.

San Juan County Shoreline Modification Inventory Restoration Opportunities Report

The *San Juan County Shoreline Modification Inventory Restoration Opportunities Report* (Friends of the San Juans 2011) uses the results of the 2009 shoreline modification inventory completed by the Friends of the San Juans (Friends of the San Juans 2009b) to prioritize restoration sites based on the presence of priority habitats and species, geomorphic shore type, and the type of modification to the shore including its size, material, condition, and

tidal elevation. The study evaluated over and in water structures (including buoys, pilings and docks) as well as nearshore structures (such as boat ramps, groins, and armoring). The study is documented in a report and mapbook covering these two categories of modifications.

The study also included a targeted outreach effort to shoreline landowners to identify those that might be interested in restoring their shoreline, to provide assistance with ways to reduce habitat impacts when owners consider repairs or replacements of existing structures, and to offer assistance with redesign or removal of existing structures.

Table 2. Top Ten Sites Ranked for Enhancement and Restoration in Soft Shore Protection/Structure Removal Blueprint for San Juan County Forage Fish Beaches.

Rank ^a	Site Name	Island	Potential Habitat Increase (Square Feet)	Recommended Restoration Activities	Recommended Enhancement Activities	Project Status
1	Blind Bay Road (S)	Shaw	5,919	Nourish Beach, Revegetate	Nourish Beach, Remove Intertidal Rock and Groins	Funding is secured and designs to rehabilitate surf smelt spawning habitat are complete.
1	Blind Bay Road (E)	Shaw	9,208	Nourish Beach and Revegetate	Nourish Beach, Remove Intertidal Rock	Funding is secured and designs to rehabilitate surf smelt spawning habitat are complete.
2	Blind Bay, Private Road (SW)	Shaw	4,806	Remove all Rock, Nourish Beach, and Revegetate	Nourish Beach, Remove Intertidal Rock	Funding is secured and designs to rehabilitate surf smelt spawning habitat are complete.
2	Blind Bay Private Road	Shaw	350	Remove all Rock, Nourish Beach, and Revegetate	Nourish Beach, Remove Intertidal Rock	Funding is secured and designs to rehabilitate surf smelt spawning habitat are complete.
2	Blind Bay Private Road (W)	Shaw	3,219	Remove all Rock, Nourish Beach, and Revegetate	Nourish Beach, Remove Intertidal Rock	Funding is secured and designs to rehabilitate surf smelt spawning habitat are complete.
3	Barlow Bay Road	Lopez	4,315	Remove Rock, Nourish Beach, Remove Debris	Nourish Beach	Rock Removal Complete ^b
4	Smuggler's Cove Road	Shaw	1,685	Setback Road, Remove all Rock, Nourish Beach, and Revegetate	Nourish Beach, Install Large Woody Debris	Beach Nourishment Complete ^b
5	West Shoal Bay	Lopez	1,665	Remove Rock Debris Covering Intertidal	Remove Rock from Intertidal	Not complete

6	Jasper Bay	Lopez	2,385	Relocate Road, Nourish Beach	Nourish Beach, Remove most Rock	Not complete
7	Deer Harbor Pool	Orcas	6,387	Remove all Concrete, Nourish Beach and Revegetate	Remove Concrete, Nourish Beach	Completed ^c
8	Aleck Bay south	Lopez	1,821	Adequate Restoration Likely not Feasible	Remove Debris	Not complete
9a	MacKaye Harbor Road South	Lopez	2,854 of recoverable backshore habitat (above MHHW)	Relocate Road, Remove Rock, Nourish Beach, and Restore Wetlands	Nourish Beach, Remove Intertidal Rock	Rock Removal Complete ^b
9b	MacKaye Harbor Road Southeast	Lopez	427 of recoverable backshore habitat (above MHHW)	Relocate Road, Remove Rock, Nourish Beach, and Restore Wetlands	Nourish Beach, Remove Intertidal Rock	Not complete
10	Deer Harbor Road (East Center)		7,411 of recoverable backshore habitat (above MHHW)	Relocate Road, Remove Rock, Nourish Beach, and Revegetate	None Provided	Not complete

Source: Soft Shore Protection/Structure Removal Blueprint for San Juan County Forage Fish Beaches (Johannessen and MacLennan 2006a, 2006b)

^a Sites with the same ranking are in the same general location.

^b Work completed by Friends of the San Juans.

^c Work completed by the San Juan County Land Bank and partners.

Of note, the study concluded that:

- The majority of shoreline modifications are from single-family development and have cumulative impacts that continue as long as the modification is present.
- There are many degraded, outdated or unnecessary shoreline structures where removal would improve habitat and habitat forming processes.
- Significant County infrastructure is located in close proximity to shorelines with consequent adverse impacts to shoreline structure and habitat functions.
- The location of most shoreline modifications is along sandy shorelines, which concentrates impacts in areas that are important for beach forming processes and that provide important forage fish spawning habitat.

The report provides detailed information on prioritization methods and their rationale. The mapbook provides the prioritized locations for the suggested restoration projects.

Salmon Habitat Protection Blueprint for San Juan County, Washington

The *Salmon Habitat Protection Blueprint for San Juan County, Washington* (Friends of the San Juans 2008) provides multiple strategies to achieving shoreline protection. The study analyzed biological, physical and land use data to identify high quality habitat sites that were at-risk of future shoreline modification. In addition, shoreline landowners were engaged through informational mailings, a shoreline landowner survey, and community workshops. Landowner willingness results from the shoreline landowner survey were then analyzed spatially with the biological, physical and land use data sets to prioritize the most important sites for protection. The study identifies a range of tools including land acquisition, conservation easements, tax incentive programs, and improved land management that can be used to assist with salmon habitat protection.

The study's results directly support strategic conservation efforts because of the detailed information provided on species, habitats, site characteristics, and landowner willingness. For example, the highest ranked shoreline sites for protection were defined as at-risk parcels with very high priority nearshore habitat values, and having a landowner with an interest in long-term habitat protection. In addition, at-risk sites with both high and medium priority habitat and landowners interested in long-term protection strategies are identified. Knowing the locations of these properties and having an indication of landowner interest can help conservation organizations target strategic acquisition of land or easements.

The Salmon Habitat Protection Blueprint results can also be used to monitor effectiveness of protection efforts over time as the computer modeling approach used allows analyses to be updated as new information becomes available. Species and habitat specific information supports development of management plans and easements that focus on the most important elements of that individual site. The Land Bank and the SJPT are both applying results to internal planning processes. Local salmon recovery efforts can also use the project results to leverage landowner interest and funding support for implementing protection of remaining, high quality nearshore habitat.

Those seeking a restoration project may be able to use the 2007 shoreline survey database, which was created to house the information returned from the shoreline property owner surveys in a user friendly manner that can be easily accessed in the future by project partners. The database has three tables linked by a common primary key. The tables are “landowner” where there is a unique record for every individual property owner who returned a survey; “surveymain” where the records contain fields to accommodate the yes/no responses to the survey; and a “comments” table which stores all comments from the returned survey forms. These three tables are linked in the order above via their parcel number. A simple menu system provides pre-designed reports for select survey questions, access to the data for viewing, and easy links to printing mailing labels. All survey results are also housed in the spatially explicit, Salmon Habitat Protection Blueprint Arc 9.2 geodatabase.

Strategic Salmon Recovery Planning in San Juan County Washington: The Pulling it All Together (PIAT) Project

The *Strategic Salmon Recovery Planning in San Juan County Washington: The Pulling it All Together (PIAT) Project* (Whitman et al. 2012) was completed for the San Juan County Lead Entity for Salmon Recovery by Friends of the San Juans, Anchor QEA and Coastal Geologic Services and a technical team of 25 local and regional experts. This document presents the latest effort to coalesce the available assessments and data bases covering San Juan County to create a tool that would prioritize protection and restoration activities for marine shorelines. The PIAT project provides a framework for prioritizing and sequencing restoration and protection actions to support the Puget Sound Chinook Salmon Recovery Plan and marine ecosystem recovery in WRIA2, and to inform the ongoing adaptive management process underway with the Puget Sound Regional Recovery Implementation Technical Team (RITT).

The PIAT project used key ecological attributes and indicators for estuarine and marine habitats from work completed by RITT. Spatial data on shoreforms and stressors as well as conceptual and analytical frameworks from the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) were also adapted and applied. The prioritization is primarily based on providing and protecting habitat for out-migrating juvenile Chinook salmon and forage fish.

PIAT project results offer both a shoreform and landscape scale approach to prioritizing salmon recovery efforts in San Juan County. Eight shoreform types were evaluated and include artificial, barrier beaches, embayment estuaries, embayment lagoons, feeder bluffs, transport zones, pocket beaches and rocky shores. Information on fish use and current degradation is provided and analyzed for each individual geomorphic shoreform in San Juan County as well as for 12 landscape regions. Four general landscape regions were identified as top salmon recovery priorities, including Waldron Island/Presidents Channel, Rosario Channel Southwest, Strait of Juan de Fuca/South Lopez and Haro Strait Northeast (Whitman et al. 2012). Figure 2 shows a summary of the shoreline regions with the highest fish use in San Juan County based on the project results (Whitman et al. 2012; Beamer and Fresh 2012). Restoration targeted to salmon recovery would be most effective if focused on those areas identified as highest priority in Figure 2.

Shoreforms Priorities for Protection and Restoration

Shoreforms were prioritized for protection and restoration based on a combination of fish use and how functional or degraded nearshore processes were. Shoreforms that ranked highest for protection were those that had fully functioning nearshore processes (no degradation) and ranked high for fish use by juvenile salmon, rearing forage fish, providing forage fish spawning habitat, or were fish transport zones. The highest count of sites and miles of shoreline ranked as the highest priority for protection were predominantly comprised of rocky shores (287 sites and 71.2 miles), followed by pocket beaches (78 sites and 3.3 miles), and transport zones (52 sites and 4.6 miles). Among both high and medium ranked shoreforms, rocky shores had the highest priority for protection.

