SHORELINE RESTORATION PLAN

City of Bainbridge Island

Prepared for
City of Bainbridge Island
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July 2012

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City of Bainbridge Island

Prepared for
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EXECUTIVE SUMMARY

This restoration plan serves as a science-based guide for the City of Bainbridge Island to achieve island-wide improvements in ecological functions of degraded shoreline areas as required by WAC 173-26-201(2)(f). This plan describes opportunities for restoration covering all of Bainbridge Island.

The plan identifies existing, site-specific, restoration activities discussed previously in the public record, some of which are in various stages of implementation, as well as several proposed opportunities that specifically address ecological deficiencies identified in the 2011 Addendum to the Summary of Science (Herrera 2011). Those proposed opportunities are all located on public land.

The proposed, site-specific, restoration actions are grouped by management area, an established delineation set forth in the island's original shoreline characterization work completed by Williams et al. (2004). This plan describes, in general, the types of projects to be implemented within each management area to improve the City's shoreline ecological functions.

This plan also includes recommendations for land conservation through fee acquisitions or easements, property owner education programs, and programmatic activities that support shoreline restoration, such as mitigation banking and derelict pile removal programs. Although not discrete restoration projects, such strategies are included in this plan because, as most of the shoreline of Bainbridge Island is in private ownership, they are considered fundamental to the recovery of shoreline ecological functions on the island. Finally, this document describes partnering and grant opportunities that could facilitate implementation of the restoration plan.

This plan was constructed based on Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) guidance and methodologies for identifying, assessing, and prioritizing restoration actions. PSNERP's restoration strategies are process-based and aimed at restoring damaged or degraded ecosystems. Process-based restoration involves making intentional changes to an ecosystem to allow erosion, accretion, tidal exchange, accumulation of wood debris, and other natural process to occur. Process-based restoration is expected to deliver benefits to the diverse array of species that rely upon nearshore ecosystems in a manner that is sustainable and reduces the need for future interventions at the restored site.

Although PSNERP did not identify specific projects on Bainbridge Island, the approach advocated by PSNERP of identifying those areas where human activities have altered geomorphic processes was used throughout this document. In addition, the restoration priorities identified by PSNERP will be used by the City to identify future additional strategic opportunities for restoring nearshore ecosystem processes.

PURPOSE AND INTENT

The purpose of this restoration plan is to improve degraded areas of the shoreline environment of Bainbridge Island 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 and enhance shoreline areas identified and prioritized in this plan for improvement.

This plan serves as a science-based guide for the City of Bainbridge Island to achieve island-wide improvements in ecological functions of degraded shoreline areas as required by WAC 173-26-201(2)(f). This plan identifies and prioritizes where improvements can be most effective; identifies existing and ongoing restoration projects; and includes education and outreach activities to encourage shoreline restoration by individual shoreline homeowners. The plan is intended to describe opportunities for restoration for all of Bainbridge Island, not just the city. The following information is provided in this document for use as a basis for shoreline restoration planning:

- Identification of degraded areas and opportunities for restoration that will improve shoreline functions for the future
- Identification of development that is harming shorelines
- Opportunities for protection and conservation
- Identification of programmatic restoration strategies, as well as general restoration activities, that could be applied to any candidate shoreline within the city

A summary of ongoing and proposed restoration projects in the city is provided in Appendix A. A summary of completed restoration projects in the city is provided in Appendix B.

Scope and Context

This plan describes restoration opportunities and programmatic strategies to improve ecosystem functions along the marine shorelines of Bainbridge Island. The island has approximately 53 miles of marine shoreline, which includes bays, spits, estuaries, bluffs, and stream and tidal deltas (Williams et al. 2004). Marine 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 ordinary high water mark (OHWM) and nearshore waters to the local government's in-water jurisdictional boundary.

This plan's success depends on the involvement of a number of government, tribal, and non-profit organizations, in addition to the City of Bainbridge Island, that are stewarding and restoring land on the island. They include, for example, Bainbridge Island Metropolitan Park and Recreation District (BIMPRD), Bainbridge Island Land Trust, the Suquamish Tribe, and the Puget Sound Restoration Fund.

This plan also relies on preservation of ecological functions on remaining undeveloped parcels to offset ecological losses from ongoing 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 and restoration projects.

Educational opportunities represent an unusual aspect of this restoration plan. Because most of Bainbridge Island shorelines are privately owned and are developed with single family residences, homeowner education is viewed as an essential strategy for maintaining and improving ecological conditions along the shoreline. As detailed in the Addendum to the Summary of Science (Herrera 2011), the largest stressors on the ecological health of the island are cumulative impacts from private development that was/is completed without adequate protection for shoreline ecological functions. Reduction and removal of such impacts will be more common and effective with an educated shoreline populace.

The following sections describe the relationships between this restoration plan, and City regulations, plans, ongoing programs, and broader regional goals that have been identified for the restoration of Puget Sound.

State Shoreline Master Program

The 2010 Washington Department of Ecology Shoreline Management Plan Guidelines (Ecology 2010a) require the development of a shoreline restoration plan as part of the shoreline management plan (SMP) update process. This plan reflects the findings of the shoreline inventory and characterization work completed for the City of Bainbridge Island and supports the goals, policies, and regulations of the City'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 city achieve no net loss with potential for improvement over time. As such, this plan serves as a technical companion to the SMP to improve degraded and impaired shoreline resources.

This plan, in conjunction with the SMP policies and regulations, is designed to satisfy Ecology's SMP requirements for shoreline restoration planning. It provides a planning-level framework for understanding how and where shoreline ecological functions can be restored in the city. This plan also describes how future restoration activities can be integrated with existing and ongoing restoration efforts including: the region-wide effort to restore Puget Sound spearheaded by the Puget Sound Partnership and the West Sound Watersheds Council, and the work of several non-profit organizations (including Bainbridge Island Land Trust, Puget Sound Restoration Fund, and People for Puget Sound), as well as private citizens. In addition, community partnerships, collaborations, and willing landowners are key to implementing the many recommended restoration actions.

City Comprehensive Plan

The City of Bainbridge Island completed an update to its comprehensive plan in 2004 (City of Bainbridge Island 2004). The comprehensive plan update motivated several studies that have provided information used for this restoration plan (for example, EDAW|AECOM 2008). The comprehensive plan goals are broadly consistent with planned activities mentioned herein, particularly the first two guiding principles of the comprehensive plan, which are: 1) preserve the special character of the land and 2) protect fragile water resources.

Bainbridge Island Metropolitan Park and Recreation District Comprehensive Plan

The BIMPRD comprehensive plan identifies restoration as an important component of conserving the public shoreline areas of Bainbridge Island parks. The BIMPRD comprehensive plan has many policies that support resource conservation and coordination with public agencies and non-profit groups to conserve, preserve, and protect wildlife habitat, natural areas, and open spaces, including shorelines and waterfronts (BIMPRD 2009). Some of the suggested restoration actions developed herein are intended to assist BIMPRD with conceptual planning for projects that support its comprehensive plan and can be used as a tool for developing park plans under the SMP.

City Water Quality and Flow Monitoring Program

The City's Water Quality and Flow Monitoring Program conducts status and trends monitoring in both freshwater and marine nearshore environments island wide in order to assess current water quality conditions and discern apparent trends. The results of this monitoring help guide the prioritization and optimization of water resources protection and restoration efforts in the City. Typical monitoring activities include:

- Monthly status and trends monitoring
- Targeted storm event sampling (every 5 years)
- Sediment sampling (every 5 years)
- Automated continuous flow and precipitation monitoring

The Water Quality and Flow Monitoring Program also engages in special water quality monitoring projects such as targeted basin-wide illicit discharge detection and elimination, and joint-agency shoreline survey pollution identification and correction.

City Stormwater Management Program

The City's Stormwater Management Program (SWMP) is a comprehensive program plan designed to reduce or eliminate pollutant discharge from the City of Bainbridge Island's municipal storm sewer system in order to restore and protect beneficial uses of the waters of the state. This program addresses the conditions of the City's municipal stormwater permit (aka. NPDES Phase II). Typical activities of the program include:

- Implementing the Road Maintenance Manual and the Stormwater Pollution Prevention Plan, which outlines goals and objectives for protecting water quality and also establishes best management practices (BMPs) for conducting municipal operations. Examples of water quality operations include cleaning of catch basins, and maintaining water quality vaults and stormwater control facilities.
- Training and educating City staff in recognizing and reporting illicit discharges, construction inspection, and municipal housekeeping practices
- Conducting surveys and outreach activities designed to engage and inform the public and the business community regarding water quality protection issues and to effectively focus education efforts
- Contracting with the Kitsap Conservation District to provide expertise to farmers, animal hobbyists, and other agricultural entities on water quality protection measures, including BMPs for soil management, animal waste handling and storage, pasture management, and irrigation
- Providing the Mutt Mitt program that allows individuals, neighborhood groups and businesses to obtain and maintain dispensers for dog waste pick up bags to preserve their neighborhood water quality
- Offering Business Technical Assistance Visits to local businesses and commercial properties to identify sources of pollutants transported by stormwater and provide information on good housekeeping practices that prevent pollutant discharges
- Providing Household Hazardous Waste Collections to citizens as an avenue to dispose of unwanted waste and eliminate dumping
- Conducting outfall reconnaissance during dry weather to evaluate the water quality of outfalls discharging to the shorelines and to pursue pollutant elimination
- Conducting investigations of illicit discharges and pollutant sources to allow the city to eliminate such sources of pollutants
- Regulating water quality and quantity impacts of development, redevelopment and construction through Municipal Code compliance, including inspecting sites under construction and requiring erosion control and reduction of sediment deposition to waterways
- Encouraging Low Impact Development (LID) through a guidance manual adopted with the latest Municipal Code update
- Requiring stormwater facilities to be operated and maintained appropriately in perpetuity
- Cooperating with Kitsap Public Health District to conduct surveys of the City's shorelines to evaluate water quality

Broader Puget Sound Restoration Goals

This plan seeks to establish a basic framework for improving the quality and sustainability of the city's shoreline resources over time in a collaborative and cohesive manner. This overarching goal is consistent with the Shoreline Management Act and with the Puget Sound Partnership's regional strategy for restoring Puget Sound.

The Washington legislature directed the Puget Sound Partnership to coordinate and lead the regional restoration effort. In 2008, the Partnership developed an "Action Agenda" that describes the steps needed to restore the Sound by 2020. In identifying specific restoration goals and objectives that the Action Agenda must achieve, the legislature described the characteristics of a healthy and restored Puget Sound as follows:

- A healthy human population supported by a healthy Puget Sound that is not threatened by changes in the ecosystem
- A quality of human life that is sustained by a functioning Puget Sound ecosystem
- Healthy and sustaining populations of native species in Puget Sound, including a robust food web
- A healthy Puget Sound where freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained
- An ecosystem that is supported by ground water levels, as well as river and stream flow levels, sufficient to sustain people, fish, and wildlife, and the natural functions of the environment
- Fresh and marine waters and sediments of a sufficient quality so that the waters in the region are safe for drinking, swimming, shellfish harvest and consumption, and other human uses and enjoyment, and are not harmful to the native marine mammals, fish, birds, and shellfish of the region.

This restoration plan seeks to achieve those same goals by contributing to the Puget Sound restoration effort and to the specific strategies being developed by the Partnership as part of the 2020 Action Agenda. This plan is also intended to be compatible with the restoration goals already developed by other restoration planning entities working within the city.

In addition to being compatible with the Puget Sound Partnership goals, this plan used Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) guidance and methodologies for identifying, assessing, and prioritizing restoration actions described herein. PSNERP's restoration strategies are process-based and aimed at restoring damaged or degraded ecosystems. Process-based restoration involves making intentional changes to an ecosystem to allow erosion, accretion, tidal exchange, accumulation of wood debris, and other natural process to occur. Process-based restoration is expected to deliver benefits to the diverse array of species that rely upon nearshore ecosystems in a manner that is sustainable and reduces the need for future interventions at the restored site.

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Restoration Plan Objectives

- Encourage and facilitate cooperative restoration and enhancement 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 requirements 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, bull trout, and other species and/or populations for which a recovery plan is available.
- Seek funding for various restoration actions and programs from local sources and by working with the BIMPRD and other jurisdictions in Water Resource Inventory Area (WRIA) 15 and stakeholders to seek federal, state, grant and other funding opportunities.
- Continue to develop and implement the City's Shoreline Stewardship Program as a public education program to inform private property owners in the shoreline jurisdiction and in the remainder of the city about the effects of land management practices and other unregulated activities (such as vegetation removal, pesticide/ herbicide use, car washing) on fish and wildlife habitats.

Restoration Policies

The following policies will guide the City's restoration activities:

- **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 and/or enhance physical and biological ecosystem-wide processes that create and sustain shoreline habitat structures 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 and/or processes.

- **Policy 3**. Target restoration and enhancement actions to improve habitat requirements 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 Puget Sound Salmon recovery planning, West Sound Watershed planning, and WRIA 15 watershed management planning.
- **Policy 5**. As feasible, include provisions for shoreline vegetation restoration, fish and wildlife habitat enhancement, and low impact development techniques in projects located within the shoreline through project mitigation and incentive-based restoration.
- **Policy 6**. Seek funding from state, federal, private, and other sources to implement restoration and enhancement, and to provide support to restoration work, by identifying shoreline restoration priorities and organizing information on available funding sources for restoration implementation.
- **Policy 7**. Encourage restoration and enhancement projects by developing project permitting and processing guidelines that will streamline the review of restoration-only projects.
- **Policy 8**. Identify and encourage the use of tax incentive programs, mitigation banking, grants, land swaps, or other programs, as they are developed, to encourage restoration and enhancement of shoreline ecological functions and to protect habitat for fish, wildlife, and plants, provided that mitigation sequencing is maintained.
- **Policy 9**. All shoreline restoration and enhancement projects should avoid adverse impacts on existing saltwater critical areas, fish and wildlife habitat conservation areas, water quality, and flood holding capacities.
- **Policy 10**. Shoreline restoration and enhancement projects are intended to restore or enhance a shoreline in conjunction with shoreline stabilization, recreational enhancement, and aquatic habitat creation or restoration, and shall not be utilized to create new land area along the shoreline below the OHWM or to raise the elevation to create dry upland areas.
- **Policy 11**. Supplementary beach nourishment should be encouraged where existing shoreline stabilization is likely to increase impoverishment of existing beach materials at or downdrift from the project site, and should be coordinated with an island-wide shoreline restoration plan.
- **Policy 12**. Shoreline stabilization should incorporate beach restoration or enhancement in accordance with the restoration provisions of this plan.

METHODS

Information Sources

Analysis and conclusions presented in this plan are based on data collected during two site visits to Bainbridge Island, a virtual tour of all of the island's shorelines during a meeting of interdisciplinary Herrera staff, and a review of existing information and observations.

The site visits occurred on February 19 and 21, 2011. The visits accessed the shoreline at public access points and within public road rights-of-way. Lynwood Center, Port Blakely Park, and Strawberry Plant Park were visited between 3:00 PM and 4:30 PM on February 19. Those visits occurred during a neap tide, but close to a lower low tide of 3.36 feet mean lower low water (MLLW) that occurred at 11:42 AM. Various locations along Eagle Harbor Drive, Crystal Springs Drive, and Manitou Beach Drive were visited between 11:00 AM and 4:00 PM on February 21. Also visited during that time were Williams-Olson Park, Fay Bainbridge Park, Pritchard Park, Fort Ward Park, and Gazzam Lake Park, including the beach on the former Close property. Like the earlier site visits, neap tide conditions were present with a lower low tide of 0.96 feet MLLW occurring at 1:06 PM. All tidal heights were those observed at Seattle (NOAA 2011).

A workshop was held with a Herrera geomorphologist, fisheries biologist, and plant ecologist to determine additional site-specific projects and strategies for restoration. During the workshop, the entire marine shoreline was examined using Google Earth and the Washington Coastal Atlas (Ecology 2010b). Herrera identified projects based upon geomorphic setting, existing ecological conditions, and land ownership. The identified projects were also cast in terms of existing natural resource assessments performed or contracted by the City of Bainbridge Island.

A variety of information sources were also examined and used to identify and evaluate possible restoration actions. They include peer-reviewed literature describing the shoreline processes most negatively affected in the city and publically available materials regarding the historic character of the shoreline. Also included were a variety of maps and plans prepared by the City and its collaborators to guide future restoration efforts. Most important were databases of restoration actions proposed and completed by local groups, including the Habitat Work Schedule website (2011), 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. A complete list of information sources used is included in Appendix D.

Identification of Management Area Boundaries

Management areas provide a scientific context for organizing restoration activities by like environments. They also facilitate preparation of a coherent strategy for a given area.