Shoreforms prioritized for restoration were also based on fish use and the condition of nearshore processes; however, top ranked sites were those that ranked high for fish use but had low to moderate levels of nearshore process degradation. Pocket beaches ranked highest for restoration priorities (160 sites and 11.5 miles), followed by transport zones (72 sites and 7.3 miles) and rocky shores (65 sites and 18 miles). Including both high and medium rankings, pocket beaches had the highest priority for restoration.

Prioritized Salmon Recovery Activities for Landscape Regions

A summary of the prioritized salmon recovery activities for each landscape region is provided below and is taken from Whitman et al. (2012).

- **Waldron Island/President's Channel:** The top salmon recovery action for Waldron Island/ President's Channel is protection. With virtually all shorelines ranked as top or medium protection priorities, restoration of the minimally degraded sites in this region is also a top salmon recovery priority for San Juan County. The Waldron Island and Northwest Orcas sections of this region are dominated by drift cell systems, while the Sucia Island and West Orcas Island regions consist primarily of rocky shores and pocket beaches. Overall, much of this important region is intact, or has low levels of degradation, providing significant protection and feasible restoration opportunities. Sections of shoreline on Waldron and Sucia Islands may have some opportunities to enhance marine riparian vegetation, primarily along drift cell and pocket beach shoreforms. Significant public ownership exists within this landscape region, which may improve successful implementation of recommended protection and restoration efforts.

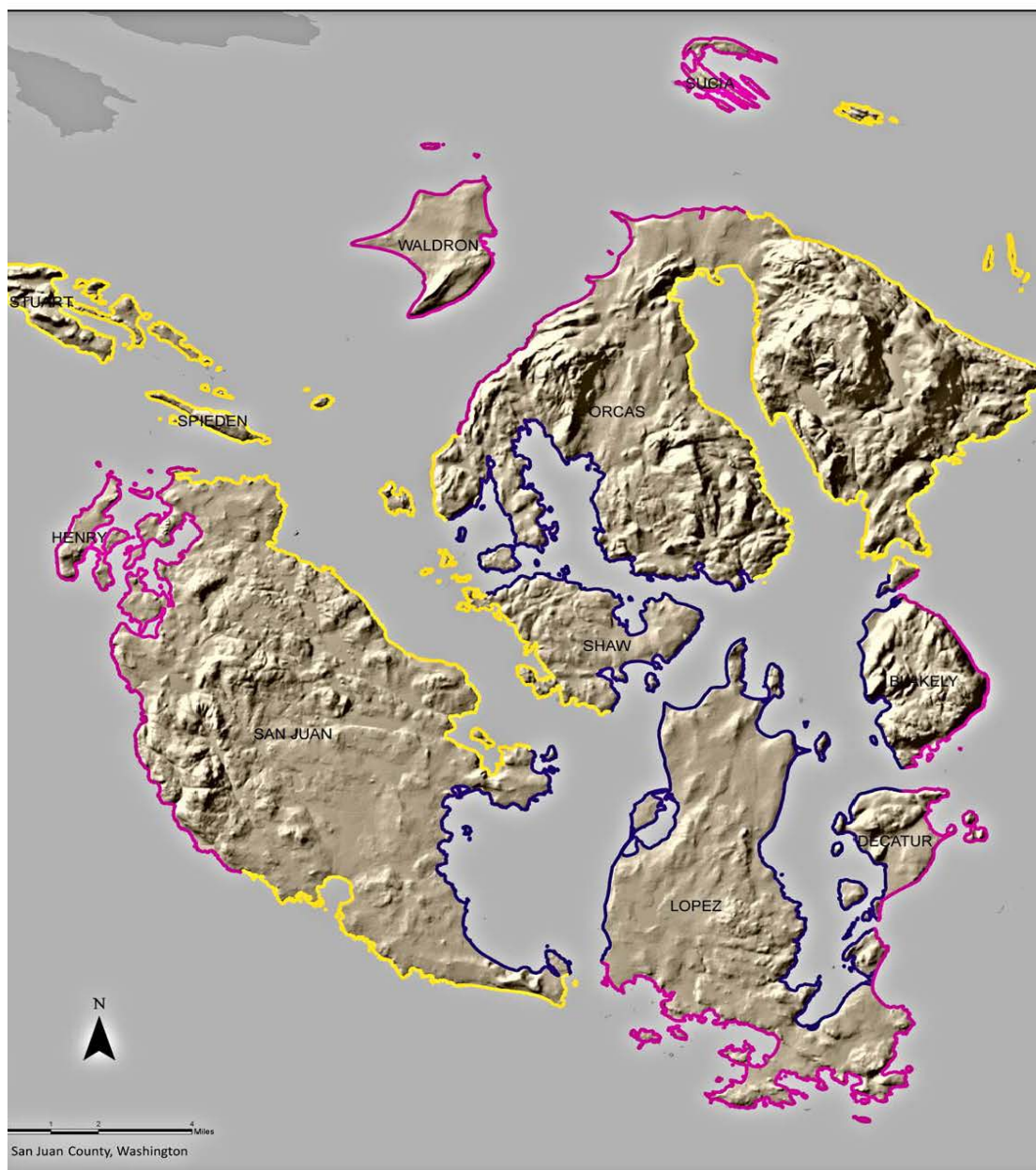


Figure 2. Priority Fish Use Regions, San Juan County, Washington

Landscape Regions (Beamer & Fresh 2012)

— HIGHEST — HIGH — MODERATE



San Juan County, Washington



Figure 2. Priority Fish Use Regions, San Juan County, Washington.

April 05, 2016



Rosario Channel Southwest: This region along the eastern edge of the county has a high percentage of high priority shoreforms identified for protection. Shoreform distribution in this area is a combination of rocky shores, pocket beaches, and drift cell systems. Nearly all of the shoreline is ranked as high or medium protection priority, with intact areas for protection at the north Blakely Island portion of the region, and areas with low degradation that are top restoration (and medium protection) priorities located to the south along East Decatur and the Southeast Lopez shore. Highly degraded shoreforms are extremely limited in this region.

- **Strait of Juan de Fuca/South Lopez:** This region has a fairly well balanced combination of protection and restoration needs. This landscape region consists exclusively of rocky shores and extensive pocket beaches. With a high percentage of high protection priority shoreforms, multiple feasible priority restoration opportunities also exist at many pocket beaches that have low degradation scores. While the majority of the region has degradation scores of zero or the low range, significant areas of highly degraded shores exist along Agate Beach, Barlow Bay, and MacKaye Harbor areas of south Lopez.
- **Haro Strait Northeast:** The primary salmon recovery need in this region is restoration. The region has very few fully functioning areas; primarily these are located on the rocky western shore of Henry and San Juan Islands along Haro Strait. This landscape region is highly diverse, with all shoreforms represented. Sites with low degradation are concentrated along rocky shores, with pocket beaches and drift cell systems (includes feeder bluffs, transport zones, and barrier beaches) identified as the most degraded. The region has the largest number of high priority restoration sites of any region in the county, mostly concentrated in the more developed areas of Nelson, Westcott, Garrison and Mitchell bays. A few scattered sites prioritized for protection also exist, on north Henry and Pearl islands.

Programmatic Restoration Opportunities

In addition to the planning-area-specific actions mentioned and summarized in the previous sections, several broad-scale programs are being implemented, or are suggested to be implemented to assist with County restoration efforts. They are described below.

Create a Neighborhood Salmon Habitat Conservation Easement

This conceptual pilot project is developing, testing, implementing, and evaluating a voluntary landowner incentive program designed to protect critical forage fish spawning habitat, juvenile Chinook salmon habitat, and habitat forming processes (Habitat Work Schedule 2012). Led by the Friends of the San Juans and the SJPT, these organizations are promoting incentives, targeted outreach, and special events as part of the pilot program to cultivate landowner interest and commitment of a 'neighborhood' or multiple landowners to protect shoreline habitat. While traditional voluntary land conservation programs have been developed and implemented for individual properties to protect current habitat conditions, this program seeks to develop a new conservation model that addresses larger issues, such as, adequate protection of forage fish and juvenile Chinook salmon habitat forming processes over the long term and providing habitat resilience in the face of climate change impacts and projected sea level rise. Conservation easements on small parcels are difficult to administer and typically lack conservation values to warrant the effort; however, by working with multiple property owners along important stretches of beach, it is anticipated that the overall habitat value of individual easements would be enhanced.

Green Shores For Homes: Incentivizing Low Impact Shoreline Development

San Juan County is partnering with the City of Seattle to test a program designed to incentivize protection and improvement of ecosystem functions and processes along shorelines of single family waterfront homes. The assessment framework, Green Shores for Homes, is based on the existing Green Shores for Coastal Development certification system developed in British Columbia (www.greenshores.ca) and the Green Shorelines guidelines developed by the City of Seattle. The City of Seattle proposes to pilot Green Shores for Homes credits and locally customized incentives on Lake Washington. San Juan County will pilot test Green Shores for Homes in rural marine locations. Implementing Green Shores for Homes simultaneously for urban freshwater and rural marine shorelines will model how other jurisdictions can protect Puget Sound from future impacts of growth. This program is being largely funded by a grant from the U.S. Environmental Protection Agency.