Management area boundaries were used from the most recent Bainbridge Island shoreline characterization report (Williams et al. 2004), which was based upon earlier characterization work (Williams et al. 2004). The following management areas are addressed in this plan and are shown on Figure 1:

- Agate Passage
- Port Madison Bay
- Rolling Bay – Point Monroe
- Murden Cove
- Eagle Harbor
- Blakely Harbor
- Rich Passage
- Point White – Battle Point
- Manzanita Bay

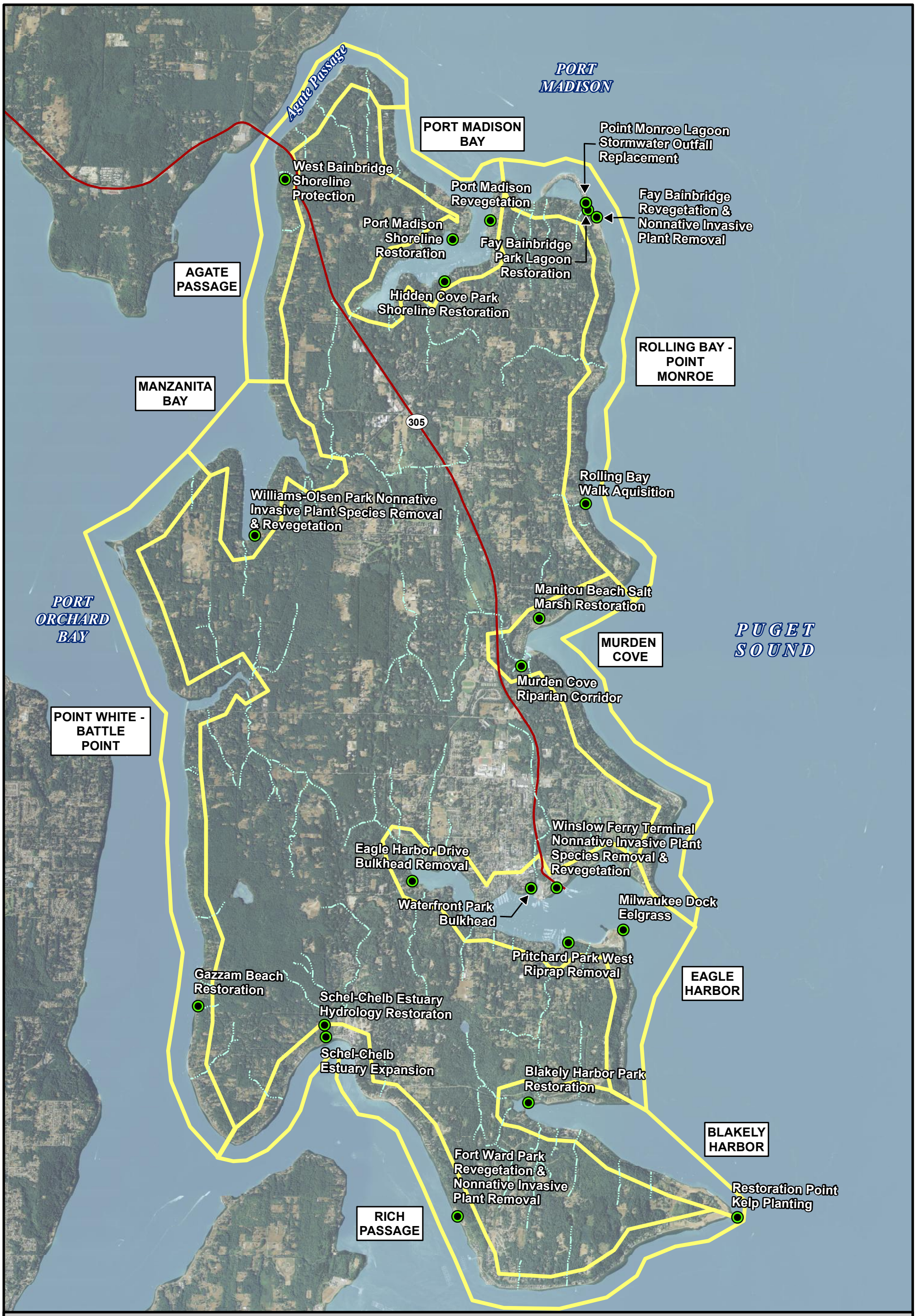
Selection of Restoration Opportunities

Restoration opportunities were identified for each management area from a list of restoration projects obtained from City documents, and from the sources described in the *Information Sources* section and listed in Appendix D. Many of the sources (such as from the Habitat Work Schedule website) target habitat requirements of priority species, including Chinook salmon and forage fish. Restoration opportunities were selected that integrated with the larger-scale restoration objectives of the Puget Sound Partnership and the City of Bainbridge Island (see Restoration Plan Objectives and Policies subsections above). Finally, new proposed restoration sites were selected based on the following site characteristics:

- 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 abandoned infrastructure (e.g., relict piers and docks) where removal would necessarily 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 riparian vegetation, beach and eelgrass 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.



Legend

- Restoration/Preservation Site *(Click on restoration/preservation site locations to review specific projects)*
- Management unit
- Stream
- Highway

Figure 1. Management area boundaries, City of Bainbridge Island, Washington.

N

0 2,000 4,000 8,000 Feet

HERRERA

Aerial: USDA (2009)

K:\Projects\10-04851-000\Project\Site_Map.mxd

- 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.

The following types of restoration actions were considered in this plan:

- **Removal of deleterious structures, fill, soil, and infrastructure** – There are many places around the island that have fill and structures associated with abandoned industrial activities on the shoreline. Because the impacts from such past activities often continue to impair the nearshore ecosystem and even contribute to ongoing pollution, removal can increase ecological function and have positive environmental benefits into the future.
- **Native revegetation and non-native plant species removal** – Native vegetation plays a key role in the health of the nearshore ecosystem (Brennan et al. 2009). Vegetation on many of the island's shorelines has been altered significantly, and many areas are dominated by non-native plant species. Removing non-native species and revegetating the shoreline is a key way to restore these lost functions.
- **Beach nourishment** – Some of the island's shorelines are critically impaired with regard to sediment supply (Herrera 2011). Beach nourishment with appropriately sized sediment is a simple way to minimize the impact of the extensive bulkheading around the island. While beach nourishment can have negative ecological impacts if done improperly, properly-designed nourishment projects can have ecological benefits well beyond the sediment placement area.

Protection of existing shoreline functions via property or easement acquisition is included as a restoration strategy in this plan because it 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 degradation of an important sediment source for a 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** – While most of the island's shorelines are developed, there are some properties that are either under-developed or undeveloped. Acquiring such properties can provide habitat continuity 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.

Since most of shorelines within the city are privately owned and already developed, education is included as a key restoration strategy. 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 activities.

- **Educational programs** – Because of the extensive development of the Bainbridge Island shoreline by individual landowners, landowner education on the implications of their land-use activities is an essential strategy to ensure no net loss of ecological function. The types of property owner restoration activities considered highest priority are identified within each management area discussion.

Prioritization of Restoration Opportunities

Twenty-two restoration opportunities within the city were analyzed to prioritize their ecological benefits and feasibility. Data sheets for each of the potential restoration projects are linked to the management area map and are summarized in Appendix A.

To set priorities for individual restoration opportunities, Herrera used a simple rating system. The rating system was first implemented by the City of Kirkland (The Watershed Company 2009) but was modified to reflect the existing data and field observations incorporated from MacLennan et al. (2009) and Borde et al. (2009). In addition, ecological features and processes (such as sediment supply and loss of pocket estuarine habitat) deemed most at risk by the Addendum to the Summary of Science (Herrera 2011) were included in the rating method in place of other ecological attributes not relevant on Bainbridge Island. Also included were some measures of the complexities associated with each restoration project, such as its constructability and ease of obtaining permits from agencies. For each restoration opportunity, it was assumed that the project would be fully built out, incorporating all of the recommendations from the project sheet.

Note that the ecological benefit and feasibility measures assigned in this plan should be evaluated for each project prior to its start in order to verify conditions documented in this plan and potentially modify restoration activities.

Assumptions and Limitations

The following assumptions were made for this plan:

- Site-specific restoration actions were confined to those that could occur exclusively on public land, except where private properties had been specifically identified as target restoration sites by other public documents. In reality, there are a significant number of actions that could be taken that would improve nearshore ecological conditions on private land, but they would require landowner permission. Potential actions on private land are generally described in the *Programmatic Restoration Opportunities* section.

- Two former state parks on the island (Fort Ward and Fay Bainbridge) are now owned and managed by BIMPRD. The park sites present excellent restoration opportunities because they are in public ownership and there have been numerous alterations to the environment that could be easily corrected (such as removing fill from marsh areas at Fay Bainbridge).
- All projects would benefit from an assessment by qualified and licensed professionals to determine project feasibility and the best ways to plan and implement restoration activities.

RESTORATION OPPORTUNITIES AND PRIORITIES

Restoration opportunities were identified and prioritized using the procedures described in the *Methods* section for each management area, and the results are detailed within the individual management area discussions in this section. Some of the opportunities more directly aid the nearshore ecosystem than others. The Addendum to the Summary of Science report highlights the importance of pocket estuaries, as a key ecological environment crucial to the recovery of salmonid populations (Herrera 2011). In addition, the addendum (Herrera 2011) describes the large impact that sediment starvation has had on the character of shorelines throughout the island, and the loss of predevelopment geomorphic conditions. Therefore, projects that directly addressed those types of losses to ecological productivity were ranked higher than projects that addressed other deficiencies.

Table 1 summarizes the results of the prioritization of restoration opportunities. The sums in each category (ecological and feasibility) provide a quantitative comparison of the projects, with higher numbers representing more ecological gain and easier implementation. Because the projects often have differing goals (improvement in water quality, restoration of sediment supply, etc.), the outcomes of each project must also be considered when making comparisons. Nevertheless, the numeric values provide a general way to estimate the ecological benefits and feasibility of each project. Consistent with the ecological priorities identified in the Addendum to the Summary of Science (Herrera 2011), those projects that improve sediment supply, restore predevelopment geomorphic conditions, and expand estuarine habitat score highest. Those projects that only enhance the riparian corridor or only preserve a portion of the shoreline score much lower. Typically, the highest-rated projects from an ecological perspective are also the hardest to implement.

Table 1. Evaluation of Restoration Opportunities and Priorities for Ecological Benefits and Feasibility.

	Agate Passage	Port Madison Bay			Rolling Bay / Point Monroe				Murden Cove		Eagle Harbor						Rich Passage				Pt White / Battle Pt	Manzanita Bay
Evaluation Criteria	**West Bainbridge Shoreline Protection**	**Port Madison Revegetation**	**Port Madison Shoreline Restoration**	**Hidden Cove Park**	**Rolling Bay Walk**	**Fay Bainbridge Lagoon**	**Fay Bainbridge Revegetation**	**Point Monroe Outfall Replacement**	**Manitou Beach Marsh**	**Murden Cove Preservation**	**Eagle Harbor Drive**	**Pritchard Park West Riprap**	**Waterfront Park**	**Winslow Ferry Terminal**	**Milwaukee Dock Eelgrass**	**Blakely Harbor**	**Schel-Chelb Expansion**	**Schel-Chelb Hydrology**	**Restoration Point Kelp**	**Fort Ward Revegation**	**Gazzam Beach**	**Williams-Olson Park**
Enhances native riparian/aquatic vegetation (no=0, yes=1)	0	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1
Ensures predevelopment geomorphic processes (no=0, some=1, completely=2)	2	0	1	1	1	2	2	1	1	2	1	1	1	0	1	2	1	1	1	1	2	1
Reduces shoreline armoring (no=0, yes=1)	0	0	1	1	1	0	0	1	1	0	1	1	1	0	0	1	0	0	0	0	1	0
Reduces overwater or in-water structures (no=0, yes=1)	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Expands estuarine marsh areas (no=0, yes=1)	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0
Proximal to intact shorelines (no=0, yes=1)	1	0	0	1	1	1	0	1	0	1	0	1	1	0	0	1	1	1	0	0	0	1
Reduces risk to future impacts (no=0, yes=1)	1	0	1	0	1	0	0	1	1	1	0	0	0	0	0	1	1	1	0	0	1	0
Improves water quality (no=0, yes=1)	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	1	1	1	1	0	0	0
Increases sediment supply (no=0, yes=1)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Ecological Total	**4**	**1**	**4**	**5**	**6**	**6**	**3**	**7**	**6**	**4**	**3**	**4**	**4**	**2**	**2**	**10**	**6**	**5**	**3**	**2**	**6**	**3**
Access and/or constructability (poor=0, average=1, good=2)	1	2	1	1	1	2	2	1	1	1	2	0	1	2	0	0	1	1	0	2	1	0
Regulatory requirements (many=0, some=1, none=2)	2	2	1	1	1	0	2	1	1	2	1	1	1	2	1	0	2	0	1	2	1	1
Project cost (high=0, average=1, low=2)	0	2	1	1	0	0	2	1	0	1	1	1	0	2	1	0	1	0	1	2	0	1

Table 1 (continued). Evaluation of Restoration Opportunities and Priorities for Ecological Benefits and Feasibility.

	Agate Passage	Port Madison Bay			Rolling Bay / Point Monroe				Murden Cove		Eagle Harbor						Rich Passage				Pt White / Battle Pt	Manzanita Bay
Evaluation Criteria	**West Bainbridge Shoreline Protection**	**Port Madison Revegetation**	**Port Madison Shoreline Restoration**	**Hidden Cove Park**	**Rolling Bay Walk**	**Fay Bainbridge Lagoon**	**Fay Bainbridge Revegetation**	**Point Monroe Outfall Replacement**	**Manitou Beach Marsh**	**Murden Cove Preservation**	**Eagle Harbor Drive**	**Pritchard Park West Riprap**	**Waterfront Park**	**Winslow Ferry Terminal**	**Milwaukee Dock Eelgrass**	**Blakely Harbor**	**Schel-Chelb Expansion**	**Schel-Chelb Hydrology**	**Restoration Point Kelp**	**Fort Ward Revegation**	**Gazzam Beach**	**Williams-Olson Park**
Maintenance requirements (many=0, some=1, none=2)	2	1	1	1	2	2	1	1	1	2	2	2	1	1	2	1	2	1	1	1	1	2
Improves public access or recreational opportunities (no=0, yes=1)	1	0	0	1	1	0	0	0	1	1	1	1	1	0	0	1	1	0	0	0	1	1
Ease of funding (difficult=0, average=1, easy=2)	1	2	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1
Feasibility Total	**7**	**9**	**5**	**6**	**6**	**4**	**8**	**5**	**5**	**8**	**8**	**6**	**5**	**8**	**5**	**3**	**8**	**3**	**5**	**8**	**5**	**6**

Notes:

Average access and/or constructability is one that could be accessed relatively easily via a dirt road; good means a paved road.

Project cost is taken relative to all of the projects being discussed.

Average funding is one where the project would likely have at least one funding source, easy means that there are numerous potential funders.

Restoration Opportunities in Each Management Area

The following subsections summarize the general approach to restoration for each management area and provide a framework for selecting other restoration activities beyond the opportunities identified in Table 1. The restoration opportunities identified were tailored to the limiting factors identified in Bainbridge Island Nearshore Habitat Characterization & Assessment, Management Strategy Prioritization, and Monitoring Recommendations (Williams et al. 2004), the Bainbridge Island Nearshore Assessment: Summary of the Best Available Science (Williams et al. 2003), and the more recent City of Bainbridge Island Addendum to the Summary of Science Report (Herrera 2011). In order to better guide future restoration projects in each management area and provide a summary of the results of the following sections, Table 2 summarizes the types of restoration actions that are best suited to each management area. More details on specific restoration opportunities within each management area provided in Appendix A.

Table 2. Preferential Type of Restoration in Each Management Area.

Management Area	Preferred Restoration Activities
Agate Passage	Protection of existing shoreline processes (acquisition and easement)
Port Madison Bay	Removal of deleterious structures, fill, soil, and infrastructure, Native revegetation and non-native plant species removal
Rolling Bay / Point Monroe	Removal of deleterious structures, fill, soil, and infrastructure, Protection of existing shoreline processes (acquisition)
Murden Cove	Protection of existing shoreline processes (acquisition)
Eagle Harbor	Removal of deleterious structures, fill, soil, and infrastructure
Blakely Harbor	Removal of deleterious structures, fill, soil, and infrastructure
Rich Passage	Beach nourishment, Native revegetation and non-native plant species removal
Point White / Battle Point	Beach nourishment
Manzanita Bay	Protection of existing shoreline processes (acquisition and easement)

Agate Passage Management Area

Overview

The Agate Passage Management Area comprises 19,495 feet of shoreline along Agate Passage and around Agate Point (Figure 2). The management area comprises two drift cells with northerly alongshore drift that converge at Agate Point. The southern boundary of the first drift cell begins at a divergence zone north of Manzanita Bay and moves along the western shoreline along Agate Passage, encompassing a long stretch of shoreline with actively eroding

feeder bluffs. The smaller second cell begins at a divergence zone located just southeast of Agate Point on the western shore of Port Madison, and also includes a small area with feeder bluffs. Relative to wave exposure, shorelines are considered "semi-protected" along Agate Passage and "protected" along Port Madison (Williams et al. 2004). There are no major watersheds in the management area.

Overhanging riparian vegetation is greater in Agate Passage than in any other management area on Bainbridge Island, and the riparian zone is much more intact. Shoreline development, like on much of the rest of the island, is primarily residential in nature. Despite the relatively intact riparian corridor, the management area has among the highest densities of shoreline structures on Bainbridge Island (City of Bainbridge Island 2011). The most widespread structures are stairs, a typical feature for shoreline access along the high bluffs common in this area, followed by overwater structures, such as docks and piers.

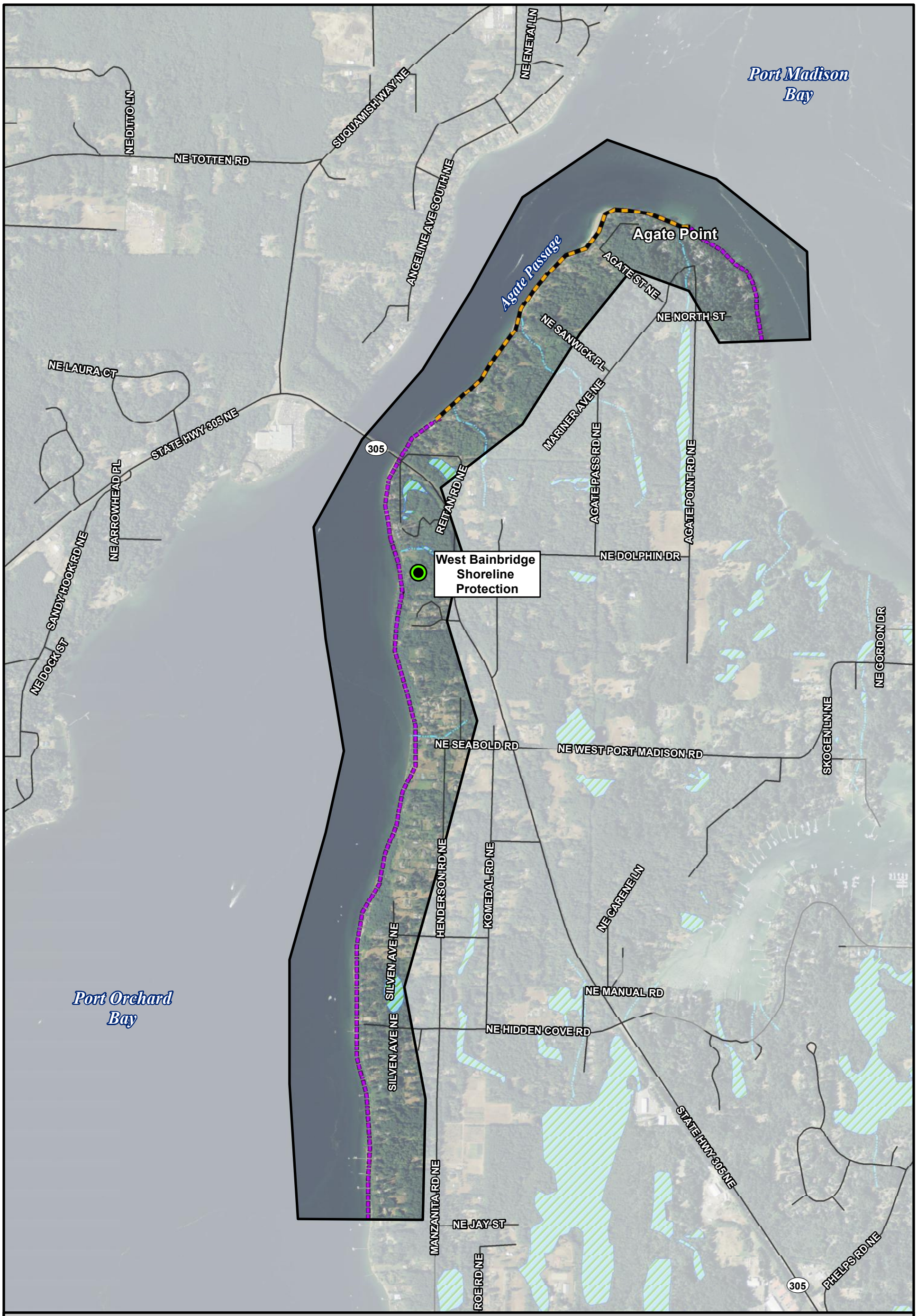
Restoration Strategy

As mentioned in MacLennan et al. (2010), the Agate Passage area is a high priority area for conservation. The Agate Passage Management Area has the most intact riparian corridor of any management area on the island. Therefore, conservation should be emphasized in this management area. An example project is one identified as a potential project by the Habitat Work Schedule (Habitat Work Schedule 2011). The strategy for this management area should identify key parcels for acquisition that are located within documented high-priority conservation areas, like the West Bainbridge Shoreline Protection.