Remove Bulkheads on Private Property through Public Education

Slightly less than 4 percent of San Juan County's marine shorelines are armored in some way (Friends of the San Juans 2011). When rock shores are excluded the percent of armoring in the County rises to 22 percent. Although the overall percentage of shorelines with armoring is low compared to many other places in Puget Sound, oftentimes the armoring is constructed on private property in ecologically sensitive and important locations, including pocket beaches, estuaries, feeder bluffs, and drift cells. Therefore, to correct for the ecological

impacts (and the ongoing future ecological impacts) of such structures, the public must be engaged proactively. In fact, removal of shoreline armoring has been identified by the Puget Sound Partnership as a key “ecosystem pressure” on the health of Puget Sound (Puget Sound Partnership 2011a). Over 700 armored beaches were documented by the Friends of the San Juans in the County, including several of which were located on documented forage fish spawning beaches (Friends of the San Juans 2011).

This initiative would use public education and outreach to make the public aware of alternatives to bulkheads and show examples of types of shoreline protection that have less impact on nearshore ecosystem functions. The County could sponsor a demonstration project in which a bulkhead is removed and the habitat restored, or in which a bulkhead is replaced with a friendlier protection alternative. The Shoal Bay forage fish restoration project sponsored by the Friends of the San Juans is a great example of how restoration of shoreline functions can be conducted, and could be used as a model for to engage private property owners (Habitat Work Schedule 2012) (see Figure 3).

Restore Beaches along Shoreline Roadways

Numerous roadways have been constructed adjacent to shorelines throughout the County. The Soft Shore Protection/Structure Removal Blueprint for San Juan County Forage Fish Beaches (Johannessen and MacLennan 2006a, 2006b) ranks and describes several roadways in the County that are suitable for beach nourishment and nearshore restoration. Since its publication, several shorelines identified in the Soft Shore Report have been successfully restored, including Smuggler’s Cove Road (Habitat Work Schedule 2012).

Remove Derelict Piles

There are several locations along San Juan County’s shorelines with derelict wood piles (Friends of the San Juans 2011). The ecological impacts of wood piles are highly dependent on whether they have been treated and, if so, with what (for example, creosote versus epoxy paint). Therefore, they should be prioritized by those that have been positively tested for creosote. Pile locations were identified by the Friends of the San Juans (2011) and piling material was found to be predominantly treated with creosote (89 percent) (Friends of the San Juans 2011). Coordination with Washington Department of Natural Resources (DNR) could leverage local funding sources by using their piling removal program to support the clean-up efforts. Piles in areas owned by DNR should be the first priority for removal.

Before:



After:



Photos courtesy of the Friends of the San Juans

Figure 3. Shoal Bay Forage Fish Restoration Project, Before and After Restoration, Lopez Island, Washington.

Remove Groins on Private Property

There are several groins along San Juan County's shorelines that have interrupted sediment transport alongshore (Friends of the San Juans 2011). The impacts and ramifications of groins are discussed in some detail in Herrera et al. (2012). In many cases, the groins are located, predominantly, if not exclusively, on private property. Because groins affect sediment transport throughout the rest of the drift cell and encourage sediment loss offshore, they can produce significant, negative, geomorphic and ecological impacts farther downdrift. The impacts persist for long periods, even after sediment behind the groins has built up to a point where they are no longer actively storing sediment.

Removing the groins will restore natural physical processes, decrease neighbor-to-neighbor disputes, and reduce offshore loss of beach sediment. Because groins have had a tendency to incite litigation elsewhere, due to their propensity to produce unintended off-site impacts, care should be taken in discussing these issues in a large workshop setting. However, convincing groin owners to remove the structures would provide significant benefits to the nearshore environment.

Build upon Successful Existing Site-specific Restoration Projects

There are a number of existing and ongoing restoration projects throughout San Juan County. Often these projects were funded and completed because they were in areas that would leverage large ecological benefits if restored. Several of the site-specific projects identified in this plan meet this goal (See Appendix B). Other projects could be funded and implemented that follow this model of being in areas that would leverage ecological functions or are adjacent to existing restored areas and would improve habitat connectivity (Johannessen and MacLennan 2006a, 2006b; Friends of the San Juans 2008, 2011; Whitman et al. 2012).

Vegetate Shoreline Road Rights-of-Way with Native Vegetation

Many miles of roads are adjacent to marine and lacustrine shorelines throughout San Juan County. In many cases, there is a small buffer of land (typically a public right-of-way) between the roadway and the beach. These areas typically lack vegetation or have been colonized by non-native, invasive species.

It has been shown that marine riparian vegetation is essential to healthy nearshore ecosystems (Brennan and Culverwell 2004; Brennan et al. 2004; Brennan et al. 2009) and forage fish spawning success (Rice 2006). There are a few locations in the county where the roadway buffer is large enough and the ecological benefits of revegetation are significant enough to implement a project (such as the Smuggler's Cove Road forage fish habitat restoration project [Habitat Work Schedule 2012]). However, there are many roadsides in the County where the road shoulder is little more than a few feet and the ownership is complex with the tidelands typically in private ownership. In such areas, engagement with local residents is necessary; however, any revegetation would likely improve ecological conditions. Revegetation and removal of non-native invasive plant species could be implemented on public rights-of-way throughout the County. Doing so could create an opportunity to engage

the community and thereby encourage people to remove invasive plants, and plant native vegetation on their private properties.

Encourage Daylighting Natural Stream Outfalls

There are innumerable outfalls throughout the County, many of which have been installed by private landowners. There are also many outfalls associated with County roads along the shoreline. Many of the outfalls are the result of concentrating natural watercourses in a pipe or culvert, which have negative impacts on fish migration and use of the nearshore as well as nearshore water quality. The County is encouraged to identify the largest of those outfalls and assess whether daylighting the drainages for some distance would be beneficial. An example project is the recently completed Point Lawrence Road/Cascade Creek culvert replacement project on Orcas Island (Habitat Work Schedule 2012).

In cases where new development is occurring, the County should also encourage private landowners to use low-impact development techniques to treat diffuse stormwater runoff where appropriate. For larger, perennial streams, daylighting should be undertaken only under the direction of trained professionals (e.g., stormwater facility and culvert design engineers, fisheries biologists, and fluvial and coastal geomorphologists) to ensure that impacts on the environment and neighboring properties are avoided.

Encourage Reconfiguration of Piers, Docks, and Marinas to Accommodate Fish Habitat

Many of the piers, docks, and marinas in San Juan County were developed prior to the Shoreline Management Act and implementation of other land use regulations. As such, they were installed in ways that did not necessarily protect fish habitat and nearshore ecosystem processes. A re-examination of overwater structure configuration and potentially small alterations to slip geometry may have significant ecological improvements. This could take the form of an educational campaign oriented to overwater structure owners, or a re-examination could be required to take place if repairs are made to such facilities. A professional fisheries biologist should be engaged in the design of reconfigured and reconstructed piers, docks, and marina infrastructure to ensure that planned changes meet habitat restoration goals.

Support Long-Term Habitat Protection in San Juan County

San Juan County contains numerous drift cells, pocket beaches, and beaches with documented forage fish spawning. The Friends of the San Juans is working with project partners to utilize the results of ecosystem prioritizations, such as the Salmon Habitat Protection Blueprint (Friends of the San Juans 2008), to achieve long-term protection of priority nearshore habitats through acquisition or use of conservation easements (Habitat Work Schedule 2012). Funding for the project will come from project partners, including the Land Bank, funded by a one percent real estate property tax, and the SJPT, using 501c3 private donations.

This project will create new incentives for private landowners, develop targeted outreach materials and special events, and coordinate among existing and potential organizations interested in shoreline protection and restoration (Habitat Work Schedule 2012). The pilot

April 05, 2016



incentive program will be implemented in multiple drift cell and pocket beaches with documented forage fish spawning habitat in the County.

Monitor Restoration Projects

One of the primary means to ensure no net loss of ecological functions is to monitor existing and future restoration projects to determine if they are performing as designed and to evaluate the efficacy of different approaches. Whenever possible, monitoring of future restoration projects should include baseline monitoring prior to project construction, as that is critical to understanding and demonstrating the effects of restoration.

Monitoring can be accomplished in many different ways. For instance, the University of Washington and its staff often perform monitoring as part of class projects and studies. The University of Washington owns several natural areas in San Juan County, and Friday Harbor Labs is well situated to partner in monitoring projects (University of Washington 2012).

Determining a physical and ecological baseline is crucial for documenting the ecological lift of restoration projects. As such, it is recommended that all of the proposed and potential projects described above be monitored. In some cases, such as the eelgrass monitoring being conducted in Westcott and Garrison Bays, the monitoring program has been completed.

COMMUNITY RESOURCES FOR RESTORATION

The following programs, organizations, and agencies support the types of restoration projects described in this plan. Most are grant-based programs, but there are local organizations mentioned that could lead the work or serve as partners to the County to accomplish its restoration goals. This section also includes suggestions for potential County programs to obtain restoration funding.

Puget Sound Restoration Fund

The Puget Sound Restoration Fund is a Washington-based nonprofit organization. Founded in 1997, the organization is dedicated exclusively to restoring marine habitat, water quality, and native species in Puget Sound. The organization pursues restoration collaboratively with industry, tribes, government agencies, private landowners, and community groups and takes a non-activist, project-oriented, broadly inclusive approach to its work (Puget Sound Restoration Fund 2012). The organization has already completed several projects in the County, including the ongoing Pinto Abalone Recovery project, but its programs could be expanded to other locations in the County.