Another component of the restoration strategy is to educate landowners on impacts that shoreline structures might have on the environment. As mentioned above, there are a large number of distinct shoreline structures on individual parcels. Where possible, workshops could be held to present current scientific knowledge about the nearshore environment and people's impact on it, such as what has been done in an equivalent minimally-developed area on Whidbey Island (Herrera 2009). On Whidbey Island, neighborhood workshops were held, and a written report documented the specific actions that waterfront landowners could proactively take to improve habitat conditions on their property. The workshops were well received by the community and diffused tensions related to planning and permitting decisions, as the workshops clarified the purpose of the regulations and landowner benefits. Similar events could be organized through the existing Shoreline Stewards Program.

Habitat Benefits

The Agate Passage Management Area has abundant forage-fish spawning areas, eelgrass meadows, and geoduck resources (Williams et al. 2004). However, as mentioned in other recent science documents (MacLennan et al. 2010; Herrera 2011), a key ecological impact on Bainbridge Island shorelines has been the loss of sediment to the nearshore from shoreline armoring. The strategy in the Agate Passage Management Area is to acquire remaining undeveloped parcels and preserve the feeder bluffs that have yet to be armored. This, in conjunction with education of private landowners about the importance of sources of natural sediment supply to the shoreline, will ensure that there is no further loss of sediment supplied to the nearshore system, preserving the relatively high ecological function in the



Legend

- Restoration site
- Management unit
- Wetland
- Stream
- Road

Shoreline designation

- Island Conservancy
- Shoreline Residential Conservancy
- Natural
- Shoreline residential
- Urban

Figure 2. Agate Passage Management Area restoration opportunities, City of Bainbridge Island, Washington.

N

0 625 1,250 2,500 Feet

HERRERA

Aerial: USDA (2009)

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area. Educational efforts could be specifically targeted to actions (e.g., beach nourishment) that will improve the loss of sediment to the drift cell, which is one of the key ongoing habitat impacts.

Port Madison Bay Management Area

Overview

The Port Madison Bay Management Area comprises 32,037 feet of shoreline that encompasses much of Port Madison and the entirety of Port Madison Bay (Figure 3). Much of the management area is typified by low-lying banks that have been developed for residential housing. The management area is defined by two drift cells with southerly alongshore drift that terminate at Port Madison Bay, a region that has been mapped as an area that lacks appreciable alongshore drift (Ecology 2010b). In actuality, transport does occur within the confines of the bay, but at slow rates and generally leaving only a veneer of sandy sediment on the upper beach. The northern boundary of the first drift cell begins at a divergence zone located just southeast of Agate Point on the western shore of Port Madison and moves south into Port Madison Bay, encompassing a short stretch of shoreline with actively eroding feeder bluffs. The smaller second cell begins at a divergence zone located on the eastern shore of Port Madison. Relative to wave exposure, shorelines are somewhat protected in Port Madison and extremely protected within Port Madison Bay. The management area receives upland flows from Coho Creek, as well as from several other small coastal streams. Overhanging riparian vegetation is less prevalent than on other areas on the island due to the nearly continuous and relatively dense residential development.

Shoreline development is primarily residential in nature, with a large number of overwater structures. Armoring structures occupy about two-thirds of the shoreline, nearly half of which encroach into the intertidal zone (below the mean higher-high water [MHHW] elevation). There are also several large marinas within Port Madison Bay. Outside of the bay, the management area is dominated by low-density development and the Bloedel Reserve, a permanently protected property that possesses more than 1/4 mile of a largely intact vegetated corridor along the shoreline.

Restoration Strategy

Port Madison Bay is relatively highly developed with numerous overwater structures. Much of the area has been delineated as not having appreciable alongshore drift, though it is likely that sand was present and mobile on the upper beach prior to development. Therefore, acquisition of shoreline parcels and restoring and removing overwater structures that may be affecting alongshore sediment transport could incrementally improve shoreline ecological conditions. For instance, at Hidden Cove Park, which was recently acquired by the BIMPRD, relict shoreline infrastructure could be removed. Doing so would restore nearshore sediment transport. Studies may be needed to determine whether one specific overwater structure or a group of structures currently impede sediment movement along the shoreline.

Acquisition is just one mechanism to achieve restoration objectives. The Port Madison Shoreline Restoration project, a site-specific project currently underway in the management

area, has shown that it is possible to engage private landowners to remove or retrofit bulkheads and overwater structures to improve fish habitat on private lands. The project exemplifies how the public can be engaged in restoration and could serve as a model for similar future projects in the management area.

Another component of the strategy is education of existing landowners on impacts that shoreline structures might have on the environment. As mentioned above, there are many overwater structures in the management area. Where possible, workshops could be held that present current scientific knowledge about the nearshore environment, the influence overwater structures have on salmonid migration, and potential overwater structure uses and design alternatives. This could also be done through the existing Shoreline Stewards Program.

Habitat Benefits

The restoration strategy for the Port Madison Bay Management Area should focus on stemming the loss of migratory habitat for juvenile salmonids that use the management area. Forage-fish spawning is also common in the management area and could be negatively affected by future development. Restoration activities would include removing overwater structures and land acquisition where feasible. Property acquisition could be opportunistic anywhere within Port Madison Bay, but would ideally build upon existing conservation areas, like Hidden Cove Park or the Bloedel Reserve. Further, the strategy should seek to increase the amount of sediment being transported alongshore by placing nourishment and/or re-engaging potentially eroding shorelines that have been armored. Such activities would reduce the ongoing impact that existing overwater structures and bulkheads have on nearshore processes. Considering the current highly developed state of the management area (particularly within the confines of Port Madison Bay), retrofits and/or acquisition of a few selected properties would have a net positive benefit.

Rolling Bay – Point Monroe Management Area

Overview

Rolling Bay – Point Monroe Management Area comprises 29,707 feet of shoreline that encompasses Point Monroe, Point Monroe Lagoon, and Rolling Bay to Skiff Point (Figure 4). Much of the management area contains extensive tideflats associated with erosion of bluffs along the length of the management area. The management area is defined by two drift cells that converge at Point Monroe. The smaller drift cell begins at a divergence zone located on the eastern shore of Port Madison and moves southeast into Point Monroe Lagoon; high bluffs on the landward margin of the lagoon have exhibited some recent soil instability and have been designated as feeder bluffs (Williams et al. 2004; MacLennan et al. 2010). The larger second cell begins to the south at a divergence zone located near Skiff Point, with northerly alongshore drift that terminates at the end of Point Monroe. That drift cell contains bluffs that are delineated as feeder bluffs and are significantly different in character than the low-lying Point Monroe drift cell. Both drift cells have some portions of bluff designated as the highest conservation priority by MacLennan et al. (2010). Point Monroe lagoon meets the definition of a pocket estuary, as does the mouth of a small creek that discharges halfway

Agate Passage
Agate Point
AGATE ST NE
NE NORTH ST
NE SANWICK PL
MARINER AVE NE
AGATE PASS RD NE
Bloedel Reserve
NE DOLPHIN DR
AGATE POINT RD NE
Port Madison Bay
NE GORDON DR
NE COUNTY PARK RD
NE ENDICOTT ST
NE LAFAYETTE AVE
Port Madison Revegetation
GROTLE ST NE
BROOM ST NE
SKOGEN LN NE
NE MEIGS RD
EUCLID AVE NE
NE WEST PORT MADISON RD
Port Madison Shoreline Restoration
WASHINGTON AVE NE
Hidden Cove Park Shoreline Restoration
Coho Creek
NE HIDDEN COVE RD
PHELPS RD NE
NE CARENE LN
STRANNE RD NE
NE MANUAL RD
ELLINGSEN RD NE
NE TORVANGER RD
STATE HWY 305 NE
TEEMLOOP RD NE
NE SUMANEE PL
CONNEMARRA LN NE
MADISON AVE NE

Legend

- Restoration site
- Management unit
- Wetland
- Stream
- Road

Shoreline designation

- Island Conservancy
- Shoreline Residential Conservancy
- Natural
- Shoreline residential
- Urban

Figure 3. Port Madison Bay Management Area restoration opportunities, City of Baingride Island, Washington.

N

0 500 1,000 2,000 Feet

HERRERA

Aerial: USDA (2009)

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Point Monroe

Point Monroe Lagoon

Point Monroe Lagoon Stormwater Outfall Replacement

Fay Bainbridge Park Lagoon Restoration

Fay Bainbridge Revegetation & Nonnative Invasive Plant Removal

Puget Sound

Rolling Bay

Rolling Bay Walk Aquisition

Skiff Point

NE GORDON DR
SKOGEN LN NE
GROTLE ST NE
BROOM ST NE
NE LAFAYETTE AVE
WASHINGTON AVE NE
EUCLID AVE NE
SUNRISE DR NE
NE SPARGUR LOOP RD
MISTY VALE PL NE
NE HIDDEN COVE RD
PHELPS RD NE
ELLINGSEN RD NE
CONNEMARRA LN NE
NE TORVANGER RD
JOHN ST NE
NE MONSAAS RD
NE KNIGHT RD
NE MARY SAM LN
NE SUNROSE LN
NE RACCOON LN
NE DAY RD E
STATE HWY 305 NE
KALLGREN RD NE
NE VIEWCREST AVE
NE LOVGREEN RD W
NE LOVGREEN RD E
NE WINTHERS RD
NE MORGAN RD
NE ROBERTS RD
NE KOURA RD
NE VALLEY RD
LOGG RD NE
ROLLING BAY WALK NE
HYLA AVE NE
N MADISON AVE NE
FALK RD NE
MANITOU BEACH DR NE
NE BEACH CREST DR

Legend

- Restoration site
- Management unit
- Wetland
- Stream
- Road

Shoreline designation

- Island Conservancy
- Shoreline Residential Conservancy
- Natural
- Shoreline residential
- Urban

Figure 4. Rolling Point - Point Monroe Management Area restoration opportunities, City of Bainbridge Island, Washington.

N

0 750 1,500 3,000 Feet

HERRERA

Aerial: USDA (2009)

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between Point Monroe and Skiff Point. Otherwise the shoreline is typical barrier beach habitat.

Shoreline development is primarily residential in nature. Many of the homes built along the spit at Point Monroe are built on fill that encroaches into the intertidal area (below the MHHW elevation). Fay Bainbridge Park, which is a stretch of undeveloped, but disturbed, sandy beach, is included in the management area. It is used extensively by the public for shoreline access. There may be fill in the park as well. Otherwise, shoreline development is typically low-density residential development on bluffs and low banks, where they exist. Overwater structures are confined to Point Monroe lagoon, but there they are extensive.

Restoration Strategy

The two key features that could be restored in this management area are the pocket estuaries (Point Monroe lagoon and the estuary halfway between Point Monroe and Skiff Point) and the feeder bluffs that maintain them. There has been considerable fill on the spit that defines the Point Monroe lagoon and for the roadway that serves it. Placed fill could extend southward into Bainbridge Park, which will soon be a part of the BIMPRD. The park sits on the site of a former lagoon that was once associated with Point Monroe (U.S. Coast and Geodetic Survey 1868). Now the Point Monroe lagoon is truncated by fill associated with Point Monroe Drive. Future phases of restoration may seek to acquire properties on the spit and remove fill and associated shoreline armoring, which is common along the spit. Similar activities could also be conducted on the small creek mouth and pocket estuary about halfway between Point Monroe and Skiff Point.

Acquisition of remaining undeveloped parcels on the feeder bluffs would ensure that sediment supply to the remainder of the drift cell is permanently protected. Ideally, acquisition would occur in the high conservation areas identified by MacLennan et al. (2010), but other opportunities would also have some ecology benefit due the distributed nature of the sediment supply along the bluff. For instance, acquisition of properties along Gertie Johnson Road could be undertaken with both restoration and public safety in mind, as the area was the site of the 1997 Rolling Bay Walk tragedy where a family of four was killed by catastrophic bluff failure. Acquisition of existing abandoned lots is included as a site-specific restoration opportunity.

Like the other management areas, an educational component could be included in the strategy. A similar set of workshops as recommended for the Agate Passage Management Area (or even combined with them) is suggested here also because of the similarity of the issues encountered along high bluff areas.

Habitat Benefits

As mentioned in many of the relevant documents (Beamer et al. 2003, 2005; Redman et al. 2005; Herrera 2011), pocket estuaries comprise a key ecological feature on Bainbridge Island shorelines. Restoration of pocket estuaries disconnected from marine waters could provide significant ecological gains because it would expand critical pocket estuary habitat (Beamer et al. 2003, 2005; Redman et al. 2005). The Point Monroe lagoon is probably the largest single

pocket estuary on the island. It is also heavily impacted by existing development. The strategy for this management area is to restore, expand, and improve habitat conditions in the estuary. Another part of the restoration strategy is to ensure sediment supply to the spit is not reduced because the spit has documented forage-fish spawning habitat (Williams et al. 2004). Although armoring on the spit likely increases the loss of sediment offshore, the tip appears to be actively growing and the beaches in Fay Bainbridge Park are rich with sediment. As such, it is one of the few places on the island where sediment starvation is not already acute. Therefore, the educational component, along with both strategic and opportunistic acquisitions, should limit further losses of sediment to the nearshore system in order to ensure no net loss of ecological functions in this management area.

Murden Cove Management Area

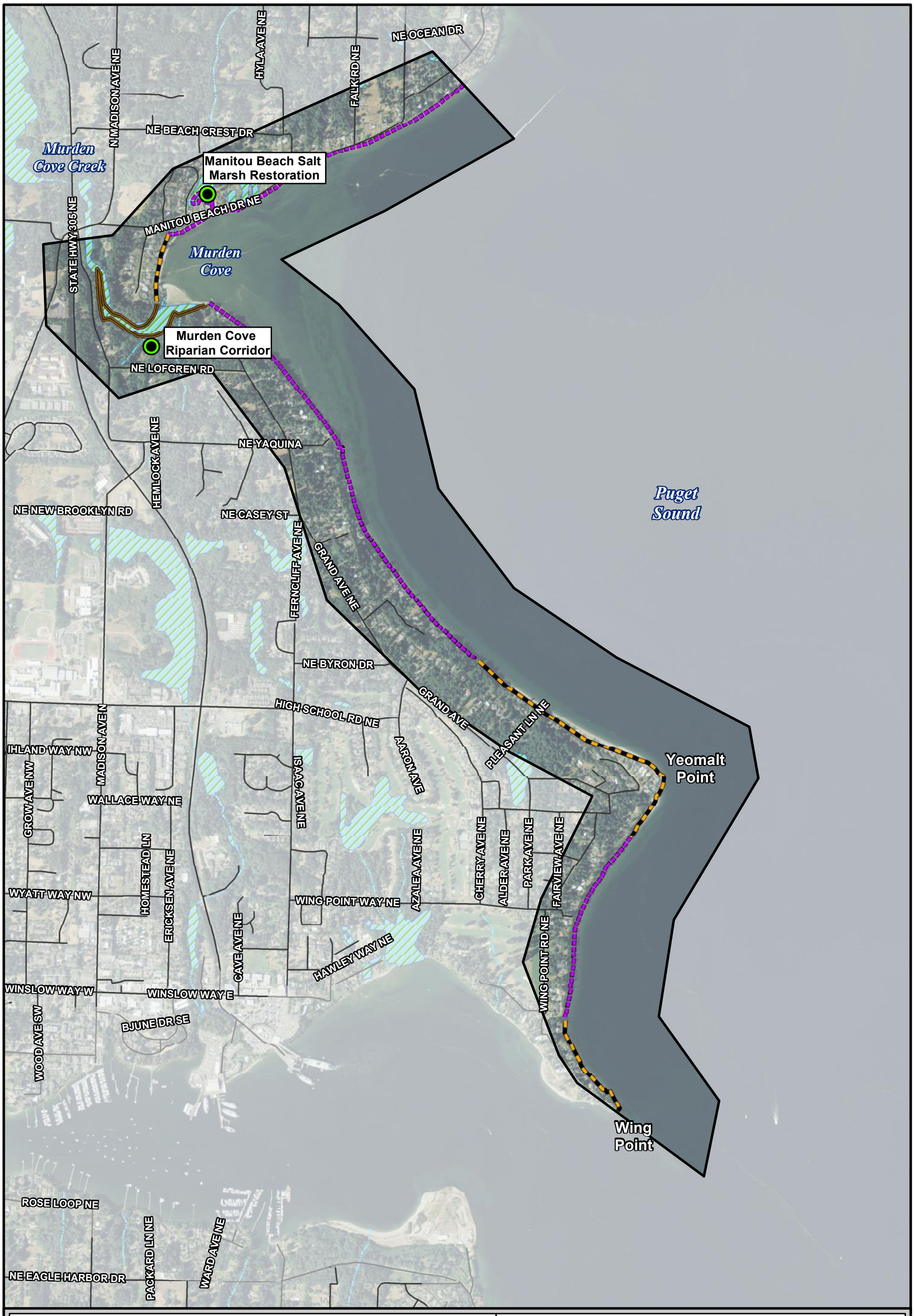
Overview

The Murden Cove Management Area comprises 28,843 feet of shoreline that encompasses all of Murden Cove, as well as Yeomalt Point and part of Wing Point (Figure 5). Murden Cove has a wide range of shoreline types and contains extensive subtidal mudflats. The management area is defined by two drift cells that converge at the head of Murden Cove, forming the Murden Cove Creek pocket estuary (Williams et al. 2004). The drift cells are quite different; the northern one consists of a low-gradient, low-bank shoreline, and the southern one consists of unstable, but largely vegetated bluffs. Wave exposure is relatively high for outer portions of the management area, with wave energy diminishing further into the head of Murden Cove. Murden Cove receives upland flows from Murden Cove Creek, which drains upland areas with low to moderate levels of development. In addition, several small streams enter the cove from the north. Marshes associated with those streams have been cut off from tidal circulation by development and Manitou Beach Drive (Herrera 2004). Overhanging riparian vegetation at the toe of the large bluffs at the south end of the management area is quite extensive because development of the immediate shoreline is precluded due to the presence of the unstable bluffs.