Alliance for Puget Sound Shorelines

The Alliance for Puget Sound Shorelines is a joint effort between People for Puget Sound, The Trust for Public Land, and The Nature Conservancy (Alliance for Puget Sound Shorelines 2012). Their goals closely align with San Juan County Shoreline Master Plan restoration goals: improving nearshore habitat and increasing public use of the shoreline in Puget Sound. They have recently acquired more than 625 acres of Puget Sound waterfront property with nearly 4 miles of shoreline, and they assisted with the acquisition of Judd Cove on Orcas Island (now owned by the Land Bank). The alliance also has completed restoration work on 54 miles of shoreline, and has an additional 55 miles of restoration actions underway. It has completed several projects in the County, and has several more underway.

Salmon Recovery Funding Board

In 1999, the Washington State legislature created the Salmon Recovery Funding Board (SRFB), which is now administered by the Puget Sound Partnership. The SRFB provides grants to protect or restore salmon habitat. Composed of five citizens appointed by the governor and five state agency directors, the SRFB brings together the experiences and viewpoints of citizens and the major state natural resource agencies. The SRFB is one of the most common mechanisms to fund shoreline restoration projects in Washington State and has funded several of the projects mentioned herein, such as, the President Channel Shoreline property acquisition, and San Juan County Neighborhood Salmon Conservation Easement program.

Aquatic Lands Enhancement Account

In 1984, the Washington State legislature created the Aquatic Lands Enhancement Account (ALEA) to ensure that money generated from aquatic lands was used to protect and enhance those lands. Aquatic lands are all tidelands, shore lands, harbor areas, and the beds of

navigable waters. ALEA grants may be used for the acquisition, improvement, or protection of aquatic lands for public purposes. They also may be used to provide or improve public access to the waterfront. The ALEA program is targeted at re-establishing the natural, self-sustaining ecological functions of the waterfront, providing or restoring public access to the water, and increasing public awareness of aquatic lands as a finite natural resource and irreplaceable public heritage. It is administered by the Recreation and Conservation Office and is funded almost entirely by revenue generated by the Washington State Department of Natural Resources' management of state-owned aquatic lands (Washington State Recreation and Conservation Office 2012).

Washington Wildlife and Recreation Program

The Washington Wildlife and Recreation Program (WWRP) is a state grant program that provides funding to protect habitat, preserve working farms, and create new local parks. It is administered by the state Recreation and Conservation Office and funded by the legislature in the state's capital construction budget (WWRP 2012).

NOAA

The National Oceanographic and Atmospheric Administration (NOAA) has numerous grant programs that fund restoration-oriented projects. The programs are often tailored to particular goals that NOAA has and can vary from year to year. However, it is likely that there are programs that would apply to the restoration goals described herein, particularly with regard to monitoring of completed restoration projects.

Puget Sound Acquisition and Restoration Program

Capital budget appropriations for Puget Sound Acquisition and Restoration (PSAR) began in 2007 as a keystone component of Governor Gregoire's launch of the Puget Sound Partnership. The initial \$42 million PSAR appropriation for the 2007-2009 biennium was matched through other sources, doubling funding to more than \$80 million for critical salmon and ecosystem recovery projects. The 2011-2013 biennium request was \$55 million dollars (Puget Sound Partnership 2011b). Three projects in San Juan County (including the Webb and Springmeyer property acquisition projects) were included in that request. It is expected that the PSAR program will increase in size over time, provided that state shortfalls do not compromise it. Therefore, it could be another mechanism for the County to achieve funding for restoration work.

Estuary and Salmon Restoration Program

The Estuary and Salmon Restoration Program (ESRP) provides grants to protect and restore the Puget Sound nearshore. The program was created by Washington Department of Fish and Wildlife to support the emerging priorities of the Puget Sound Nearshore Ecosystem Restoration Program, which was originally begun as a collaboration between the US Army Corps of Engineers and the State of Washington. All phases of project development, from feasibility through monitoring, are eligible for funding (ESRP 2011). While many of the projects funded are in estuaries of large rivers, the ESRP funds can be applied to pocket estuaries, which are common in San Juan County.

US Fish and Wildlife Service

The US Fish and Wildlife Service has grant programs that fund restoration-oriented projects. The programs are often tailored to particular goals of the agency and, as with NOAA, can vary from year to year. However, it is likely that there are programs that would apply to the restoration goals described herein, particularly projects that support protection of endangered species and critical habitats.

IMPLEMENTATION AND MONITORING

Effective implementation of restoration projects and programs may require both regulatory and non-regulatory approaches to be effective. In many cases, the restoration opportunities described herein require acquisition of or easements on private land, potential relocation of public infrastructure (predominantly roads), and extensive cooperation and coordination with citizens, private landowners, and other stakeholders. While technically feasible, many of the suggested restoration strategies are extremely challenging from a socio-political perspective and will require consensus on what needs to be accomplished and how.

Timelines and Benchmarks

Specific timelines and benchmarks for implementing individual elements of this plan are difficult to determine without additional information regarding the feasibility and cost of identified restoration measures. The County will need to develop timelines according to the general priorities described herein and emphasis should be given to areas with the greatest restoration potential.

In the context of the SMP update, restoration planning is a long-term effort. The SMP guidelines include the general goal that local master programs “include planning elements that, when implemented, serve to improve the overall condition of habitat and resources within the shoreline area” (WAC 173-26-201(c)). As a long-range policy plan, it is difficult to establish meaningful timelines and measurable benchmarks in the SMP by which to evaluate the effectiveness of restoration planning or actions. Many aspects of restoration can be highly opportunistic where one finds a willing landowner; or an event, such as a road failure due to wave induced erosion requires immediate repair, thus lending an opportunity for a more ecologically beneficial solution. Establishing timelines is further complicated by the fact that shoreline restoration is almost entirely dependent on grant funding, which is unpredictable at best.

Nonetheless, the legislature has provided an overall timeframe for future amendments to the SMP. The County is required to review its SMP once every seven years, and amend if necessary, (RCW 90.58.080(4)). During this review period, the County should document progress toward achieving shoreline restoration goals. The review could include:

- Reevaluating adopted restoration goals, objectives, and policies
- Summarizing both planning efforts (including application for and securing grant funds) and on-the-ground actions undertaken in the interim to meet those goals
- Revising the SMP restoration planning element to reflect changes in priorities or objectives

Funding

Funding sources for restoration projects and programs are identified in the report section *Community Resources for Restoration*. In addition to those outside funding sources, the County could identify some projects as part of its capital facilities planning or develop a specific restoration fund to ensure that shoreline restoration is considered during the budget process. It is expected that restoration funding will be derived from a variety of sources selected for their appropriateness to the project or program goals.

Applicants for shoreline permits may also be allowed to implement one or more of the restoration projects to fulfill project mitigation requirements.

Monitoring Strategies

The County is required to monitor the effectiveness of the SMP, including this restoration plan, over time to assess whether net loss of ecological functions and processes is occurring. This will require tracking shoreline development activities to ensure permit compliance and periodically re-assessing the ecological health and status of shoreline resources. The latter should include identifying which restoration activities have occurred compared to the stated goals, objectives, and priorities of this plan.

DATA GAPS

Monitoring Results

One of the largest data gaps found during the preparation of this plan was the lack of information on the effectiveness of past and current restoration activities in the county. Monitoring of sites has also been limited. Demonstration projects featuring environmentally friendlier shoreline stabilization alternatives (e.g., sediment nourishment, addition of stable wood, planting) used along areas currently armored with bulkheads should be implemented and monitored. Such monitoring data should then be used to educate landowners and guide future bulkhead replacement projects.

Lakeshore Modifications

The lakes in the county are large, vegetatively diverse, and nearly all are in high quality condition and their protection is important. Therefore, the detailed information collected for marine shorelines, including armoring and overwater structures (existing DNR data set for lake overwater structures is incomplete, and includes only structures on Cascade Lake), could be collected and added to the shoreline database for the lakes. This information can then be used to make informed decisions on protection and restoration opportunities along lacustrine shorelines.

Tidal Flow Data

The only reliable information for tidal current magnitude and direction within the County is provided by the Canadian government (Canadian Hydrographic Service 2010). The information is based upon numerical modeling of tidal flows. As the body of knowledge grows on ecological processes, it will be imperative to understand the dynamics of the nearshore waters in greater detail than is resolved in the Canadian work and previous investigations made by others. Therefore it is recommended that observation data be sought that broadly but more accurately characterizes tidal flow around the islands.

Climate Change

Weather

There has been an extensive amount written about expected weather related precipitation and hydrologic changes in the Olympic and Cascade mountains, and the Puget Lowland due to climate change. However, it is unclear the extent to which these predicted climate changes apply to the county. There is also no information addressing potential changes associated with the location and timing of the Olympic Mountain rain shadow, which dominates much of the county's weather.

Sea Level Rise and Ocean Acidification

Mote et al. (2008) completed a study that provided predictions of sea-level rise for Washington's Northwest Coast, Southern and Central Coasts, and Puget Sound. Predictions varied considerably between those three regions due to varying rates of vertical land movement (VLM). VLM is considered a basis for sea level rise predictions in Washington State. In the case of San Juan County, there is net tectonic uplift (Verdonck 2006), which reduces the overall effect of global sea level rise (Canning 2005; Mote et al. 2008). However, the rate and extent of VLM in the future is uncertain. Identification of sea level rise impacts on San Juan County needs continued study and remains a serious and significant data gap for restoration design. Assessment tools, such as the NOAA Sea Level Rise and Coastal Flooding Impacts Viewer (NOAA 2012) are helpful in understanding the location of potential flooding and inundation areas, but the impacts of such occurrences are speculation given the potential effect of VLM. In addition, significant and pressing effects, which need more rigorous study, may be from changes in wave energy, storm surge potential, and threats to marine species from ocean acidification.