Shoreline development is primarily residential in nature, with some shoreline bordered by Manitou Beach Drive. The management area is much less armored (and there is less shoreline encroachment) than other areas on Bainbridge Island. On the north side of the cove, development is generally on the landward side of Manitou Beach Drive, although there is some fill on the seaward side in a few locations. Most of the homes along the south side of the cove are built on high bluffs where the shoreline is inaccessible without access stairs. A feasibility study to restore those areas was completed (Herrera 2004) and is discussed in Appendix A. Armoring is unnecessary unless used to prevent toe erosion of the bluffs. Despite the lower level of armoring, the density of development in the management area is high (Williams et al. 2004). Several portions of the high bluffs have been targeted as having high conservation value (MacLennan et al. 2010).

Restoration Strategy

The ecological centerpiece of Murden Cove is the Murden Cove pocket estuary and the salt marshes that fringe the north side of the cove. Increases in local-scale connectivity



Legend

- Restoration site
- Management unit
- Wetland
- Stream
- Road

Shoreline designation

- Island Conservancy
- Shoreline Residential Conservancy
- Natural
- Shoreline residential
- Urban

Figure 5. Murden Cove Management Area restoration opportunities, City of Bainbridge Island, Washington.

N

0 625 1,250 2,500 Feet

HERRERA

Aerial: USDA (2009)

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correspond to increasing juvenile salmon abundance in pocket estuary habitats (Beamer et al. 2003, 2005). The salt marshes of Manitou Beach provide many opportunities to improve connectivity, some of which have already been analyzed in detail (Herrera 2004). Restoring the connectivity of the salt marshes to Murden Cove should be the focus of restoration efforts in this management area.

The bluffs on the south side of the cove also present restoration opportunities, but, given the larger setbacks of most of the homes from the shoreline, conservation of the intact riparian corridor should be the focus there.

There are a few properties that have shore protection that intrudes into the intertidal area along the south side of the cove. Those properties have a disproportionately negative impact on nearshore processes because the shore protection excludes the availability of habitat in upper beach areas. If those properties were to have the intertidal armoring removed, there would be significant habitat benefits because it would restore access to upper beach habitat. Education of local landowners on the detrimental impacts of bulkheads and intrusive fill would also be helpful to prevent further shoreline development that produces losses in sediment supply.

Habitat Benefits

As mentioned in many of relevant documents (Beamer et al. 2003, 2005; Redman et al. 2005; Herrera 2011), a key ecological feature of Bainbridge Island shorelines are pocket estuaries. The Murden Cove pocket estuary is already the focus of intense conservation because the creek provides spawning habitat for cutthroat trout and coho and chum salmon (Williams et al. 2004). With the acquisition of the Trick Property, a site-specific opportunity already identified by others, the core of the Murden Cove pocket estuary will be protected permanently from further development. Further restoration of one or more of the marshes along Manitou Beach would significantly improve this critical habitat type and would serve to provide rearing habitat for the fish that use Murden Cove Creek as well as marine fish species known to use pocket estuary habitat. The bluffs along the southern shore of the cove are in relatively good condition because of the large setbacks of most of the homes there. Acquisition and removal of the few homes that have bulkheads that intrude into the intertidal would expand the limited forage-fish habitat in the area. It would also help to achieve no net loss of ecological functions within the management area.

Eagle Harbor Management Area

Overview

The Eagle Harbor Management Area comprises 46,054 feet of shoreline that encompasses all of Rockaway Beach and Eagle Harbor, including all of Bill Point and part of Wing Point (Figure 6). The management area is defined by three major drift cells. Two of them begin at the outer margins of Eagle Harbor (Wing Point and Bill Point) and move westward, terminating in the middle of Eagle Harbor in an area that has been mapped as lacking alongshore drift (Williams et al. 2004; MacLennan et al. 2010). The third drift cell begins at a divergence zone just to the north of Blakely Harbor and moves north along Rockaway Beach

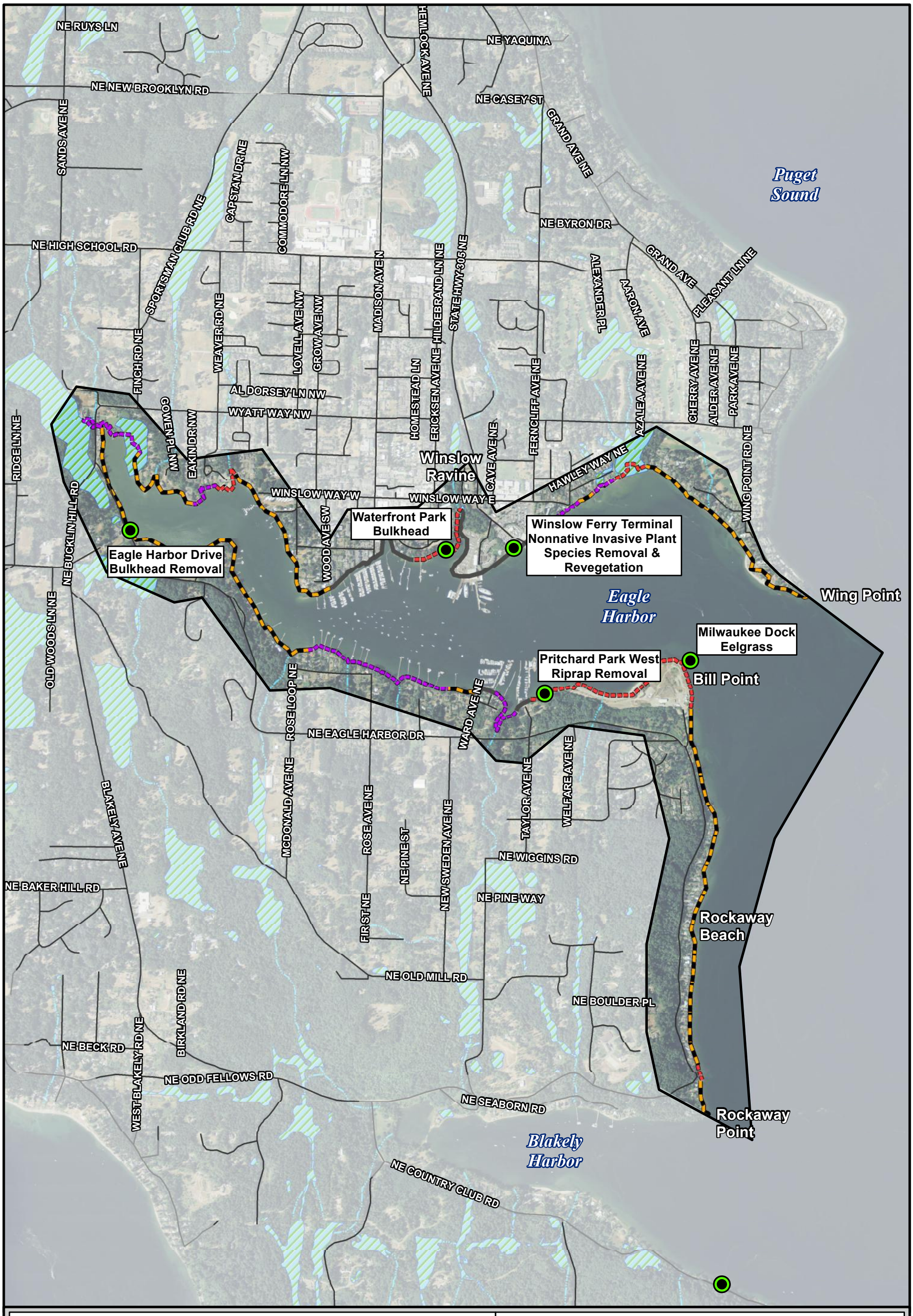
to Bill Point. Wave exposure varies throughout the management area, with Rockaway Point being relatively exposed and inner Eagle Harbor being relatively quiescent. Ferry traffic also contributes to wave energy near the Winslow Ferry Terminal. Streamflow into the harbor is significant. It comes from a variety of sources, including urban stormwater outfalls and at least five streams (Williams et al. 2004). Two of the largest streams include Winslow Ravine and an unnamed creek at the head of the harbor. Both streams have a small estuaries associated with them and provide coho and chum spawning areas further upstream.

The management area is the commercial and industrial heart of the island, and includes the city's downtown, a Washington State Ferry terminal and repair facility, multiple commercial marinas, and the Wyckoff Superfund site at Bill Point. There is also the city's Waterfront Park in Eagle Harbor, which provides shoreline access, boat launch facilities, and visitor moorage. As a consequence of development there is limited overhanging riparian vegetation within the management area (Williams et al. 2004), although there are some areas that retain substantive overhanging vegetation. The remainder the management area has moderate to low-density single-family residential development, with some shoreline backed by Eagle Harbor Drive. More than half of the shoreline is modified by armoring, and more than half of the armoring encroaches into the intertidal zone. Documented pollution from stormwater and past industrial activities (e.g., the Wyckoff Superfund site) has closed the area to shellfish harvest (Williams et al. 2004). Several restoration projects have already been completed in the management area; they are discussed in detail in Appendix B.

Restoration Strategy

Eagle Harbor is the most developed management area on the island. It includes the only urban shorelines on Bainbridge Island, and has existing or remnant infrastructure nearly everywhere within its limits. Existing development will continue because it is the city's urban core, and stormwater contamination will persist; however, the significant amount of remnant infrastructure provides many restoration opportunities. Several projects to remove former uses and shoreline structures are already underway but are included in this document because they are not yet fully complete. There is also significant public land in the management area that would be available for restoration sites. Therefore, the strategy is to continue to be opportunistic with acquisition of formerly developed and public properties, ideally focusing on the restoration of the small, estuarine areas that are present throughout the harbor (e.g., Waterfront Park). In addition to acquisition and restoration of formerly developed, but abandoned, properties, small projects could be undertaken in active public, developed areas. In particular, there are several site-specific opportunities to improve the lack of overhanging vegetation through riparian plantings. Adding vegetation may even be possible where the shore is paved by planting native trees in planting strips or, where soils are unsuitable, in planter boxes, located near the shore to provide some canopy shade, litter fall, and insects to the highly developed nearshore area.

The education component of the strategy should focus on preventing stormwater pollution to Eagle Harbor and Puget Sound, which is a significant ongoing problem in the area. Ongoing stormwater pollution is probably the largest impact on the health of the harbor. As a result, the City could develop a plan to identify and retrofit areas requiring stormwater treatment and to trigger the implementation low-impact development practices for the greater Winslow



Legend

- Restoration site
- Management unit
- Wetland
- Stream
- Road

Shoreline designation

- Island Conservancy
- Shoreline Residential Conservancy
- Natural
- Shoreline residential
- Urban

Figure 6. Eagle Harbor Management Area restoration opportunities, City of Bainbridge Island, Washington.

N

0 750 1,500 3,000 Feet

HERRERA

Aerial: USDA (2009)

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area. For instance, rain gardens and planter boxes could have the dual effect of improving water quality and providing shoreline vegetation. The educational component could also be targeted not only to shoreline landowners (as in other management areas), but also Winslow residents and overwater infrastructure users, who all contribute to this problem. Education could also include workshops addressing overwater structures (as in Port Madison Bay) or the impacts of shoreline armoring (as in Manzanita Bay), although such issues are also being addressed by other restoration activities on public land.

Habitat Benefits

Existing habitat conditions within the management area are relatively poor, although there are at least three fish-bearing streams and some areas of documented sand lance and surf smelt spawning. To improve ecological functions within this management area over time, the focus should be on improving stormwater quality and re-establishing riparian vegetation. Also included is the removal of abandoned industrial facilities, which expands opportunities for forage-fish spawning and eases salmonid migration. The revegetation opportunities will also increase forage-fish spawning success and decrease future stormwater contamination from the urban area and large transportation facilities, such as the Winslow Ferry Terminal.

Blakely Harbor Management Area

Overview

The Blakely Harbor Management Area comprises 20,345 feet of shoreline that encompasses all of Blakely Harbor, including the northern half of Restoration Point (Figure 7). The management area is defined by two drift cells with westerly alongshore drift that terminates at the head of Blakely Harbor, the site of an extremely large commercial sawmill (Williams et al. 2004). The log pond area of the mill site is currently disconnected from sediment supply by a rock jetty (MacLennan et al. 2010). The first drift cell begins at a divergence zone located at a point on the northern margin of Blakely Harbor and moves west into the harbor; this short stretch of shoreline is naturally starved of sediment due to the lack of unconsolidated sediment (that could naturally erode and thus be recruited in the system) along the shoreline. The second drift cell begins at Restoration Point, a rocky headland that is also relatively starved of sediment, and extends northwest into Blakely Harbor. Relative wave exposure is generally low throughout the harbor, though it does increase toward the points at the entrance of the harbor. Blakely Harbor receives considerable upland flows from five watersheds characterized by minimal land development and high forest cover.

Historically, Blakely Harbor was the site of a large commercial lumber mill, which included a log rafting pond that dominated the head of the harbor. That facility has been abandoned for a number of years. The area is now parkland (Blakely Harbor Park) with public shoreline access, recreational trails, and plans for an interpretive center, but it still contains many remnants of its industrial past. The remainder of shoreline has low-density, single-family residential development. Riparian conditions are typical of the rest of the island with patchy deforestation due to development and moderate levels of invasive plants. In addition, there is bedrock near the surface throughout the area that naturally limits the development of shoreline vegetation. There are also some largely undeveloped stretches of shoreline (not

necessarily protected from future development), particularly near the promontories at the mouth of the harbor.

Restoration Strategy

Blakely Harbor is dominated by the former mill site, both in terms of physical footprint and impact on the environment. It was likely that, prior to construction of the mill and associated disturbance, the head of the harbor was as productive as similar embayments elsewhere on the island (such as Eagle Harbor). Pocket estuaries, such as the one that likely existed at the head of the harbor, have been shown to be vital to salmon population recovery and survival (Beamer et al. 2003, 2005; Redman 2005). However, the productivity of the inner harbor and the management area at large is currently very low (Williams et al. 2004). Complete restoration of pocket estuaries is unusual in Puget Sound, despite their ecological importance (Redman 2005). Although restoring the pocket estuary would be challenging because of the constraints imposed by the historical and cultural resources present on the site, such as the Blakely Harbor Mill, it would provide improved ecological functions to the current degraded site. At a minimum, the mill site should be restored, although it may be an expensive and complicated project due to the site's contaminated soils and historic significance.

Elsewhere in the management area, protection of undeveloped, privately owned areas could be expanded, either through acquisition or via conservation easements. Blakely Harbor is one of the few management areas on the island that have significant tracts of shoreline that remain undeveloped and in private ownership, and there is an existing conservation easement on the northern end of Blakely Harbor.

Habitat Benefits

Habitat use of the management area is currently poor (Williams et al. 2004), likely because of past industrial activities (and their lingering contamination). Restoration of Blakely Harbor Park is crucial to the ecological success of the harbor. If that restoration project were to proceed, it is expected that a significant ecological benefit would result.

Rich Passage Management Area

Overview

Rich Passage comprises 34,565 feet of shoreline that encompasses most of Rich Passage between Restoration Point and Point White (Figure 8). The area includes Pleasant Beach, South Beach, Lynwood Center, and Fort Ward, all of which possess an uplifted, formerly subtidal, hardpan or bedrock bench. The management area is defined by two drift cells that converge in the embayment near the outlet of Schel-Chelb estuary at Lynwood Center. The first drift cell begins at Restoration Point, a rocky headland with little to no appreciable alongshore drift, and moves westward. The second drift cell begins at a divergence zone located at Point White and moves eastward (Williams et al. 2004). Shorelines in the management area have variable wave exposure ranging from heavily exposed Restoration Point to relatively protected Pleasant Beach. In more protected areas, tidal forces and boat wakes (primarily from the Bremerton-Seattle ferry) can help initiate sediment transport and

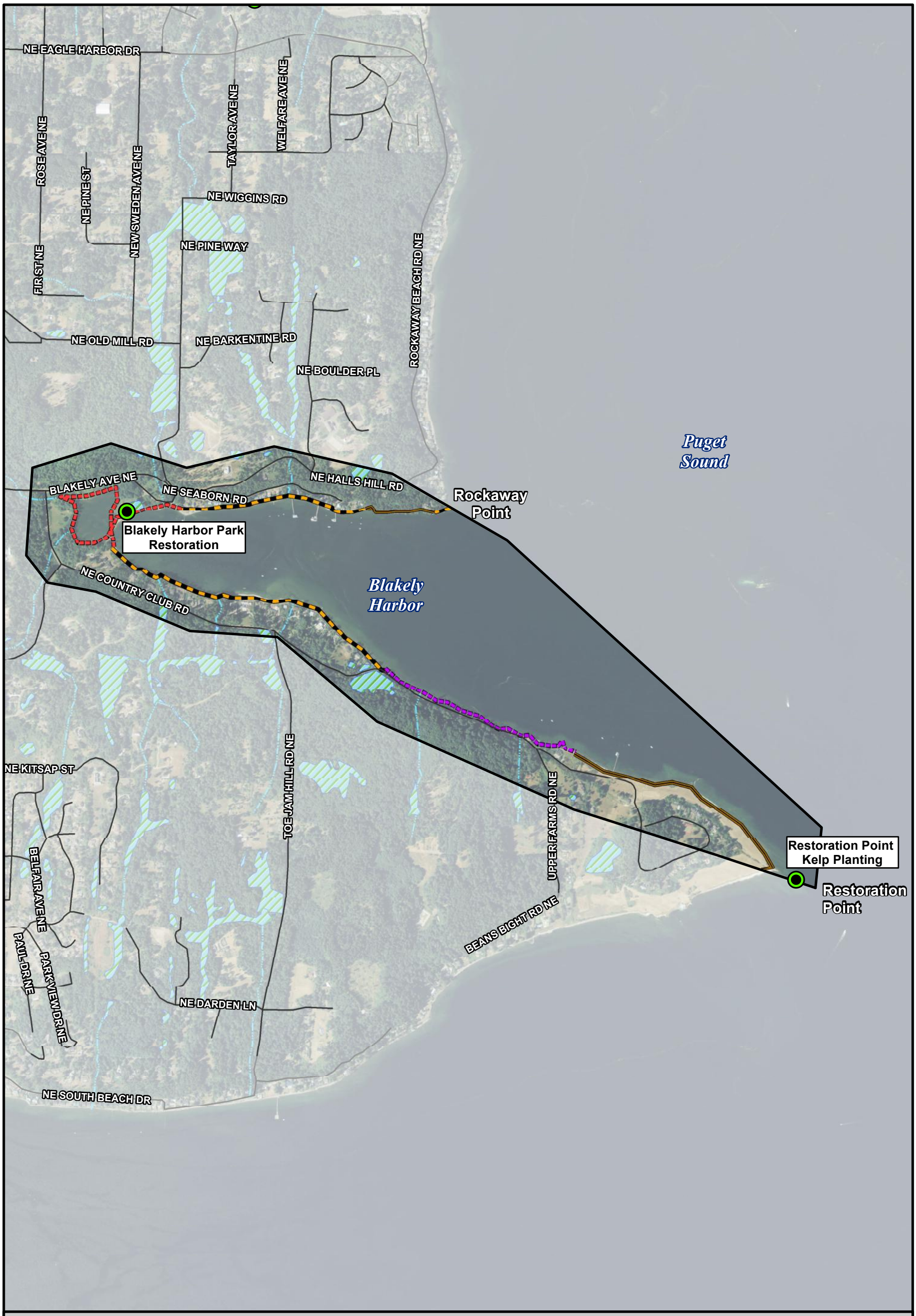
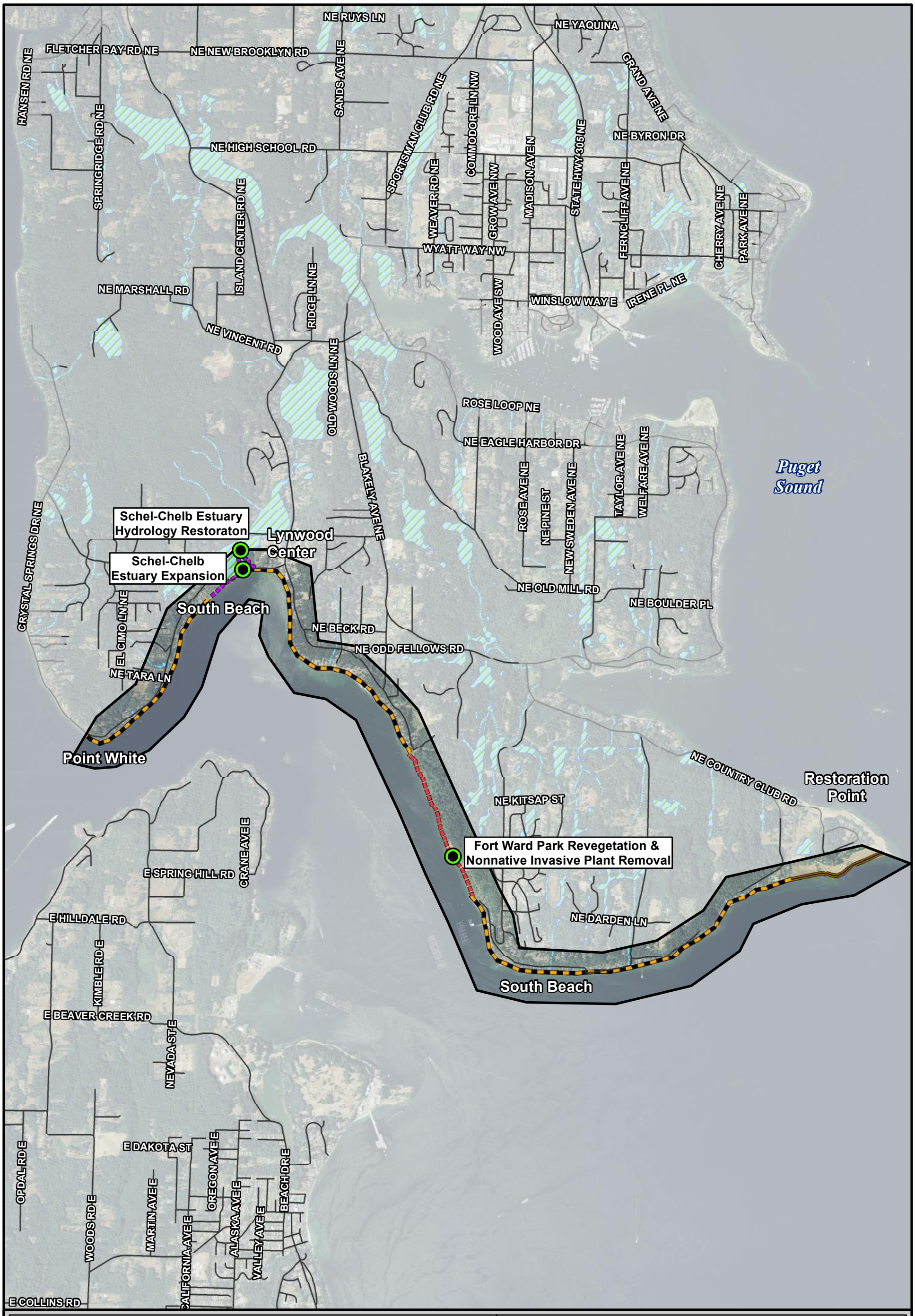


Figure 7. Blakely Harbor Management Area restoration opportunities, City of Bainbridge Island, Washington.



Legend

- Restoration site
- Management unit
- Wetland
- Stream
- Road

Shoreline designation

- Island Conservancy
- Shoreline Residential Conservancy
- Natural
- Shoreline residential
- Urban

Figure 8 Rich Passage Management Area restoration opportunities, City of Bainbridge Island, Washington.

N

0 1,125 2,250 4,500 Feet

HERRERA

Aerial: USDA (2009)

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erosion (Curtiss et al. 2009; Herrera 2011). Rich Passage receives upland runoff from direct overland flow and small seeps, as well as from several small watersheds with moderate to low levels of land development and high forest cover, including Schel-Chelb Creek (Williams et al. 2004).

Most of the shoreline in Rich Passage is backed by single-family residential development, with highly accessible beaches. The beaches are made accessible because the residences are located on a recently (geologic time scale) uplifted low-tide terrace (i.e., low bank to spit/backshore). The bench has been largely deforested, even within protected areas such as Fort Ward Park, thereby making overhanging riparian vegetation in the management area by far the least extensive of any management area on the island. Shorelines within the management area also have long lengths of adjacent road front—more than any other management area on the island. In addition to residences, the shoreline land uses include a park (Fort Ward Park), a restored estuary (Schel-Chelb estuary), a commercial fish farm (the American Gold Seafood Atlantic salmon aquaculture facility), and a sewage treatment outfall (Kitsap County Sewer District #7 treatment facility discharges just east of Fort Ward Park). Many of the residences have bulkheads, despite the fact that bedrock and other durable soils are located just beneath the ground surface.

Restoration Strategy

Rich Passage is somewhat unique on the island because of its geology. The uplift on the south side of the Seattle Fault Zone from its most recent rupture has left a wave-cut terrace along its entire length that is predominantly developed with single family residences. The terrace naturally separates the nearshore from historic (in geologic time scale) feeder bluffs. This is compounded by enforced separation of those bluffs by development and increased offshore sediment transport from armoring. Therefore, the shorelines are extremely starved of sediment, and sedimentary bedrock is exposed for most of the management area, particularly between Lynwood Center and Restoration Point. As such, the area is good kelp habitat, and the Puget Sound Restoration Fund is pursuing projects to enhance this natural strength.

There are few private undeveloped parcels remaining for acquisition and protection efforts. If property could be acquired and restored, it might provide a benefit to the nearshore environment. However, given the physical scale and complexity of the issues in the management area, the expectation should be that any single acquisition project could have limited ecological benefit.

Within the low-bank residential development, an extensive pocket estuary exists in the vicinity of Lynwood Center. The Schel-Chelb pocket estuary is probably the second largest pocket estuary on the island. Because of the uplift of the historic marsh area, the marsh complex extends more than one-quarter of a mile inland to more than 30 feet above sea level. The complex has been dissected and disturbed by development and infrastructure, but the core of the marsh (i.e., the lowest portion near the shoreline) was recently successfully restored. There are several opportunities to build upon the success of that project by expanding it to its historic extents. Because that would essentially be creating new pocket estuary habitat, ecological gains would be large.

The educational component of the restoration strategy should focus on the numerous individual shoreline landowners in the area. While the area was recently uplifted and has a naturally starved shoreline, bulkheading has had a profound impact on the nearshore ecology, causing it to rank as the worst management area in terms of nearshore ecological health in a recent shoreline characterization (Williams et al. 2004). Educating people about the geomorphic setting (in particular, that there is no need to have a bulkhead on a shoreline made up of reasonably competent bedrock) could enable wiser choices for shoreline protection in the future. Efforts to correct the ecological losses associated with extensive bulkheading could include acquiring conservation easements along shoreline properties and convincing shoreline landowners to remove bulkheads where possible. Habitat-friendly beach nourishment could be encouraged to improve habitat as well as beach conditions for human use.

Habitat Benefits

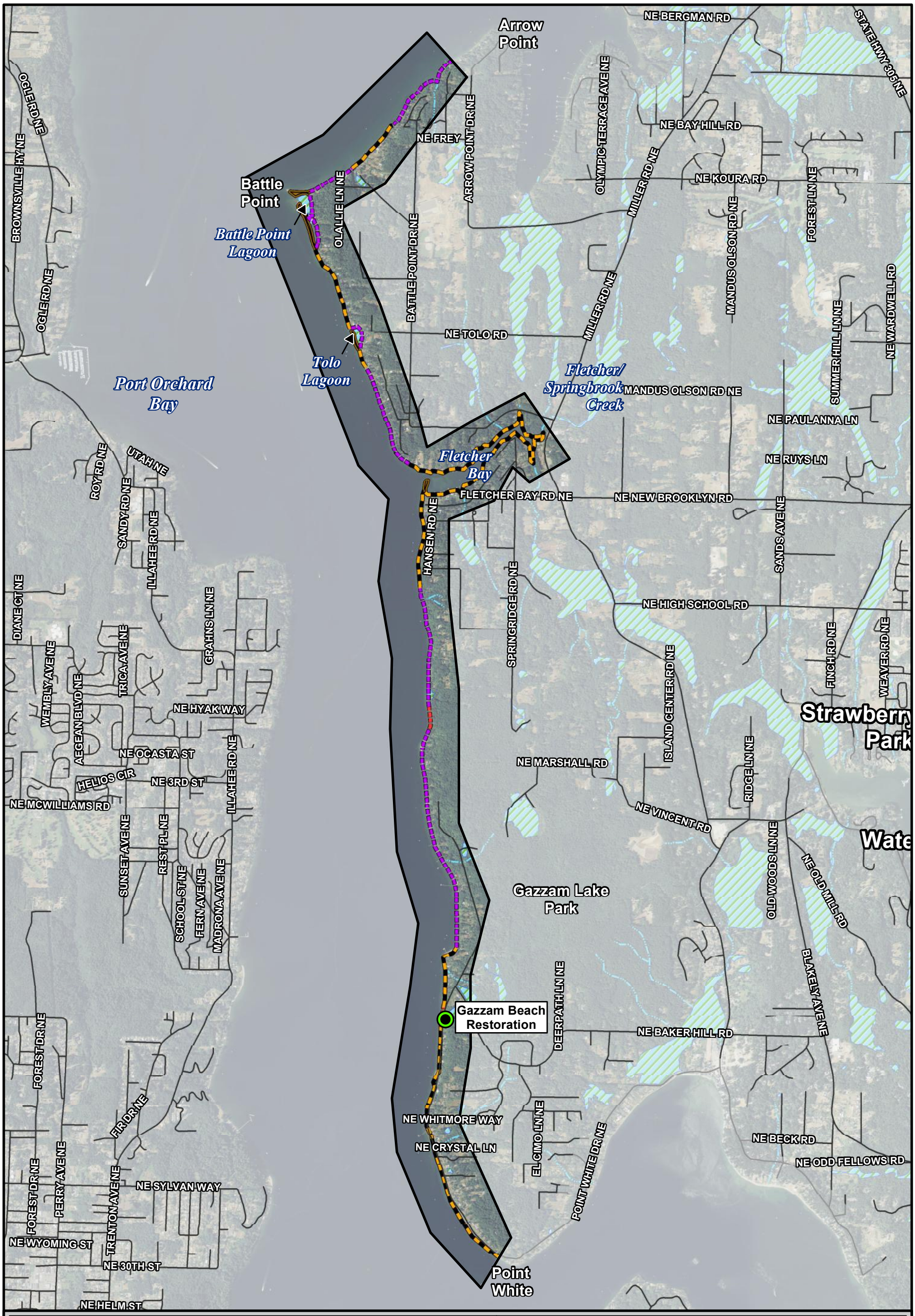
The unusual geomorphology of the Rich Passage Management Area makes significant habitat gains difficult. The most promising opportunity is to expand the successful restoration programs already constructed in the area. They include the kelp replanting effort at Restoration Point and the restoration of the Schel-Chelb pocket estuary. With a concerted effort to educate landowners about the ecological consequences of bulkheads and riparian vegetation removal, there may be consequent improvements in ecological functions within the management area. However, they may be limited because the area has naturally poor habitat conditions for some nearshore species such as forage fish. While the ecological benefit of a project on a single residential parcel would likely be small, the cumulative impacts of many projects could be significant.

Point White – Battle Point Management Area

Overview

The Point White – Battle Point management area is the largest management area on Bainbridge Island (Figure 9). It is extremely diverse and includes Battle Point, Battle Point Lagoon, Fletcher Bay, Tolo Lagoon, and part of Point White, as well as several miles of bluff-backed shoreline. Near Point White, the bluff is separated from the beach by the uplifted platform that is described in detail in the *Rich Passage Management Area* section.

Two drift cells are in the management area. The larger drift cell begins at a divergence zone located at Point White and moves north past Fletcher Bay and a nearby reach with eroding feeder bluffs. The second drift cell begins at a divergence zone just south of Arrow Point and moves south to Battle Point (Williams et al. 2004). Wave energy is relatively small in the management area because Port Orchard is protected from main basin waves; the embayments at Fletcher Bay and the lagoons are very protected. The management area receives upland flows from five watersheds with low levels of development, including Fletcher/Springbrook Creek that discharges to Fletcher Bay. Overhanging riparian vegetation is typical of the rest of the island with a mix of invasive and native species, and with a highly disturbed or eliminated riparian corridor in developed areas, less so in the parks and natural areas (e.g., the Close property at Gazzam Lake).



Legend

- Restoration site
- Management unit
- Wetland
- Stream
- Road

Shoreline designation

- Island Conservancy
- Shoreline Residential Conservancy
- Natural
- Shoreline residential
- Urban

Figure 9. Point White - Battle Point Management Area restoration opportunities, City of Bainbridge Island, Washington.

N

0 1,125 2,250 4,500 Feet

HERRERA

Aerial: USDA (2009)

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Shoreline development is primarily low-density residential development. Approximately half of the shoreline is modified by armoring, but less than half of that encroaches into the intertidal zone (Williams et al. 2004). The management area has an unusually large number of groins and small outfalls.

Restoration Strategy

The Point White – Battle Point shoreline is diverse, but it is dominated by bluffs with low-density development at their base. Observations at the relatively pristine beach within the Gazzam Lake Park and Preserve indicate that the impacts of shoreline armoring and consequent sediment starvation are felt far from the area where the impacts occur (Figure 10). Some of the sediment starvation (particularly in the south) can be attributed to the displacement of the natural beach associated with the most recent slip of the Seattle Fault Zone. However, the majority of the sediment loss to the littoral system is related to the anthropogenic disconnection of feeder bluffs from the drift cell by shoreline armoring, road infrastructure, development, and the placement of many small groins in the nearshore. This likely explains the relatively patchiness of forage fish use in the area, particularly south of Battle Point. As such, restoration of sediment supply is a high priority, particularly for the southern drift cell. This is corroborated by the findings of MacLennan et al. (2010) and provides support for the expensive, but potentially sediment-producing, Gazzam Beach project proposed in this restoration plan (see Appendix A: Summary of Ongoing and Proposed Restoration Projects).

Because of the length of the larger drift cell (it is the longest drift cell on the island and one of the longer drift cells in Puget Sound), groins are particularly effective at locally arresting erosion of all types in this management area and may explain why they are so common. However, this effectiveness also compounds and expands impacts on adjacent areas. Therefore, acquisition of properties with groins (or acquisition of tidelands or tideland easements for groin removal) should be a high priority. This restoration strategy would improve lost sediment supply and would also be an educational opportunity to inform landowners of the impact of groins and their history of legal disputes elsewhere in the United States. This management area would benefit from an internal City program to expedite beach nourishment permitting on those sites that currently have groins. Beach nourishment would afford shoreline landowners the protection provided by groins (albeit temporary) but would also increase sediment supplied to the adjacent nearshore.

In addition to the long stretches of barrier beaches, there are several pocket estuaries in this management area (Battle Point Lagoon, Tolo Lagoon, and Fletcher Bay). None of the barriers to those estuaries have been developed, and there is some protection from development where the tidelands are owned by public entities. However, the inner (marsh) portions of the estuaries have all been developed. The inner marsh areas represent good targets for acquisition or conservation/restoration easements, particularly where fill has been placed in the past (all of the pocket estuaries have some amount of fill within them). The undeveloped land at the head of Fletcher Bay and the undeveloped small stream corridor that leads away from Battle Point Park would also be useful conservation targets.

Figure 10. Exposed Glacial Hardpan on the Upper Beach of the Close Property within the Gazzam Lake Park and Preserve.