Tide Gates

The county lacks detailed inventory information on tide gate locations, which are potential restoration sites. For instance, anecdotal reports indicate there are many more tide gates along Lopez Island's MacKaye Harbor and Barlow Bay Roads as well as other areas of the County than identified in the shoreline inventory (Herrera et al. 2013). Given the lack of a tide gate inventory for the County, the assertion is likely accurate.

GLOSSARY

Accretionary shoreform – Low-lying areas along the shoreline that consist of accumulated drift. These areas are often developed in the County.

Anthropogenic – Caused either directly or indirectly by human activity.

Archipelago – A group or cluster of islands; San Juan County is an archipelago.

Banks – Shorelines that have a steep portion less than 10 feet in height. Banks typically do not contribute a significant amount of sediment to the nearshore.

Barrier beach – A landform caused by the deposition of sediment being transported alongshore.

Bluffs – A steep bank or slope rising from the shore that are greater than 10 feet in height. Where eroding, these features typically contribute a significant amount of sediment to the nearshore.

Ditching – The act of draining perennially or seasonally wet areas through an artificial channel network.

Downdrift – In the direction of dominant, alongshore sediment transport.

(Glacial) Drift – Sediment deposited under (often marine) water during periods where the islands were close the glacial front. Sediment can be highly variable in grain size, ranging from muddy sediments to gravel.

Drift cell – An independent segment of shoreline along which littoral movements of sediments occur at noticeable rates depending on wave energy and currents. Each drift cell typically includes one or more sources of sediment, such as, feeder bluff or stream outlet that transport sediment onto a beach; a transport zone within which the sediment drifts along the shore; and an accretion area where the sediment material is deposited, including spits and lagoons.

(Glacial) Drift terrace – A prism of sediment emplaced when sea level was locally much higher than it is now. These terraces are often flat and sandwiched between bedrock outcroppings. This material from these terraces serves as the primary source for nearshore sediment in many areas in the County.

Feeder bluff – A shoreline bluff that provides significant sediment to the nearshore zone via erosion.

Fetch – The distance over which the wind blows to generate a given wave field.

Forage fish – A term for a variety of small fish species that commonly use the Puget Sound nearshore, including sand lance (*Ammodytidae* sp.), surf smelt (*Hypomesus pretiosus*), and Pacific herring (*Clupea pallasii*).

Foreshore – The steep part of the beach that is generally composed of gravel, although it can contain sand or even boulders. The foreshore on the shoreline of San Juan County typically extends from approximately 1 to 3 feet above MLLW to MHHW. It is the most sedimentologically active portion of the nearshore (Finlayson 2006).

Littoral fish – Those fish that are found in the intertidal zone, moving in and out with the tide. They include anadromous salmonids, forage fish, and many marine fish species.

Low-tide terrace – A broad, flat portion of the nearshore that extends from a few feet above to a few feet below MLLW, but seaward of the foreshore. The low-tide terrace is finer grained than the foreshore above it.

Management area – An area of shoreline typically distinguished by similar characteristics relating to the relative intensity of land use, the physical landscape and/or critical hydrogeomorphic or biological processes. Management areas are comprised of smaller units called reaches.

Marine – All oceans, seas, estuaries, and saline water body areas that are seaward of the mean higher high water mark.

Marine shoreline – the area along a coast that contains or is inundated by saline water and includes bays, spits, estuaries, bluffs, and stream and tidal deltas.

Mean higher-high water (MHHW) – The average elevation of the two high tides in each day over a tidal epoch (19 years).

Mean lower-low water (MLLW) – The average elevation of the two low tides in each day over a tidal epoch (19 years).

Mitigation – Mitigation is the process of avoiding, limiting, reducing, or eliminating the adverse environmental impacts of a project over time, and ultimately compensating for impacts that remain.

Nearshore – The nearshore generally extends from the top of a shoreline bank or bluff to the depth offshore where light penetrating the water falls below a level supporting plant growth, and extends upstream in estuaries to the head of tidal influence. The nearshore includes bluffs, beaches, mudflats, kelp and eelgrass beds, salt marshes, gravel spits, and estuaries.

Ordinary High Water Mark (OHWM) – The point on all water bodies that will be found by examining the bed and banks and ascertaining where the presence and action of water are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland as it may naturally change thereafter provided where such mark cannot be found on marine shorelines such point shall be the mean higher high tide line, and on freshwater shall be the mean high water line.

Pocket beach – A small beach that is contained between two bedrock headlands that exhibits little to no net longshore transport (Shipman 2008). Transport can be significant in a cross-shore sense.

Pocket estuary – A small estuary that forms behind spit or barrier beach landform at a submerged, tectonically- or glacially-derived valley or at a small creek delta (Beamer et al. 2003).

Restoration – The re-establishment or upgrading of impaired ecological shoreline processes or functions. It may be accomplished through measures including but not limited to revegetation, removal of intrusive shoreline structures, and removal or treatment of toxic materials. Restoration does not imply a requirement for returning the shoreline area to aboriginal or pre-European settlement conditions.

Shorelands – Lands extending 200 feet from the ordinary high water mark of floodways and contiguous floodplains 200 feet from the floodway, and all associated wetlands; or lands extending 200 feet from MHHW of marine waters.

Shoreline – In this document, the term ‘shoreline’ is synonymous with marine ‘shorelines of the state.’ These are defined in RCW 90.58 and generally include shoreline areas and all uplands within 200 feet of the shoreline edge and associated tidelands and wetlands, as defined landward by the mean higher-high water (MHHW) mark and include nearshore waters to the local government’s in-water jurisdictional boundary.

Updrift – In the direction opposite of dominant alongshore sediment transport.

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Planned Restoration Projects

Project name	Table A1. Mud Bay Bulkhead Removal		
Location	Lopez Island		
	Project sponsor		
	Project status	Study Complete: Dormant	
	Target habitat	Forage fish spawning, juvenile salmon migration	
	Current ownership	Private, SJC County	
	Zoning	Rural Farm Forest	
	Hydrogeomorphic classification	Nearshore	
	Project size	NA	
	Strategy	Restoration	
Existing conditions	Shoreline armoring, including riprap armoring along a county road and wood bulkheads on private properties have changed the natural beach processes of Mud Bay. Friends of the San Juans also completed a shoreline feasibility analysis to design and restore natural beach processes in 2007.		
Project description	The riprap along the county road and the wood bulkheads on private property would be removed. The removal of these features would restore natural beach processes of Mud Bay.		
Future threats	Increased development along Mud Bay, augmentation of the riprap along the county road.		
Project rationale	A reduction of suitable spawning habitat in documented surf smelt and Pacific herring spawning locations has also occurred. Year-round surf smelt spawning has also been documented in Mud Bay. Mud Bay’s extensive shallow water ecosystem provides important feeding and rearing habitat for juvenile salmon as well as for salmonid prey species. Due to these factors, Mud Bay was ranked by Friends of the San Juans as one of the highest priority sites for restoration.		
Functions restored	Forage fish spawning habitat, juvenile salmon rearing habitat, salmonid prey species habitat.		

Source: Habitat Work Schedule (2012)

Project name	Table A2. Buckhorn Road Beach Acquisition		
Location	Orcas Island		
	Project sponsor		
	Project status	Dormant	
	Target habitat	Beach	
	Current ownership	Private	
	Zoning	Rural Residential	
	Hydrogeomorphic classification	Nearshore	
	Project size	212 feet of shoreline, 0.53 acres	
	Strategy	Land acquisition	
Existing conditions	The project site is located at the end of Buckhorn Road on the north shore of Orcas Island near Buckhorn Lodge. The site includes a low bank with marine riparian vegetation, a pebble beach, and a boathouse deck.		
Project description	The proposed preserve (Buckhorn Preserve) would add ~0.53 acres of shoreline habitat, including 212 feet of pebble beach and tidelands. An existing structure (boathouse deck) would be removed. Public access to the beach would be included as part of the project.		
Future threats	Increased development of the Buckhorn shoreline, sale of the property to a private developer.		
Project rationale	This project would protect over 0.5 acre of shoreline habitat while improving public access to a high quality beach.		
Functions restored	Forage fish spawning habitat, marine riparian vegetation, public access to beach.		

Source: Habitat Work Schedule (2012) and Washington State Recreation and Conservation Office (2012)

Project name		Table A3. Pickett Springs Salt Marsh Restoration		
Location		Orcas Island		
		Project sponsor		
		Project status	Studies complete: Dormant	
		Target habitat	Nearshore salt marsh	
		Current ownership	Private	
		Zoning	Residential	
		Hydrogeomorphic classification	Nearshore, estuarine	
		Project size	1-acre	
		Strategy	Restoration	
Existing conditions		Two fresh water ponds have formed above a series of perched culverts, which impede tidal exchange in the creek above. The culverts also impede fish passage into the creek.		
Project description		A salt marsh will be restored by removing culverts that impede tidal exchange. In addition, the ponds and associated ditches will be dug out, allowing the tidal prism to reach upstream. The project will improve fish passage and access to prey resources, providing rearing habitat in approximately 500 feet of stream.		
Future threats		Development of the watershed and surrounding farm land, failing septic systems in the surrounding watershed.		
Project rationale		Salt marshes are highly productive nearshore environments, and provide important rearing habitat for juvenile Chinook salmon and other juvenile salmonids.		
Functions restored		Tidal exchange into a former lagoon/salt marsh, improved fish passage, juvenile salmon habitat.		