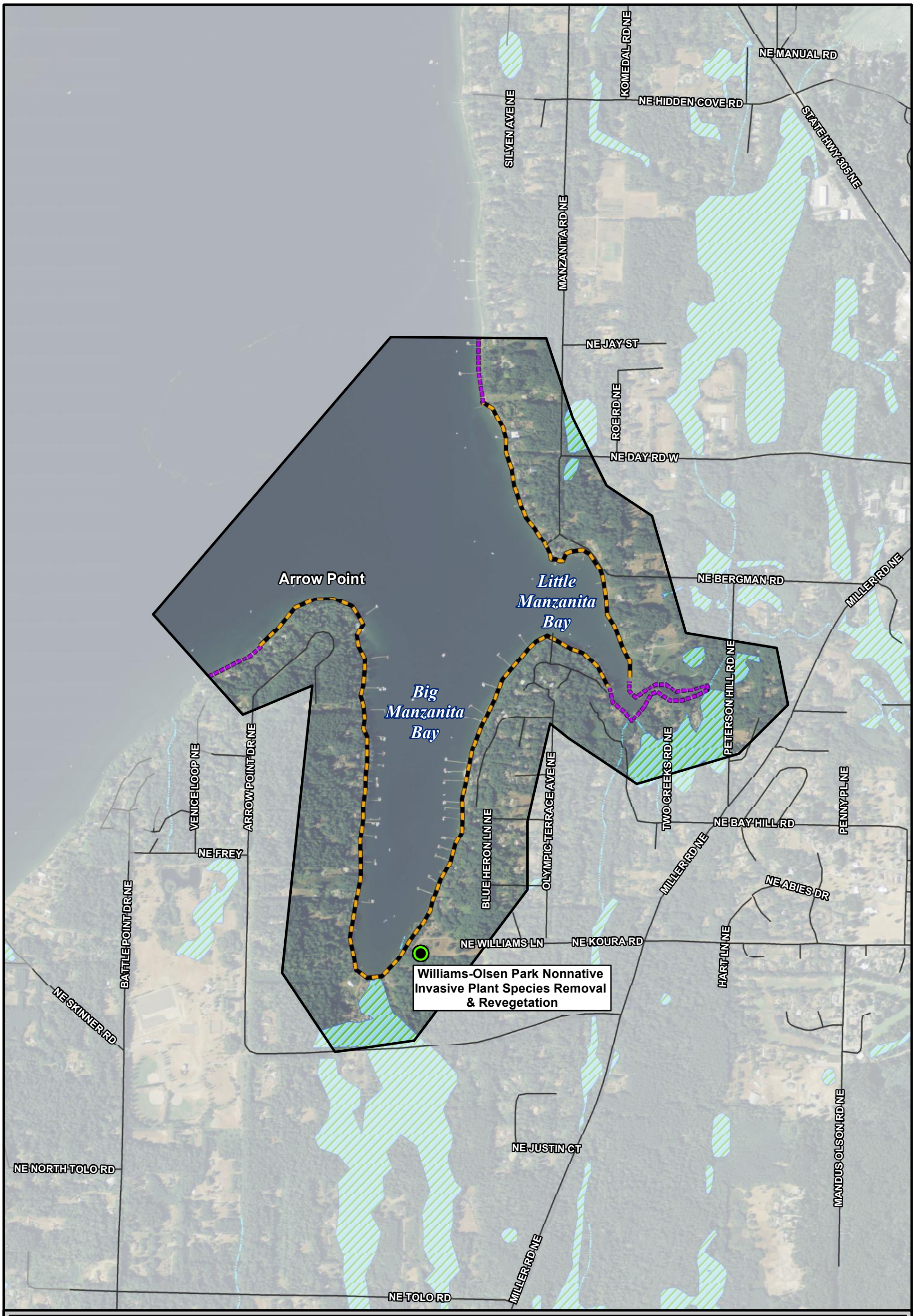
Habitat Benefits

The Point White – Battle Point Management Area is critically impaired from a sediment supply perspective. The lack of sediment supply limits the availability of substrate suitable for forage-fish spawning. Removal of groins and shoreline armoring would improve the poor existing conditions, but progress will be slow and modest given the scale of the problem. The Gazzam Beach project could provide significant amounts of sediment to the starved drift cell, but it will be expensive and will have other environmental impacts (impacts on adjacent freshwater wetlands). Continued acquisition of properties and removal of shoreline armoring in areas where sediment could recruit would prevent further loss of sediment to the system and help to prevent further losses of ecological function.

Manzanita Bay Management Area

Overview

Manzanita Bay is the smallest management area on Bainbridge Island. It encompasses all of Manzanita Bay and Arrow Point and comprises 18,879 linear feet of shoreline (Figure 11).



Legend

- Restoration site
- Management unit
- Wetland
- Stream
- Road

Shoreline designation

- Island Conservancy
- Shoreline Residential Conservancy
- Natural
- Shoreline residential
- Urban

Figure 11. Manzanita Bay Management Area restoration opportunities, City of Bainbridge Island, Washington.

N

0 500 1,000 2,000 Feet

HERRERA

Aerial: USDA (2009)

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The management area is dominated by low-energy shorelines with various bank heights. The management area is defined by four small drift cells. The first drift cell begins at a divergence zone located outside the northern margin of Manzanita Bay and moves south into Little Manzanita Bay. The second drift cell is quite small and moves eastward into Little Manzanita Bay along its south shore. The third and fourth drift cells move south from divergence zones near Arrow Point and south of Little Manzanita Bay and converge at the head of Big Manzanita Bay (Williams et al. 2004). The bay is very sheltered from wave-induced erosion, so erosion strictly from waves is not generally a problem. However, the bluffs along the margins of the bay are unstable in places and have been identified by MacLennan et al. (2010) as good restoration targets.

Shoreline development is primarily residential, but extensive. The development is older than most other low-density residential areas on the island. Most of the alterations that have been made to the shoreline are for overwater structures, which are common in the south end of the bay. Overhanging riparian vegetation is extensive along the shoreline.

Restoration Strategy

Like Murden Cove and Port Madison Bay, the Manzanita Bay management area is dominated by a shallow embayment, caused by tectonic subsidence from the most recent (geologic time scale) rupture of the Seattle Fault Zone. The subsidence has caused two pocket estuaries to develop along its fringes. Pocket estuary habitat has been identified as a critical habitat feature for the restoration of salmonid populations in Puget Sound (Beamer et al. 2003, 2005), and on Bainbridge Island in particular (Redman 2005). Because residential development is relatively modest in the area, emphasis should be placed on conservation and education activities rather than on restoration. The already completed Williams Property Acquisition and conversion to Williams-Olson Park serves as an excellent example of that type of activity. Educational activities could focus on overwater structures and their impact on juvenile salmonid migration, possibly through the Shoreline Stewardship Program or in conjunction with similar activities at Port Madison Bay or Eagle Harbor.

Habitat Benefits

Acquiring and permanently protecting key pocket estuary habitat is the major habitat benefit to this restoration plan. Parcels in the area are larger than on most other areas of the island. Because nearly all parcels are developed or placed in conservation, it is not expected that significant additional disturbance will occur in the future. Further restoration and preservation efforts to build upon past acquisitions at the heads of the estuaries in the bay should increase the habitat quality of those key areas. Ongoing restoration efforts to remove overwater structures over time will reduce the impediment of sediment flow and the potential impact that such structures have on migrating salmonids and aquatic vegetation (e.g., eelgrass).

PROGRAMMATIC RESTORATION OPPORTUNITIES

In addition to the planning-area-specific actions mentioned and summarized in the previous section, there are several broad-scale actions that can be implemented in a programmatic manner. They are described below.

Pursue a Mitigation Banking or In-lieu Fee Program for Shoreline Armoring Projects

The shorelines of Bainbridge Island are largely in private ownership. The fragmentation of land ownership and the cumulative impact of individual, small, shoreline armoring projects on nearshore ecological conditions (sediment supply) are quite similar to the issues faced in wetlands protection. Wetland mitigation banking and similar programs have been shown to be successful mechanisms to more efficiently mitigate ecological impacts owing to the economies of scale associated with restoration activities. Because mitigation banks and restoration projects funded with in-lieu fees can target particular areas that have the potential to be ecologically significant, they can have a greater impact on the overall functioning of the ecosystem. On Bainbridge Island, this is particularly true since there are clearly areas (e.g., pocket estuaries) that have high ecological value and that have either been partially protected or restored. Experience has shown that current schemes of providing only on-site mitigation will result in lost ecological function, particularly on small waterfront parcels. That is largely because there continues to be degradation from past development practices and, also, because many of the small mitigation projects do not achieve the intended ecological benefits.

Continue and Expand Shoreline Stewardship Program

Engagement and education of the public is key to any habitat restoration and preservation strategy. Management-area-focused educational efforts are mentioned in nearly all of the management restoration strategy sections. Started in 2002 by the City of Bainbridge Island, the Shoreline Stewardship Program is the ideal mechanism to promote many restoration goals. The goals may differ depending on land use in each management area. For instance, overwater structures are an important issue in Manzanita Bay, Port Madison Bay, and Blakely Harbor, while bulkheading and sediment loss is a key issue in Rich Passage, Agate Passage, and Point White – Battle Point, and stormwater is a particular concern in Eagle Harbor.

Remove Bulkheads on Private Property

Roughly half of the island is armored (Williams et al. 2004; Appendix C). Most of the armored shorelines are bulkheads for individual residences. 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).

There two different ways that the public could be approached and educated. First, the public can be made aware of the alternatives to bulkheads and shown examples of types of shoreline protection that have less impact on nearshore ecosystem functions. The City 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 Port Madison Shoreline Restoration project is a great example of how restoration of shoreline functions can be conducted on private property and could be used as a model if permission is granted. Second, the public could be educated about the need (or lack thereof) for bulkheads. In particular, in the Rich Passage management area, sedimentary bedrock is present just beneath the ground surface. While some erosion of the soil veneer at the ground surface is possible, the bedrock underneath it erodes at an extremely low rate, even on energetic shorelines. In that area and others that are actively accreting (i.e., the shoreline is moving seaward over time), erosion does not generally pose a significant threat to structures.

Remove Derelict Piles on Private Property

There is a large number of isolated derelict wood piles along the Bainbridge island shoreline (Appendix C). 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 are identified in Appendix C, but none of the piles have been tested for the presence of creosote or other polycyclic aromatic hydrocarbons. Finally, coordination with Washington Department of Natural Resources could leverage funds by using their piling removal program to support the clean-up efforts.

Remove Groins on Private Property

There are a large number of groins along the island shorelines that have interrupted sediment transport alongshore. The impacts and ramifications of groins are discussed in some detail in the *Restoration Strategy* section of the *Point White - Battle Point Management Area* section of this plan. However, there are many groins in other areas of the island, predominantly, if not exclusively, on private property (Appendix C). 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 of time, 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 on the island. Often these projects were funded and completed because they were in areas that would leverage large ecological benefits if restored. Nearly all of the site-specific projects identified in this plan meet this goal (e.g., Port Blakely Park, Waterfront Park, etc.). 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.

Vegetate Shoreline Road Rights-of-way with Native Vegetation

Many miles of roads are adjacent to the shoreline on the island. 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 (typically Scot's broom and Himalayan blackberry).

It has been shown that marine riparian vegetation is essential to healthy nearshore ecosystems (Brennan et al. 2009). There are a few locations in the city where the roadway buffer is large enough and the ecological benefits of revegetation are significant enough to have a project described (such as the Port Madison Bay Revegetation project). However, there are many roadsides on the island 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 island. Doing so could create an opportunity to engage the community and encourage people to remove invasive plants and plant native vegetation on private properties.

Encourage Daylighting Natural Stream Outfalls

There are innumerable outfalls throughout the island, many of which have been installed by private landowners. There are also many outfalls associated with city roads along the shoreline. Many of the outfalls are the result of concentrating natural watercourses in a pipe, which have negative impacts on fish migration and use of the nearshore as well as nearshore water quality. The City 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 Schel-Chelb Estuary Hydrologic Restoration project in Lynwood Center. For small drainages that result from development, the City 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 on the island 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.

Develop a Coordinating Body to Oversee Restoration Projects

Several different organizations are actively pursuing restoration projects on the island. The lead entity for projects in the city funded by the Washington State Recreation and Conservation Office is West Sound Watersheds Council. Because the West Sound Watersheds Council has a broader purview than just the city, and because other organizations are doing restoration on the island that have funding outside the Recreation and Conservation Office, coordination specific to Bainbridge Island is insignificant to non-existent compared to other jurisdictions (such as Pacific County). Therefore, it could be productive to form a small, informal, coordinating body that tracks restoration projects on the island and develops guidance for the selection of future projects. This would be helpful not only in planning for future projects, but it would also provide a mechanism to share lessons learned from projects that have already been completed or are underway. A coordinating body would keep conversation between restoration entities fluid, would review prioritization of the various projects outlined in this plan on a regular basis, would keep abreast of new opportunities that may not have been identified, and could track monitoring and the success of projects.

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. This was done at the Wyckoff site, but could be expanded to many other restoration projects on the island. Many jurisdictions have trained and used Beach Watchers for monitoring, as well.

The City is planning to develop a comprehensive, island-wide, monitoring plan that will include site-specific monitoring using approved protocols. The monitoring plan should provide

consistent protocols and standards that can be used for all restoration projects, enabling comparison of different restoration efforts on the island.

Determining a physical and ecological baseline is crucial for documenting the ecological lift of various restoration strategies. As such, it is recommended that all of the proposed and potential projects detailed in Appendix A be monitored. In some cases, such as Schel-Chelb Estuary, monitoring is already being done.

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 City to accomplish its restoration goals. This section also includes suggestions for potential City programs to obtain restoration funding.

Bainbridge Island Land Trust

The Bainbridge Island Land Trust is a 501(c)(3) Washington State private, nonprofit corporation. Twenty years after its founding, the land trust has helped to protect over 1,100 acres of vulnerable forestlands, wetlands, meadows, shorelines, agricultural lands, riparian corridors, and scenic vistas on the island, of which more than 860 acres are open to the public. The land trust holds 44 conservation easements (permanent land protection agreements on 39 private and 5 publicly owned properties) encompassing 688 acres, with an additional 41 acres owned by the land trust outright (Bainbridge Island Land Trust 2011). Through its acquisitions and restoration projects (sometimes in partnership with the City), the land trust has been one of the most effective and prolific organizations to direct restoration activities on the island. There are many examples of land trust projects (such as the Close property, Port Madison Shoreline Restoration, and Trick property) in both the proposed/ongoing and completed restoration projects' sections of this plan (see Appendices A and B).

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 2011). The organization has already completed several projects on the island, including the ongoing Restoration Point Kelp Revegetation project, but its programs could be expanded to other locations on the island.

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. Their goals closely align with City of Bainbridge Island 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 (though none on Bainbridge Island). 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 one project on the island, and has two more underway (Alliance for Puget Sound Shorelines 2011).

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 Strawberry Plant and Port Madison Shoreline Restoration.

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 2011).

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 2011). The WWRP could be used to acquire or expand existing parklands or wildlife areas. Such an effort might, therefore, be more appropriately led by the BIMPRD, which has already partnered with WWRP in the acquisition of land for Pritchard Park on the island.

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.

National Resource Damage Assessment and Restoration Program

The National Resource Damage Assessment and Restoration (NRDAR) Program collects, compiles, and analyzes information, statistics, or data through prescribed methodologies to determine damages for impacts on natural resources and provides funds to rectify past pollution via the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), sometimes known as Superfund.. The NRDAR Program has funded considerable shoreline restoration activities as a part of the Wyckoff Superfund Site project. It continues to support restoration projects, including some of the site-specific projects mentioned in the *Eagle Harbor Management Area* section.

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). Two Bainbridge Island projects (including the Port Madison Shoreline Restoration project) 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 City 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 work in pocket estuaries, which are common on Bainbridge Island. The most recent funding award included a single acquisition by the Bainbridge Island Land Trust on the west side of the island.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service has numerous grant programs that fund restoration-oriented projects. The programs are often tailored to particular goals of the agency 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.

Targeted Tax Programs

Due to the specialized use that waterfront landowners enjoy, the City may consider imposing a waterfront tax on the sale or construction of new development on the waterfront. While there may be negative perceptions of such a tax, this approach has been proposed elsewhere (such as in Baltimore) to account for the particular benefits that waterfront ownership provides.

Other local funding programs are available that can be used as a model to fund acquisitions and, potentially, restoration projects. For instance, San Juan County has a program called the Land Bank that taxes buyers of real estate 1 percent of their purchase price in order to set aside funds for acquisition of properties for public and environmental benefit. The large and nationally renowned Turtleback Mountain Preserve is an example of the type of project that can be accomplished with this sort of program. The San Juan County Land Bank has also acquired many shoreline acres in a setting similar to Bainbridge Island, where shoreline is mostly privately owned.

DATA GAPS

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 city. Monitoring of sites has been limited. It is understood that the University of Washington is sampling the beach at Pritchard Park and will compare the ecological productivity and functioning of that area to others on the island. It would be helpful to distribute the results of the university study to restoration partners to improve the performance of future restoration projects.

In addition, 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 guide future bulkhead replacement projects.

GLOSSARY

Anthropogenic - Caused either directly or indirectly by human activity.

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 - Shorelines that have a steep portion greater than 10 feet in height. Where eroding, these features typically contribute a significant amount of sediment to the nearshore.

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

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

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 Bainbridge Island extends from approximately 1 to 3 feet above MLLW to MHHW. It is the most sedimentologically active portion of the nearshore.

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.

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).

Nearshore - In the context of Bainbridge Island shorelines, the nearshore is the area of marine and estuarine shoreline. It 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 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.

Seattle Fault Zone – The Seattle Fault Zone is broadly defined by a series of east-west trending faults (including the Toe Jam Hill Fault and Macs Point Fault) that cross the southern end of Bainbridge Island.

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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APPENDIX A

Summary of Ongoing and Proposed Restoration Projects

Project name	**Blakely Harbor Park Restoration**
Location	**Blakely Harbor Park**

Project sponsor	BIMPRD
Project status	Feasibility complete
Target habitat	Juvenile Chinook migration and rearing, forage fish spawning
Current ownership	BIMPRD
Shoreline designation	Island conservancy
Hydrogeomorphic classification	Estuarine
Project size	39 acres in total, over 3,000 feet of shoreline
Strategy	Restoration

Existing conditions	Blakely Harbor Park is a largely forested park at the head of Blakely Harbor. The entire site has remaining infrastructure from a large mill constructed in 1863 and, therefore, has significant historical and cultural resources. The infrastructure includes: a concrete building, numerous piles and culverts, wood waste and a rock jetty that nearly spans the width of the harbor. Some soils are contaminated, which represents a constraint on restoration of the site. The jetty that once confined the log pond has permanently disturbed the natural flow of sediment alongshore (MacLennan et al. 2010).
Project description	Remove deleterious materials, including contaminated soils; remove or modify jetties to allow diffuse freshwater flow to site (i.e., remove old culverts); place clean sediment (sand) nourishment to restore beaches and forage fish spawning habitat, remove invasive species, and revegetate the site where appropriate. Any restorative activities will need to consider impact on significant on-site historical and cultural resources.
Future threats	Continued loss sediment from the upper beach. Continued contamination release from soils.
Project rationale	Blakely Harbor Park is a part of a large island greenbelt. The harbor has been identified as a properly functioning pocket estuary within ~5 miles of a natal Chinook watershed and provides significant foraging and refugia habitat for juvenile Chinook. It is also in a key riparian wildlife corridor (Self et al. 2000). Some of the shorelines in the park have an intact riparian corridor, with high habitat value in terms of the capability of the shoreline to accommodate both salmon migration and forage fish spawning. However, the site has large tracts of shoreline that are disturbed and/or contaminated which would preclude use by fish, and could even be harmful to fish populations due to past contamination. Also the jetty disturbs and disrupts flow of water and sediment in the most crucial (from a fisheries perspective) portion of the harbor. Removing these materials would be a significant improvement in terms of nearshore ecological health. Of all of the projects identified on the island, this project could easily provide the greatest ecological lift.
Functions restored	Predevelopment patterns of sediment transport, restored tidal circulation to head of harbor, improved riparian corridor, forage fish spawning habitat, improved migration opportunities for a variety of species of anadromous fish, improved habitat for shorebirds.

Return to Figure 1

Project name	Eagle Harbor Drive Bulkhead Removal		
Location	6533 Eagle Harbor Drive NE		
		**Project sponsor**	City of Bainbridge Island
		Project status	Proposed
		Target habitat	Juvenile salmonid rearing
		Current ownership	City of Bainbridge Island
		Shoreline designation	Shoreline Residential
		Hydrogeomorphic classification	Estuarine
		Project size	150 feet of shoreline
		Strategy	Restoration
Existing conditions	There currently exists a timber bulkhead protecting fill, within the City right-of-way along Eagle Harbor Drive. Although intended as a public access point, it is extremely difficult to access the beach. Nonnative invasive plant species are common (including Scotch broom, see photo) and there is no existing woody vegetation.		
Project description	Remove invasive vegetation. Remove timber bulkhead. Plant native riparian vegetation. Place beach nourishment material to restore an upper beach to this area and supply sediment to adjacent shorelines. Provide a well-defined trail from parking (if retained) to the beach.		
Future threats	Continued loss of upper beach through erosion. Increased opportunity for nonnative plant species colonization and expansion.		
Project rationale	Upper beaches throughout the island have been lost due to the placement of bulkheads. This environment is crucial to forage fish spawning and juvenile salmon migration. The lack of a riparian buffer represents a risk of mortality to forage fish spawn, which occurs in the harbor, and a limitation of salmon food sources. Placed clean sediment could potentially nourish adjacent shorelines, which have been starved of sediment from adjacent shoreline armoring. Finally, though intended as a shoreline public access point, access to the intertidal is difficult. Access could be improved if the bulkhead is removed and nourishment is added.		
Functions restored	Littoral drift and sediment to adjacent shorelines, forage fish spawning habitat, riparian vegetation, and improved juvenile salmonid migration.		

Return to Figure 1

Project name	**Fay Bainbridge Park Lagoon Restoration**
Location	**Fay Bainbridge Park**

Project sponsor	BIMPRD
Project status	Potential
Target habitat	Juvenile Chinook migration, forage fish spawning
Current ownership	BIMPRD
Shoreline designation	Island conservancy
Hydrogeomorphic classification	Estuarine
Project size	Approximately up to 1 acre
Strategy	Restoration

Existing conditions	Fay Bainbridge Park is a depositional shoreform that joins feeder bluffs to the south with the Point Monroe spit to the north. It is comprised mostly of recently deposited beach material and substantial wrack. At the north end of the park, the Point Monroe lagoon is truncated. According to historic documents, marsh areas associated with the lagoon extended. It is uncertain whether these areas were filled or whether they were simply drained. These low marsh areas have since been paved for parking, while other areas have planted with non-native grasses. The park was recently transferred from state ownership to the Bainbridge Island metropolitan Park and Recreation District.
Project description	Allow marine water underneath Point Monroe Drive. Remove fill where it is identified. Replant marsh areas that are at an appropriate elevation. Rearrange parking in areas that are not marsh, possibly in upland areas. Structure trail system to limit impacts and disturbance to intact habitat while maintaining public access to the shoreline and lagoon. Revegetate with native plants where possible.
Future threats	Continued stormwater contamination of marine areas from the proximity of the parking to those areas and a lack of vegetative buffer.
Project rationale	Point Monroe is a classic pocket estuary and these features have been identified as key landscape elements in the recovery of Puget Sound salmon populations. The park has encroached on the historic extent of this area by filling, paving and restricting tidal flow by fill associated with Point Monroe Drive. Expanding the pocket estuary would restore former marsh areas and increase the viability of salmon populations. The expanded marsh would also likely attract shorebirds, increasing recreational opportunities at the marsh.
Functions restored	Expanded pocket estuary habitat. Improved riparian fringe. Expanded shorebird habitat.

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Project name	Fay Bainbridge Park Revegetation & Nonnative Invasive Plant Removal
Location	Fay Bainbridge Park

Project sponsor	BIMPRD
Project status	Partially complete
Target habitat	Shorebird, forage fish spawning
Current ownership	BIMPRD
Shoreline designation	Shoreline residential conservancy
Hydrogeomorphic classification	Riparian
Project size	~3 acres, 1,000 feet of shoreline
Strategy	Restoration

Existing conditions	Fay Bainbridge Park is a depositional shoreform that joins feeder bluffs to the south with the Point Monroe spit to the north. It is composed mostly of recently deposited beach material and substantial wrack. The barrier beach/spit appears largely intact from a geomorphic point of view, despite heavy disturbance and possible fill. While native dunegrass (the vegetation type typical of this setting) is relatively common, so is Scot's broom (see photo) and English ivy. The dune grass is also highly fragmented due to the broad disturbance of foot traffic. There is little if any buffer between the parking areas and this native vegetation. The park was recently transferred from state ownership to the BIMPRD.
Project description	Remove non-native invasive vegetation. Plant dunegrass. Control human access to a few points (i.e., manage trails) to avoid excessive disturbance to backshore areas.
Future threats	Potential expansion of non-native plant species.
Project rationale	The environment is crucial to shorebirds and forage fish spawning. Removal of Scot's broom, English ivy and any other invasive or noxious plant species would benefit restoration of native dune habitat as will designating formal trails.
Functions restored	Riparian corridor, higher quality habitat for both fish and birds.

Return to Figure 1

Project name	**Fort Ward Park Revegetation & Nonnative Invasive Plant Removal**
Location	**Fort Ward Park**

Project sponsor	BIMPRD
Project status	Potential
Target habitat	Juvenile Chinook migration, forage fish spawning, shorebirds
Current ownership	BIMPRD
Shoreline designation	Shoreline residential conservancy
Hydrogeomorphic classification	Riparian
Project size	~4 acres, 1,600 feet of shoreline
Strategy	Restoration

Existing conditions	Fort Ward Park is a large park on the south end of the island. The shoreline is composed mostly of an uplifted beach terrace that for its southern half is largely vegetated only with non-native grasses that are slowly eroding away, partly because of the lack of woody vegetation. Erosion is ongoing, even though wave energy is modest, erosion vessel wakes and tidal motions are significant. The other half of the park has a reasonably intact native riparian corridor. It is a key shoreline access point in an area of the island where most of the shoreline is privately owned. The park was recently transferred from state ownership to the BIMPRD. There are significant historical and cultural resources which may preclude implementation of some restorative activities.
Project description	Plant a suite of native riparian species, including conifers in unforested areas. Remove non-native invasive plant species where they occur.
Future threats	Ongoing erosion and endangerment of historic structures. Potential expansion of non-native plant presence.
Project rationale	This site is an excellent example of erosion caused by deforestation. As can be seen in the photograph, the shoreline has receded more in areas where native vegetation has been removed. To protect the park and the historic structures in it, it is recommended that native vegetation be replanted. This would improve the spawning habitat for forage fish and expand food sources for migrating juvenile salmon.
Functions restored	Riparian corridor, higher quality habitat for both littoral fish and birds, erosion protection from vegetation

Return to Figure 1

Project name	Gazzam Beach Restoration
Location	Crystal Springs Drive NE in Gazzam Lake Park and Wildlife Reserve

Project sponsor	BIMPRD and City of Bainbridge Island
Project status	Potential
Target habitat	Juvenile Chinook migration, forage fish spawning
Current ownership	BIMPRD / City road right-of-way
Shoreline designation	Island conservancy
Hydrogeomorphic classification	Marine
Project size	600 feet of shoreline
Strategy	Restoration

Existing conditions	The portion of Crystal Springs Drive NE that passes through the Gazzam Lake Park and Wildlife Preserve has a thick riprap blanket and protrudes slightly into Port Orchard. As a result, the shoreline is denuded with little to no upper beach. There are signs that the riprap blanket is eroding (i.e., isolated riprap pieces in the middle of the beach, see photo). The roadway is on a wave-cut bench that was uplifted during the last slip of the Seattle Fault. A wetland is present on the landward side of the road. The wetland captures considerable groundwater flow from the bluff. The wetland drains to the beach via a series of culverts that are not fish passable. There is no significant riparian vegetation or any wrack in this reach of shoreline. The wave energy is relatively low.
Project description	Remove the riprap and relocate road to the base of the bluff. Plant a vegetative buffer. Nourish the beach with sediment suitable for forage fish spawning.
Future threats	Continued loss of upper beach. There is also an erosion risk to the roadway, although this is unlikely, but could occur over time.
Project rationale	Upper beaches throughout the island have been lost due to the placement of bulkheads and the reduction of sediment supply, particularly in the Crystal Springs area. As a result, some forage fish spawning habitat has been lost throughout the island, including in undeveloped, preserved areas like the former Close Property. This type of environment is crucial to forage fish spawning and successful juvenile salmon migration. Relocating the road will restore sediment supply to this reach, as well as allowing for predevelopment shoreline processes to recur at the site. The restoration of broad sandy beach would also have public access and user's benefits, as the existing reach is poorly degraded, steep and nearly impossible to access. This area was also identified as both environmentally sensitive and vulnerable to development by EDAW|AECOM (2008).
Functions restored	Forage fish spawning habitat, riparian (and backshore) vegetation, accumulation of wrack, sediment supply from slow erosion of the bench, improved juvenile salmon migratory habitat.

Return to Figure 1

Project name	Hidden Cove Park Shoreline Restoration
Location	8588 Hidden Cove Road NE

Project sponsor	BIMPRD
Project status	Potential
Target habitat	Juvenile Chinook migration, forage fish spawning
Current ownership	BIMPRD
Shoreline designation	Shoreline residential
Hydrogeomorphic classification	Estuarine
Project size	3.36 acres, 250 feet of shoreline
Strategy	Restoration

Existing conditions	This park is a recently acquired set of properties that abuts south side of Hidden Cove. While most of the site is vegetated, as can be seen in the above photo, some of the marine riparian corridor has been lost or taken over by invasive species. There is also an old public dock on the beach with decaying bulkhead.
Project description	Remove deleterious, unused bulkheads. Revegetate shorelines where possible. Improve public dock using fish-friendly methods.
Future threats	None.
Project rationale	The project will improve juvenile salmonid migration, increase shading of critical habitat and provide food resources for forage fish. This area was also identified as both environmentally sensitive and vulnerable to development by EDAW|AECOM (2008).
Functions restored	Sediment transport in the upper beach, forage fish spawning habitat, riparian corridor reestablishment, improved juvenile migration corridor.

Return to Figure 1

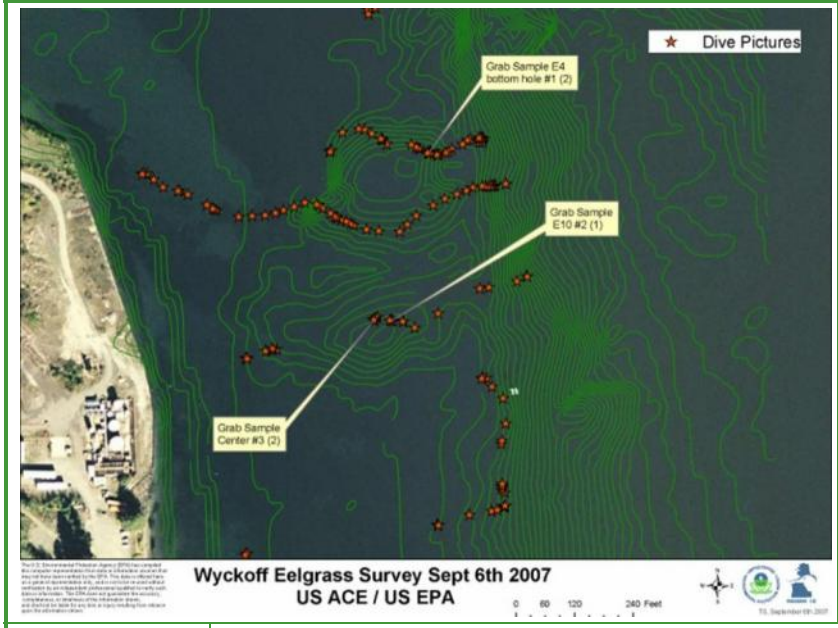
Project name	Manitou Beach Salt Marsh Restoration
Location	9800 Block of Manitou Beach Drive NE

Project sponsor	City of Bainbridge Island
Project status	Feasibility complete
Target habitat	Juvenile Chinook migration and rearing, shorebirds
Current ownership	City of Bainbridge Island (with adjacent private parcels)
Shoreline designation	Shoreline residential conservancy
Hydrogeomorphic classification	Estuarine
Project size	0.86 acre (but could be expanded)
Strategy	Restoration

Existing conditions	The site includes the uplands and marshlands bordered by Manitou Beach Drive NE on the south, the freshwater wetlands and residences amid some of the remaining wetlands to the east, the base of a hillslope to the north, and NE Murden Cove Drive to the west. Wetlands are present throughout the study area. A small stream flows through the western edge of the project site. The existing salt marsh to the west of Manitou Creek is subject to limited tidal inundation due to a partially blocked tide gate in an 18-inch-diameter culvert that conveys the flow in Manitou Creek to Murden Cove. Overall, geomorphic conditions are stable. The marsh is underutilized by juvenile and adult salmon and other aquatic species compared to what could occur under free-flowing tidal conditions.
Project description	Excavate channels and replace the partially blocked tide gate with a large culvert. Excavate channels to encourage good drainage and proper estuarine circulation. The Manitou Creek channel should be extended to the road prism of Manitou Beach Drive NE to minimize the culvert length and increase fish passage success. Replant the site with appropriate native vegetation.
Future threats	Subsidence of marsh and adjacent areas and increased risk to flood-prone residences.
Project rationale	Pocket estuary habitat is crucial to the recovery of salmon populations in Puget Sound. This project restores nearly an acre of this habitat, while restoring predevelopment hydrogeomorphic conditions that could have flood protection benefits to adjacent property owners and increasing overall marsh productivity. A feasibility analysis for the project has already been completed, so the project could be easily implemented. This area was also identified as both environmentally sensitive and vulnerable to development by EDAW|AECOM (2008).
Functions restored	Estuarine circulation, juvenile salmonid rearing and migratory habitat, adult coho habitat, improved shorebird habitat.

Return to Figure 1

Project name	**Milwaukee Dock Eelgrass Planting**
Location	**Offshore Bill Point, Eagle Harbor**



Project sponsor	NOAA
Project status	In design
Target habitat	Juvenile Chinook migration and rearing, eelgrass
Current ownership	Washington Department of Natural Resources
Shoreline designation	Aquatic
Hydrogeomorphic classification	Marine
Project size	4.5 acres
Strategy	Restoration

Existing conditions	There are several holes left over from the removal of the Milwaukee Dock associated Wyckoff Superfund site. These deep holes are nearly devoid of eelgrass because of their depth and level of disturbance. There are healthy eelgrass meadows surrounding the holes.
Project description	Fill in holes left from the removal Milwaukee dock pilings, replant with eelgrass plants scavenged from the project site. Project is due to be constructed in fall 2011.
Future threats	Disturbed sediment transport.
Project rationale	This project will restore approximately 4.5 acres of eelgrass at the mouth of Eagle Harbor adjacent to existing healthy eelgrass meadows and improve nearshore conditions in this previously disturbed, contaminated site.
Functions restored	Eelgrass habitat, will return site closer to predevelopment geomorphic conditions.

Return to Figure 1

Project name	**Murden Cove Riparian Corridor**
Location	**Murden Cove**

Project sponsor	Bainbridge Island Land Trust
Project status	Proposed
Target habitat	Juvenile Chinook migration and rearing, forage fish spawning, shorebird
Current ownership	Private
Shoreline designation	Natural
Hydrogeomorphic classification	Estuarine
Project size	4.83 acres
Strategy	Preservation

Existing conditions	The head of Murden Cove is primarily undeveloped, with the parcels either owned by the public at large or protected by conservation easement. There is a mature riparian corridor and conditions are generally of intact pocket estuary. The parcel of interest is currently in private hands and could be developed, albeit under significant restrictions as it has been zoned natural.
Project description	Acquire property, remove the uninhabitable residence, outbuildings and driveways that currently exist on the property, reforest cleared areas.
Future threats	Deforestation, residential development, bulkhead construction, bluff armoring, pollution from potentially contaminated impervious surfaces.
Project rationale	The goal of this project is to permanently protect the Murden Cove estuary that currently provides habitat for cutthroat, coho, chum salmon, surf smelt and sand lance spawning, and a large diversity of bird life. The project will also restore the riparian corridor where it has been lost to earlier low-density residential development. This area was also identified as both environmentally sensitive and vulnerable to development by EDAW|AECOM (2008) and a key riparian wildlife corridor by Self et al. (2000).
Functions preserved	Reconnection to the beach with an intact riparian upland, forage fish spawning habitat, improved migration opportunities for a variety of species of anadromous fish.