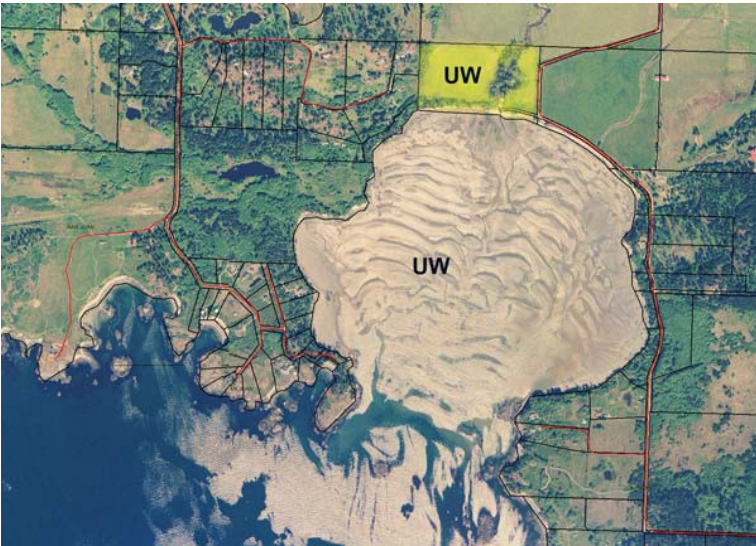
Source: Habitat Work Schedule (2012)

Project name	Table A4. Shaw Landing Creosote Bulkhead Removal		
Location	Shaw Island		
	Project sponsor		
	Project status	Studies complete Dormant	
	Target habitat	Nearshore Embayment	
	Current ownership	Private	
	Zoning	Rural Farm Forest	
	Hydrogeomorphic classification	Nearshore	
	Project size	NA	
	Strategy	Restoration	
Existing conditions	Approximately 67 creosote-treated logs were used to mitigate erosion associated with ferry wake and storm waves along a private/community dock adjacent to the Shaw Island Ferry Ramp. The creosote-treated logs were used to bulkhead the backshore to prevent additional shoreline erosion.		
Project description	The creosote-treated logs would be replaced with inert materials.		
Future threats	Continued release of creosote into the surrounding environment.		
Project rationale	Creosote is a carcinogenic compound; placement of creosote-treated wood along the shoreline creates a chronic source of contamination to the surrounding nearshore environment.		
Functions restored	Improved sediment and water quality conditions near the creosote-treated bulkhead, including eelgrass beds.		

Source: Habitat Work Schedule (2012)

Project name		Table A5. Blind Bay Forage Fish Habitat Restoration	
Location		Blind Bay, Shaw Island	
		Project sponsor	Friends of the San Juans
		Project status	Design Complete: Ongoing
		Target habitat	Forage fish spawning
		Current ownership	San Juan County
		Zoning	Rural Residential / Farm Forest
		Hydrogeomorphic classification	Nearshore
		Project size	493 feet of shoreline, 5,919 ft ²
		Strategy	Restoration
Existing conditions	Riprap and a number of groins were constructed along Blind Bay Road, which was constructed adjacent to the shoreline. This area of Blind Bay is considered protected with a maximum fetch measuring less than 2 miles. In addition, two drift cells converge at the center of the southern beach.		
Project description	Beach nourishment will be used in Blind Bay to improve spawning habitat substrate at a documented surf smelt spawning beach. Feasibility and initial design work has been completed.		
Future threats	Increased development in Blind Bay, augmentation of rip rap and groins along Blind Bay.		
Project rationale	The beaches of Blind Bay are considered valuable forage fish spawning habitat, with documented surf smelt spawning in the Bay. Beach modifications related to the construction of Blind Bay Road have degraded long stretches of shoreline.		
Functions restored	Beach nourishment will improve and expand spawning habitat for forage fish.		

Source: Soft shore protection/structure removal blueprint for San Juan County Forage Fish Beaches (2006)

Project name		Table A6. False Bay Riparian Enhancement	
Location		San Juan Island	
		Project sponsor	San Juan Islands Conservation District
		Project status	Ongoing
		Target habitat	Estuarine, riparian
		Current ownership	University of Washington
		Zoning	Natural
		Hydrogeomorphic classification	Nearshore
		Project size	~1,400 feet of shoreline
		Strategy	Restoration
Existing conditions	The mouth of False Bay Creek, which discharges to False Bay, is 95 percent covered by large driftwood logs. An unknown quantity of the driftwood is creosote-treated. Riparian vegetation at the mouth of False Bay Creek is present in relatively high concentrations and is in relatively good health.		
Project description	An assessment of the logs and driftwood covering the mouth of False Bay Creek is needed to determine if the quantity of creosote-treated wood is high enough to warrant a removal project. A hydrogeologic assessment is underway and a restoration plan identifying actions to address watershed issues is to be developed.		
Future threats	Continuing contamination of water and sediments from creosote treated wood.		
Project rationale	False Bay provides critical habitat for forage fish and juvenile Chinook salmon. The bay and potentially the creek provide habitat for chum, coho, and cutthroat trout.		
Functions restored	The proposed creosote log assessment, and potential riparian plantings at the mouth of False Bay Creek would help ensure that contaminant loading from creosote-treated wood is removed, and the ecosystem functions of the bay are protected.		

Source: Habitat Work Schedule (2012)

Project name	Table A7. Deer Harbor Bridge Replacement and Estuary Restoration		
Location	Channel Road between Deer Harbor and Cayou Lagoon, Orcas Island		
	Project sponsor	San Juan County Public Works	
	Project status	Pre-restoration studies and design completed. Final bridge design and construction ongoing.	
	Target habitat	Estuary restoration, juvenile salmon and forage fish habitat, revegetation, and fish barrier removal.	
	Current ownership	San Juan County Public Works	
	Zoning	Residential	
	Hydrogeomorphic classification	Estuarine	
	Project size	3.4 acres	
	Strategy	Restoration	
Existing conditions	In 1970, the Deer Harbor Bridge on Channel Road was replaced with a new bridge, which was constructed with abutments that reduce the channel width by 50 percent. The bridge abutments constrict flow in and out of the estuary. An artificial rock sill was also constructed under the bridge to protect the bridge pilings from scour. The sill now acts like a dam, further restricting sediment movement and tidal flow patterns. Deer Harbor is the largest estuary on Orcas Island and provides valuable habitat for juvenile salmon and forage fish.		
Project description	The Deer Harbor Bridge is nearing the end of its useful life and needs to be replaced. San Juan County Public Works has acquired grant funding to pay for the “improved bridge”, which includes increasing the spanned channel width and removing the rock sill below the bridge. These improvements will restore natural tidal flow patterns in Cayou Lagoon and reduce the on-going accumulation of fine sediment in the lagoon. The bridge replacement will entail construction of a stair-step weir to address a fish passage barrier (headcut) on Fish Trap Creek, which discharges to the Deer Harbor Estuary.		
Future threats	Additional development in the Fish Trap Creek watershed, increased water diversion from Fish Trap Creek, increased development around Cayou Lagoon.		

Project rationale	The Deer Harbor Bridge needs to be replaced, providing an opportunity to design and build a new bridge that permits a natural tidal flow regime in Cayou Lagoon. Unobstructed tidal flow will improve the water quality of Cayou Lagoon, decrease fine sediment accumulation in the lagoon, improve habitat and access for juvenile salmon, and improve shellfish habitat. The Deer Harbor Estuary is the largest estuary on Orcas Island and once supported a chum and coho salmon run in addition to native oyster beds. The estuary also has the potential to provide excellent habitat for juvenile salmon.
Functions restored	Improved water quality, sediment transport and tidal flushing of Cayou Lagoon, improved habitat and access for juvenile salmon, improved habitat for shellfish, decreased fine sediment accumulation in the lagoon, improved riparian growth, and increased shading around Cayou Lagoon.

Source: Habitat Work Schedule (2012)

Project name		Table A8. Deer Harbor Wood Waste Removal	
Location		Orcas Island	
 Michael Durland: Deer Harbor Wood Waste Removal (R09-1530) Attachment #3, Deer Harbor Boatworks property	Project sponsor		
	Project status	Dormant	
	Target habitat	Estuary	
	Current ownership	Michael Durland	
	Zoning	Residential	
	Hydrogeomorphic classification	Nearshore	
	Project size	NA	
	Strategy	Restoration	
Existing conditions	Until the 1960s and 1970s, a sawmill operated on Deer Harbor. A bulldozer was used to in the estuary to clear an area used for maneuvering logs. A sawdust burner was located on the beach on the south end of the property. Deer Harbor Boatworks now occupies the site.		
Project description	Removing the wood waste produced from the historic saw mill, which is approximately 12 to 18 deep. It is anticipated that 2,000 cubic yards of material may need to be removed.		
Future threats	Increased development surrounding Deer Harbor, maintaining existing Deer Harbor bridge, potential contaminant (dioxin) release from the wood waste.		
Project rationale	Large quantities of fine-grained wood waste left over from the historic sawmill limits natural ecosystem functioning in the affected areas and should be removed.		
Functions restored	Restoration of native clam and oyster beds, improved habitat for juvenile salmon and forage fish.		

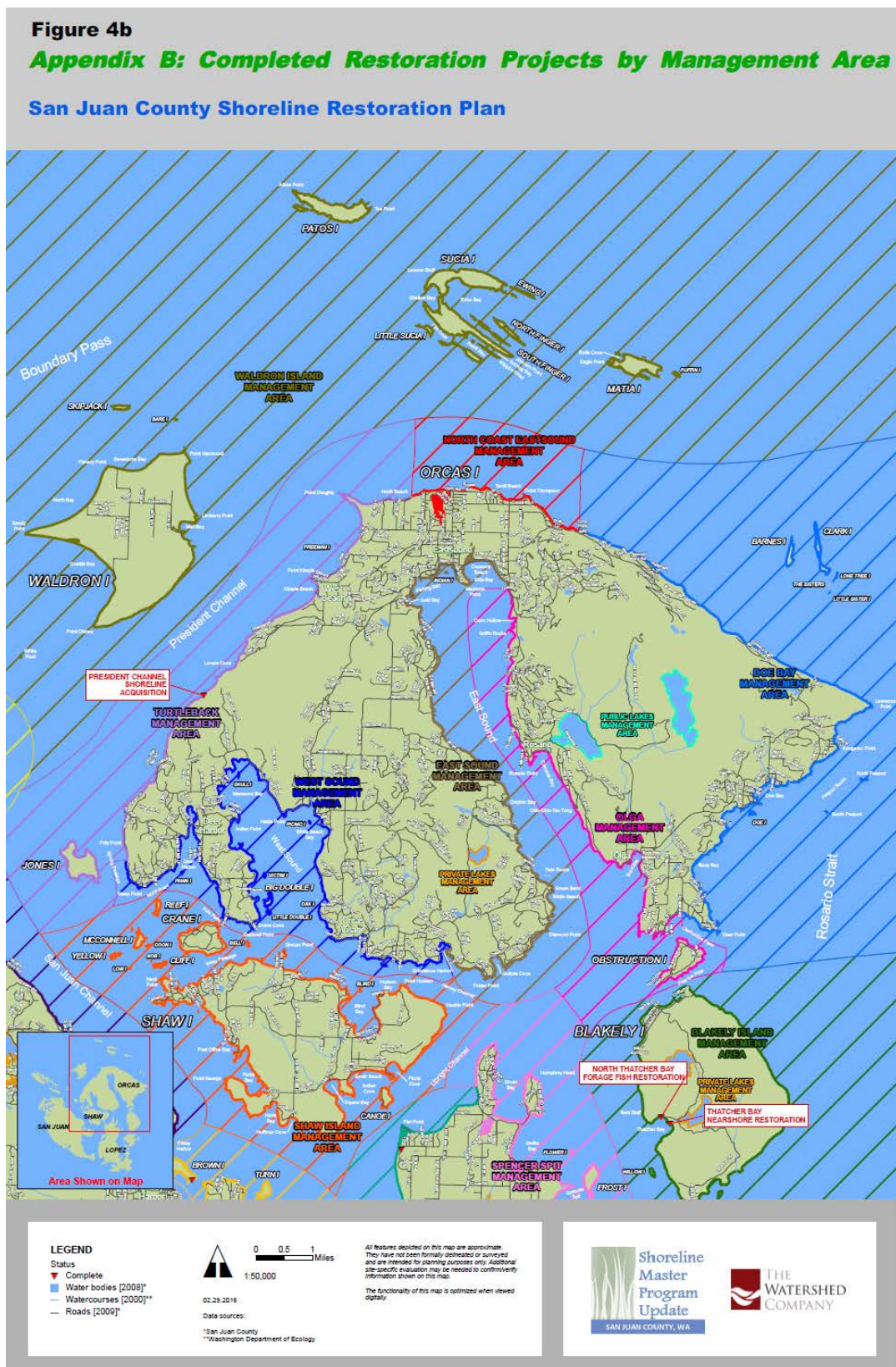
Source: Habitat Work Schedule (2012)

Completed Restoration Projects

FIGURE 4A. COMPLETED PROJECTS BY MANAGEMENT AREA



FIGURE 4B. COMPLETED PROJECTS BY MANAGEMENT AREA



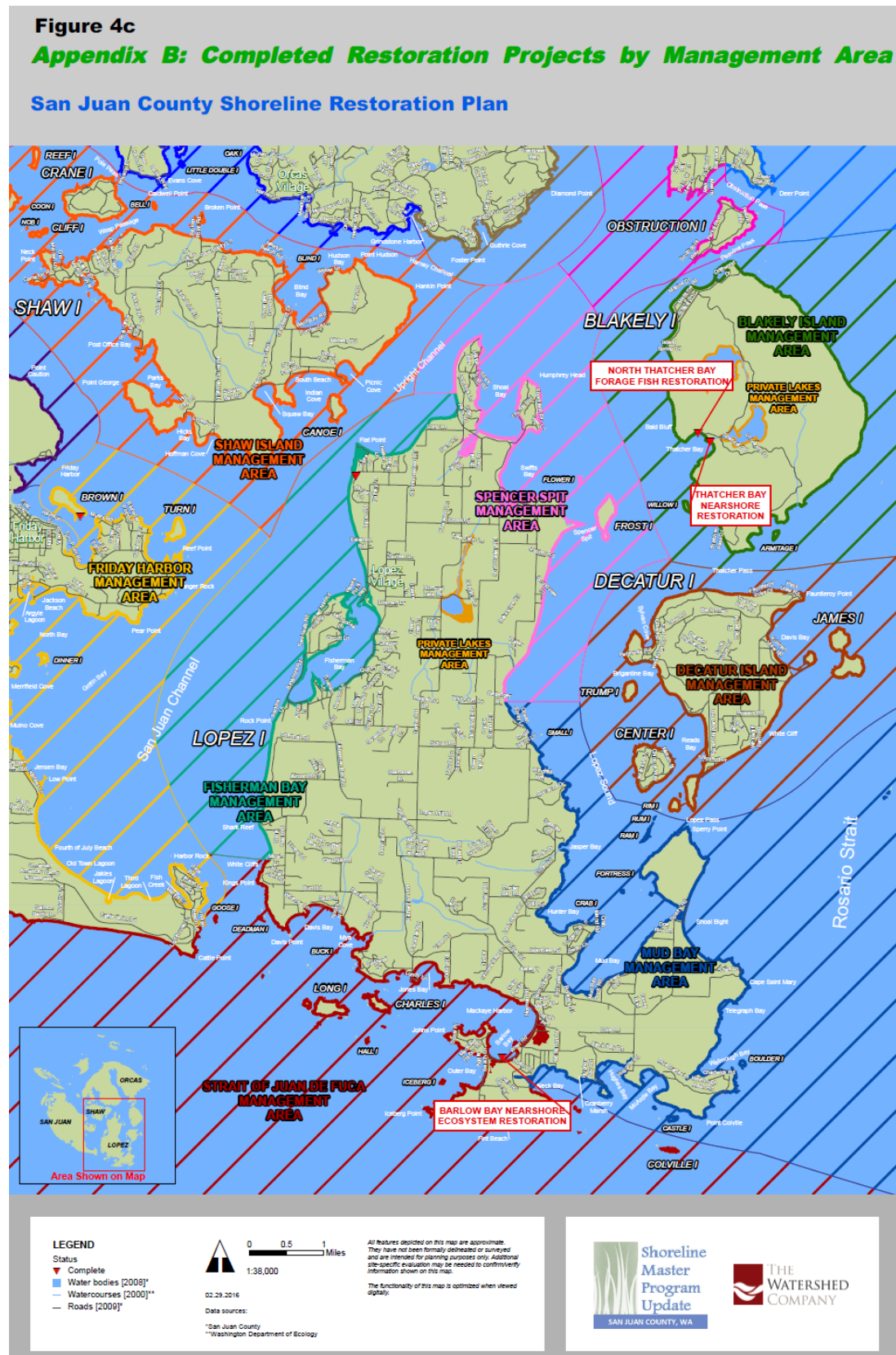
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Shoreline Restoration Plan—San Juan County

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FIGURE 4C. COMPLETED PROJECTS BY MANAGEMENT AREA



Project name	Table B1. Thatcher Bay Nearshore Restoration		
Location	Thatcher Bay, Blakely Island		
	Project sponsor	Skagit Fisheries Enhancement Group	
	Project status	Completed Dec. 2015	
	Target habitat	Nearshore Embayment	
	Current ownership	Blakely Island Trust	
	Zoning	Rural Farm Forest	
	Hydrogeomorphic classification	Nearshore, estuarine	
	Project size	1.8 acres	
	Strategy	Restoration	
Existing conditions	An historic sawmill operated in Thatcher Bay from 1879 to 1942; sawmill activities resulted in the accumulation of large quantities of wood waste in the intertidal and subtidal areas of the bay.		
Project description	Approximately 12,900 cubic yards of wood waste-contaminated material was removed from the beach at an elevation of approximately 8 feet MLLW to -8 feet MLLW. The project site was backfilled with clean sediment suitable for forage fish spawning after the wood waste is removed.		
Future threats	Development of the surrounding shoreline, timber harvest in the Spencer Lake/Creek watershed.		
Project rationale	The large accumulation of fine wood waste in Thatcher Bay alters the substrate and causes anaerobic decomposition of the organic material, resulting in elevated levels of sulfide (a toxic byproduct) in the intertidal sediments. Removal of the wood waste will improve habitat for forage fish, juvenile salmon, and benthic biota.		
Functions restored	Forage fish spawning habitat, improved habitat for benthic biota, and the establishment of intertidal flora and fauna such as eelgrass.		

Source: Habitat Work Schedule (2012)

Project name		Table B2. North Thatcher Bay Forage Fish Restoration Project	
Location		North Thatcher Bay, Blakely Island	
		Project sponsor	Friends of the San Juans
		Project status	Completed in November, 2013.
		Target habitat	Forage fish and juvenile salmon habitat
		Current ownership	Private
		Zoning	Rural Farm Forest
		Hydrogeomorphic classification	Nearshore, pocket beach
		Project size	1 acre
		Strategy	Restoration
Existing conditions	A large, degraded log handling and beach access facility sat directly on a documented surf smelt spawning beach in Thatcher Bay. The structure negatively impacted backshore, beach, and intertidal habitats and coastal processes important to a variety of fish species. Also, there were over 20 creosote piles and dolphins in the Bay.		
Project description	This project rehabilitated a known surf smelt spawning beach and restored overhanging marine riparian vegetation, creating a future large woody debris source. Existing fill material was removed, including concrete debris, steel cables, and boulders on the beach adjacent to the ramp. Future activities include restoration implementation, and education/outreach and dissemination.		
Future threats	Development of the Thatcher Bay area, increased logging and road construction in the surrounding watershed.		
Project rationale	There is a high probability of use by juvenile salmon, surf smelt, and sand lance in Thatcher Bay. This project restored forage fish spawning habitat and improve nearshore marine habitat for juvenile salmon and salmon prey by removing historic logging armoring, fill and beach debris from intertidal habitat. This project will also restore natural beach conditions through the use of beach nourishment and shoreline regrading.		
Functions restored	Enhancement of forage fish spawning habitat through removal of intertidal beach debris, improved intertidal habitat conditions for juvenile salmon, forage fish, and other fish species.		

Source: Habitat Work Schedule (2012)

Project name		Table B3. Brown Island Historic Feeder Bluff Restoration	
Location		Southeast shore of Brown Island	
	Project sponsor		Friends of the San Juans
	Project status		Completed December 2015
	Target habitat		Upper beach habitat and nearshore
	Current ownership		Private
	Zoning		Single Family Residential
	Hydrogeomorphic classification		Feeder Bluff
	Project size		4,000 sq. ft.
	Strategy		Restoration
Existing conditions		Along the southeast shore of Brown Island near Friday Harbor, is a small drift cell with a historic feeder bluff that is currently armored across multiple private properties. The wave energy is limited making it an excellent site for full bulkhead removal. The historic feeder bluff is 14 to 18 ft high. Dense high strength till deposits in the lower bank are very resistant to erosion. The upper bank deposits consist of glaciomarine drift composed of pebbly, sandy, silt and clay. The area is mostly forested with native, second growth species.	
Project description		The primary goals of the Brown Island Historic Feeder Bluff Restoration project are to restore nearshore processes, improve upper beach habitat and provide a demonstration project for shoreline managers and landowners through removal of unnecessary shoreline armoring. Short-term objectives: Restore sediment supply from a historic feeder bluff within a small drift cell. Restore potential forage fish spawning habitat. Improve habitat conditions for juvenile salmon and salmon prey. Demonstrate that removal of hard armoring can be compatible with private, residential development. Demonstrate the role of upland vegetation and surface water management in controlling shoreline erosion. Educate decision-makers, managers and planners about alternatives to hard armoring through site visits and landowner testimonials. Educate shoreline property owners and land use professionals (builders, realtors) about alternatives to hard armoring through site visits and landowner testimonials.	
Future threats		Continued requests for shoreline armoring by private property owners and lack of demonstration sites to showcase alternatives.	
Project rationale		Over the long term, this project will reduce demand for new shoreline armoring in San Juan County and increase demand for beach restoration through armor removal, where feasible. It will also increase capacity of county planners and managers to evaluate, refine, or deny proposals for shoreline armoring.	
Functions restored		Restoration of the feeder bluff uncovered potential forage fish spawning habitat, and restored coastal processes such as upper intertidal and back shore sediment, sediment source, littoral drift, and detritus potential and recruitment. Removal of the rock also allows for expansion of marine riparian vegetation onto the lower bank face and increase the connectivity of the vegetation into the littoral/nearshore system. This enhances insect and organic material delivery into the nearshore benefiting outmigrating juvenile salmon.	

Source: Habitat Work Schedule (2012)

April 05, 2016



Shoreline Restoration Plan—San Juan County

6

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Project name		Table B4. Eelgrass Distribution Monitoring in Westcott and Garrison Bays	
Location		San Juan Island	
	Project sponsor		Friends of the San Juans
	Project status		Completed December 2015
	Target habitat		Eelgrass
	Current ownership		Public
	Zoning		NA
	Hydrogeomorphic classification		Nearshore
	Project size		NA
	Strategy		Monitoring, eelgrass restoration
Existing conditions		Eelgrass habitat has declined throughout San Juan County due to a variety of factors, including modifications of the nearshore environment. Monitoring was conducted to assess the success of eelgrass transplanting in Westcott and Garrison Bays.	
Project description		Friends of the San Juans completed underwater video monitoring at Westcott Bay and Garrison Bay. The underwater video monitoring results will be used to improve habitat protection.	
Future threats		Increased development of Roche Harbor and the surrounding watershed and the associated impacts on water quality and the nearshore environment.	
Project rationale		This project will help monitoring eelgrass beds along San Juan Island, and will provide additional data regarding the causes and extent of eelgrass habitat declines.	
Functions restored		Expansion of eelgrass beds, improved habitat for Pacific herring and juvenile Chinook salmon.	

Source: Habitat Work Schedule (2012)

Project name	Table B5. Webb Property Acquisition	
Location	San Juan Island	
	Project sponsor	San Juan Preservation Trust, San Juan County Land Bank, and The Conservation Fund
	Project status	Completed December 2013
	Target habitat	Marine riparian, eelgrass, estuarine
	Current ownership	Private
	Zoning	Rural Farm Forest
	Hydrogeomorphic classification	Upland, nearshore
	Project size	76 acres
	Strategy	Preservation via Acquisition
Existing conditions	Located on Westcott Bay in San Juan Island, the Webb property is the largest unprotected shoreline parcel remaining on the bay. The property includes approximately 2,800 feet of shoreline and encompasses much of lower Doe Creek, including its terminus into Westcott Bay. A dock and commercial oyster operation is located on the shoreline; the rest of the shoreline is undeveloped. The Webb property is also located next to English Camp, which is a large tract of land that is part of San Juan Island National Historical Park owned and operated by the National Park Service and is largely managed as a natural area.	
Project description	The Webb property, located on Westcott Bay was bought and can no longer be subdivided into 15 lots. Westcott Bay provides important eelgrass habitat in San Juan County; acquisition of this property is expected to provide a variety of benefits to the Bay.	
Future threats	Increased development on the Westcott Bay shoreline, and increased water diversion of Doe Creek.	
Project rationale	Westcott Bay contains some of the most important eelgrass habitat in the County. Protection of the undeveloped shoreline and the lower section of Doe Creek provide a unique opportunity to protect nearshore ecosystem functioning on San Juan Island.	
Functions restored	This project protected one of the few remaining parcels on Westcott Bay with minor shoreline development. English Camp is also located immediately south of the Webb property, which provides an opportunity to coordinate shoreline protection over a larger area.	

Source: Habitat Work Schedule (2012)

Project name		Table B6. Barlow Bay Nearshore Ecosystem Restoration	
Location		Barlow Bay, Lopez Island	
	Project sponsor	Friends of the San Juans	
	Project status	Completed February 2014	
	Target habitat	Forage fish spawning, juvenile salmon migration	
	Current ownership	San Juan County Public Works, Tulalip Tribes	
	Zoning	Rural farm forest	
	Hydrogeomorphic classification	Nearshore estuarine	
	Project size	150 sq ft + piling removal	
	Strategy	Restoration	
Existing conditions	A derelict dock, creosote pilings, and other shoreline debris were located on the beach of Barlow Bay. Rock armoring was also placed alongside a roadway bulkhead; approximately 150 square feet of intertidal beach had been covered by the degraded rock armoring.		
Project description	The derelict dock, creosote pilings, and degraded rock armoring in Barlow Bay were removed, improving water quality, intertidal, and beach conditions in the bay. Improvements in water quality will benefit juvenile salmon, salmon prey, and shellfish. Removal of rock armoring on beach restores forage fish spawning habitat.		
Future threats	Development, additional rock armoring along adjacent road.		
Project rationale	MacKaye Harbor (including Barlow Bay) is identified as priority nearshore habitat due to the presence of juvenile salmon and forage fish spawning habitat documented in the area, including surf smelt and pacific sand lance. This project increases forage fish spawning habitat and improves the water quality in Barlow Bay.		
Functions restored	Improved water and sediment quality from the removal of creosote pilings, improved forage fish spawning, shellfish, and juvenile salmon habitat.		

Source: Habitat Work Schedule (2012)

Project name		Table B7. President Channel Shoreline Acquisition	
Location		Orcas Island	
	Project sponsor		San Juan County Land Bank
	Project status		Project Completed in the Fall of 2012
	Target habitat		Marine riparian vegetation
	Current ownership		San Juan County Land Bank
	Zoning		Forest Resource
	Hydrogeomorphic classification		Nearshore
	Project size		19.61 acres/ 2,500 feet of undeveloped shoreline
	Strategy		Land acquisition
Existing conditions	President Channel provides habitat for large numbers of juvenile Chinook salmon as they migrate to the open ocean, including 4,000 feet of undeveloped shoreline on the western side of Orcas Island. The desired parcel encompasses approximately 19 acres and 2,500 feet of shoreline. The property is in excellent condition; it is largely forested with mature Douglas firs, Pacific madrone, and shore pine.		
Project description	This project sought and received SRFB funding to purchase the property. This project was completed during preparation of this report.		
Future threats	Development of the private property and removal of the largely intact marine riparian area.		
Project rationale	Large numbers of juvenile salmon (including ESA-listed Chinook salmon) travel though President Channel as the migrate to the open ocean; acquisition of the property will protect a large section of shoreline, including excellent marine riparian habitat. In addition, a DNR school trust land property is located to the south with an additional 1,500 foot of undeveloped shoreline with mature forest. The San Juan County Land Bank will work with DNR to obtain ownership and permanently protect this property as well, now the private property acquisition is complete.		
Functions maintained	Valuable shoreline that provides important habitat for juvenile Chinook salmon is now permanently protected from future development.		

Source: Habitat Work Schedule (2012)