Return to Figure 1

Project name	**Point Monroe Lagoon Stormwater Outfall Replacement**
Location	**Point Monroe Drive NE & Fay Bainbridge Park**

Project sponsor	City of Bainbridge Island
Project status	Potential
Target habitat	Juvenile salmonid rearing
Current ownership	City of Bainbridge Island
Shoreline designation	Shoreline residential conservancy
Hydrogeomorphic classification	Estuarine
Project size	0.1 acre
Strategy	Restoration

Existing conditions	Most of the parking lots in Fay Bainbridge Park drain through a pipe underneath of Point Monroe Drive NE to the Point Monroe lagoon. The flow from the outfall is significant enough to have formed a channel between the outfall and the deeper portions of Point Monroe lagoon.
Project description	Disperse the runoff from the Bainbridge Park using low-impact development techniques. Restore marsh fringe area near stormwater outfall, where possible.
Future threats	Continued stormwater pollution entering Point Monroe lagoon from Fay Bainbridge Park, continued disruption and disturbance of marsh fringe due to outfall
Project rationale	Stormwater pollution has been identified the Puget Sound Partnership to be key limiting factor in the health of Puget Sound. The stormwater outfall in question is entirely on public property and likely a significant contributor of metals and hydrocarbons to the lagoon, given the activity at Fay Bainbridge Park and the large size of parking lots there.
Functions restored	Improved/restored marsh fringe areas, improved Point Monroe and Puget Sound water quality

Return to Figure 1

Project name	Port Madison Revegetation
Location	Port Madison

Project sponsor	Joint City of Bainbridge Island & Port Madison Water Company
Project status	Proposed
Target habitat	Juvenile salmonid migration, forage fish spawning
Current ownership	City of Bainbridge Island, Port Madison Water Company
Shoreline designation	Shoreline residential
Hydrogeomorphic classification	Riparian
Project size	1,200 feet of shoreline
Strategy	Restoration

Existing conditions	The waterfront near the center of Port Madison is largely devoid of native riparian vegetation. Non-native invasive plant species, such as Himalayan blackberry, are also common. Euclid Avenue is not currently armored, but armoring may be required if erosion continues or increases as a result of climate change. The site is generally a low-energy wave environment.
Project description	Remove non-native invasive plant species. Plant a suite of typical native riparian species, including conifers.
Future threats	Ongoing erosion and eventual endangerment of Euclid Avenue.
Project rationale	Port Madison Bay is a key migration corridor and rearing area for juvenile salmonids. It is also home to forage fish spawning areas. Currently the key roadway in the project site is not protected by armoring, but it may be required in the future, despite the low-energy environment. Armoring would ultimately result in the loss of upper beach crucial for the species that currently use it. However, there is space to plant native vegetation in the small prism of land between the road and the water. This space is all in public (i.e., the roadway) or collective (i.e., the upper intertidal and backshores) ownership. The native vegetation would improve habitat, but would also help protect the roadway.
Functions restored	Riparian corridor, higher quality habitat for both fish and birds, increased erosion protection from intact woody vegetation.

Return to Figure 1

Project name	**Port Madison Shoreline Restoration**
Location	**Broom Street NE**

Project sponsor	Bainbridge Island Land Trust
Project status	In design
Target habitat	Juvenile Chinook migration, forage fish spawning
Current ownership	Private
Shoreline designation	Shoreline residential
Hydrogeomorphic classification	Estuarine
Project size	7.5 acres, 1,500 feet of shoreline
Strategy	Restoration

Existing conditions	On this private property the shoreline is armored to varying degrees and with several different types of bulkheads and fill materials. There is fill present in several different locations, along with a saltwater pool. Riparian vegetation varies considerably throughout the site, ranging from lawn to an intact riparian corridor. The wave energy of site is very low.
Project description	Remove deleterious, unused bulkheads and fill material. Revegetate shorelines where possible.
Future threats	Further deforestation, continued impacts associated with the presence of the existing bulkheads and fill materials, increased residential development, and additional bulkhead construction.
Project rationale	The project will: 1) engage willing landowners in a large nearshore restoration project that will ultimately result in an increase of nearshore habitat critically important to juvenile salmon; 2) lead to an implementation project to restore nearshore processes, structure and functions in an area where there is documented presence of coho salmon in the single large tributary found within the bay (Coho Creek), where there is documented presence of Chinook salmon, where there is documented presence of forage-fish (herring, sand lance, surf smelt, and northern anchovy), and where eelgrass is abundant along semi-protected shorelines of Port Madison Bay; 3) be a showcase project to other landowners to increase awareness of the importance of restoring nearshore habitats in Puget Sound; and, 4) engage stakeholders and partners, including the Powel Family, Bainbridge Island Land Trust, UW Sea Grant, City of Bainbridge Island, Washington Department of Fish and Wildlife, and the Suquamish Tribe.
Functions restored	Sediment transport in the upper beach, forage fish spawning habitat, riparian corridor reestablishment, improved juvenile migration corridor.

Return to Figure 1

Project name	**Pritchard Park West Riprap Removal**
Location	**Pritchard Park, West Entrance**

Project sponsor	City of Bainbridge Island
Project status	Proposed
Target habitat	Juvenile Chinook migration, forage fish spawning
Current ownership	City of Bainbridge Island
Shoreline designation	Island conservancy
Hydrogeomorphic classification	Estuarine
Project size	600 feet of shoreline
Strategy	Restoration

Existing conditions	Pritchard Park was the site the Wyckoff Superfund site, a heavily polluted, former wood-treating facility. The western portion of the park has approximately 600 feet of riprap and construction debris armoring the shoreline. Some sediment from the containment beach to the east has been transported in front of the riprap, improving the site for both forage fish spawning and juvenile salmonid migration, but the riprap and debris has inhibited the formation of a natural beach berm, development of a back shore and accumulation of wrack. It also separates the relatively intact riparian vegetation from the beach.
Project description	Remove riprap. Renourish beach where necessary.
Future threats	Continued loss sediment from the upper beach. Increased loss of adjacent placed nourishment.
Project rationale	Upper beaches throughout the island have been lost due to the placement of bulkheads. This environment is crucial to forage fish spawning and juvenile salmon migration. Eagle Harbor is one of the few locations in Puget Sound were surf smelt are known to spawn year round instead of only during the fall/winter. Beach seine monitoring from 2002-2004 documented high occurrences of forage fish and salmonids of all life stages (larval, juvenile, adult) at the new beach just to the east. The proposed project site is the last remaining section of shoreline along the west beach in Pritchard Park with armoring and intertidal fill.
Functions restored	Forage fish spawning habitat, improved juvenile salmonid migration, more intact riparian corridor, increased accumulation of wrack.

Return to Figure 1

Project name	Restoration Point Kelp Planting		
Location	**Offshore Restoration Point**		
		**Project sponsor**	Puget Sound Restoration Fund
		Project status	In implementation
		Target habitat	Kelp
		Current ownership	Washington Department of Natural Resources
		Shoreline designation	Aquatic
		Hydrogeomorphic classification	Marine
		Project size	0.07 acre
		Strategy	Restoration
Existing conditions	Restoration Point is rocky headland at the mouth of Rich Passage. Its rocky nature makes it ideal habitat for large kelps, including bull kelp (*Nereocystis luetkeana*). Many of these species have been strongly impacted by overfishing and maritime traffic and are the focus of conservation efforts in Washington (e.g., rockfishes, salmon).		
Project description	Replant areas of historic kelp habitat lost to human activities.		
Future threats	Continued loss of kelp seed stock.		
Project rationale	The goal of the project is to regain subtidal kelp beds in areas of historic presence to improve salmon and rockfish habitat and increase ecosystem functions in near shore areas. In April and May 2010, divers completed the first experimental transplant of juvenile plants from nearby kelp beds to the area, but full implementation of the program will not occur in later in 2011.		
Functions restored	Kelp habitat regained, improved offshore habitat for forage fish, rockfish, and salmonids		

Return to Figure 1

Project name	Rolling Bay Walk Acquisition and Demolition
Location	Rolling Bay

Project sponsor	City of Bainbridge Island
Project status	Proposed
Target habitat	Juvenile Chinook migration and rearing, forage fish spawning
Current ownership	Mixed: private uplands, public intertidal
Shoreline designation	Shoreline residential
Hydrogeomorphic classification	Marine
Project size	Over 800 feet of shoreline in total
Strategy	Restoration

Existing conditions	In 1997, a family of four was killed from a debris flow crashing into their house in this area. This triggered the "red tagging" of adjacent homes, some of which have already been removed. Despite the removal of the homes, the bulkhead protecting the properties remains. Heavy rains in the winter of 2010-2011 caused further landsliding north of this site on Gertie Johnson Road, indicating the ongoing nature of risk to the area. The bluff in question supplies sediment to a drift cell to the north. Because of past development, the riparian corridor is severely impaired. Eelgrass is common on the broad low-tide terrace.
Project description	Acquire private properties at risk, remove abandoned homes, remove bulkhead, place soft shore protection or nourish beach with sediment suitable for forage fish spawning to protect bluff-top landowners, remove invasive plant species, and revegetate the site with native plant species where appropriate.
Future threats	Loss of sediment offshore from the upper beach, reduction of sediment supply to the drift cell, human safety risk from future landslides on a developable shoreline.
Project rationale	The Rolling Bay Walk bluff is a human safety risk to waterfront landowners. Further, this bluff is protected by a bulkhead which encroaches on the intertidal, possibly a result of past fill. The bulkhead, which in some locations protects empty, but formerly developed properties, only serves to protect upland landowners from toe erosion of their bluff. Protection of upland properties can be achieved through soft shore protection techniques that improve habitat, while protecting infrastructure. Finally the riparian corridor could be improved if the properties in question were acquired. This area was also identified as both environmentally sensitive and vulnerable to development by EDAW|AECOM (2008).
Functions restored	Predevelopment patterns of sediment transport and sediment supply to large northwest drift cell, restored upper beach and backshore habitat, improved riparian corridor, forage fish spawning habitat, improved migration opportunities for a variety of species of anadromous fish, improved habitat for shorebirds.

Return to Figure 1

Project name	Schel-Chelb Estuary Expansion
Location	West of Lynwood Center

Project sponsor	City of Bainbridge Island
Project status	Proposed
Target habitat	Juvenile salmonid rearing, shorebirds
Current ownership	City of Bainbridge Island, adjacent private properties
Shoreline designation	Shoreline residential conservancy
Hydrogeomorphic classification	Estuarine
Project size	1.6 acres
Strategy	Restoration

Existing conditions	The Schel-Chelb estuary was restored in 1997 as a part of a mitigation project pursued by the Washington State Department of Transportation (WSDOT). Currently fish can access the lagoon on the north side Point White Drive NE. There are numerous anecdotal accounts of juvenile salmonid presence within the lagoon. The City recently acquired properties on the east side of the lagoon for recreational and habitat buffer purposes, but the properties on the west side remain in private ownership. A small private driveway within the public right-of-way has an overhung culvert that cannot pass juvenile salmonids for most tidal elevations (see photo). The driveway road prism also separates a large wetland complex west of the road from the main body of Schel-Chelb estuary
Project description	Replace the small fish-impassable culvert across the private drive that is in the public right-of-way (seen in picture). Acquire adjacent private parcels to expand the intact portions of the estuary and possibly reconnect large wetland complex to the main body of Schel-Chelb estuary.
Future threats	Future development that impinges on the restored estuary.
Project rationale	Pocket estuaries are critical habitat for the restoration of Puget Sound salmon stocks. Schel-Chelb estuary is one of the best examples of a true pocket estuary on Bainbridge Island. Much of it is already protected by being protected public land. One of the most important facets to pocket estuaries is freshwater input. Replacement of the culvert or removal of the driveway prism restores this aspect to the entire estuary and expands the estuary by nearly an acre. This area was also identified as both environmentally sensitive and vulnerable to development by EDAW|AECOM (2008).
Functions restored	Improved estuarine circulation, expanded juvenile salmonid rearing area, restoration of salt marsh conditions.

Return to Figure 1

Project name	**Schel-Chelb Estuary Hydrology Restoration**
Location	**Immediately west of Lynwood Center**

Project sponsor	City of Bainbridge Island
Project status	Proposed
Target habitat	Juvenile salmonid migration and rearing
Current ownership	City, WSDOT, with adjacent private parcels
Shoreline designation	Shoreline residential conservancy
Hydrogeomorphic classification	Estuarine
Project size	6+ acres, including adjacent wetland areas
Strategy	Restoration

Existing conditions	Prior to development, the greater Lynwood Center was a large wetland complex that eased the transition of saltwater from Rich Passage to upland areas. It was likely that fish used much of the area currently developed in the vicinity of Lynwood Center. Roadway infrastructure and development has fragmented the former wetland complex and directed most of the freshwater in the area down a ditch and culvert that exits in the middle of Lynwood Center. Schel-Chelb estuary receives little freshwater from the former wetland complex due to this diversion, despite that it has documented anadromous fish use and an intact riparian fringe (see photo).
Project description	Direct overflow from wetland north of NE Baker Hill Road to Schel-Chelb Estuary instead of down ditch to Lynwood Center. This can be accomplished by constructing a channel from NE Baker Hill Road through an existing City right-of-way to City-owned and WSDOT-owned land in the estuary. The project could be greatly improved with the acquisition of adjacent private properties, but does not depend on it.
Future threats	Ongoing water quality disturbance to Rich Passage from piped drainage through Lynwood Center.
Project rationale	The restoration of Schel-Chelb estuary through the replacement of culvert on Point White Drive in 1997 has been a success. This intact estuary is now protected and buffered due to recent property acquisitions. However, the source of freshwater to the estuary remains lost because of diversion of water to the east through Lynwood Center. Restoration of this freshwater source will more closely mimic predevelopment physical processes to the estuary and improve water quality in Rich Passage by increasing residence time of stormwater and directing it away from an intensely developed area. This area was also identified as both environmentally sensitive and vulnerable to development by EDAW|AECOM (2008) and a key riparian wildlife corridor by Self et al. (2000).
Functions restored	Improved estuarine circulation in Schel-Chelb estuary. Possible expansion of fish use up to the wetland north of NE Bake Hill Road. Improved buffer between upland runoff and the marine environment.

Return to Figure 1

Project name	Waterfront Park Bulkhead		
Location	Waterfront Park, Winslow		
		**Project sponsor**	City of Bainbridge Island
		Project status	Feasibility complete
		Target habitat	Juvenile Chinook migration, forage fish spawning
		Current ownership	City of Bainbridge Island
		Shoreline designation	Island conservancy
		Hydrogeomorphic classification	Estuarine
		Project size	500 feet of shoreline
		Strategy	Restoration
Existing conditions	Currently approximately 500 feet of the shoreline has a 4-foot sloping riprap bulkhead backed by wood lagging. Directly behind the bulkhead is trail, beyond which is a relatively intact, mature riparian corridor. Like many other places on the island that have been bulkheaded, the beach is largely denuded and the upper beach is absent at the highest tides. Sand is limited to a narrow corridor at the base of the riprap. There is currently no easy access to the beach along the wall.		
Project description	Remove the bulkhead and nourish the beach with spawning suitable substrate such that the trail can be maintained without the bulkhead. Reconnect the beach with the upland. Construct a formal access to the beach.		
Future threats	Continued loss sediment from the upper beach. Continued disconnection of intertidal from park.		
Project rationale	Upper beaches throughout the island have been lost due to the placement of bulkheads. This environment is crucial to forage fish spawning and juvenile salmon migration. Eagle Harbor is one of the few locations in Puget Sound were surf smelt are known to spawn year round instead of only during the fall/winter. This project, entirely on City property, would reduce the amount of bulkheading in Eagle Harbor and improve conditions for all fish using Winslow Ravine. A planned, hardened route to the beach could improve access to boaters and other visitors, as the trail does not provide this opportunity.		
Functions restored	Alongshore sediment transport from the Winslow Ravine, reconnection to the beach with an intact riparian upland, forage fish spawning habitat, improved migration opportunities for a variety of species of anadromous fish.		

Return to Figure 1

Project name	West Bainbridge Shoreline Protection		
Location	**Agate Passage**		
		**Project sponsor**	Bainbridge Island Land Trust
		Project status	Proposed
		Target habitat	Juvenile Chinook migration, forage fish spawning
		Current ownership	Private
		Shoreline designation	Shoreline residential conservancy
		Hydrogeomorphic classification	Riparian
		Project size	11.87 acres, including tidelands
		Strategy	Preservation
Existing conditions	These undeveloped properties have an intact riparian corridor and predevelopment nearshore processes, including accumulation of wrack. Sediment is actively being recruited from the unstable bluffs.		
Project description	Acquire parcels and revegetate where necessary.		
Future threats	Deforestation, residential development and bulkhead construction.		
Project rationale	This acquisition project will permanently protect some of the most intact nearshore habitat on Bainbridge Island. The acquisition involves two contiguous undeveloped parcels including 4.3 acres of tidelands, approximately 550 feet of shoreline, and 7.57 acres of uplands that host eelgrass beds, active feeder bluffs, intact upper beach, riparian vegetation, and upland mixed mature forest. This 11.87-acre property is identified as highly functioning habitat in the Bainbridge Island Nearshore Assessment and is prioritized as a "highest conservation priority" for properties supplying sediment sources on Bainbridge Island. This area was also identified as both environmentally sensitive and vulnerable to development by EDAW|AECOM (2008).		
Functions preserved	Intact riparian corridor, upper beach processes, including forage fish spawning habitat and juvenile salmon migratory habitat, sediment supply to remainder of drift cell.		

Return to Figure 1

Project name	Williams-Olson Park Nonnative Invasive Plant Species Removal & Revegetation
Location	End of Williams Road NE

Project sponsor	BIMPRD
Project status	Proposed
Target habitat	Juvenile Chinook migration, forage fish spawning
Current ownership	BIMPRD
Shoreline designation	Shoreline Residential
Hydrogeomorphic classification	Riparian
Project size	3.81 acres, not including all adjacent tidelands
Strategy	Restoration

Existing conditions	This is a recently acquired property for the Bainbridge Island Metro Park & Recreation District. The property includes one single-story home and shared access with a boathouse. The shoreline is backed by an extremely steep, but low (20-foot) bluff above a disturbed pocket estuary. Vegetation is heavily disturbed and interspersed with non-native invasive plant species. In particular, English ivy (an invasive species) has covered the existing, intact riparian trees to the point where these trees are being felled and removed from the bluff. There is a utility pipe at the road that bounds the property.
Project description	Remove non-native invasive plant species. Revegetate where necessary. Construct a public access to the beach.
Future threats	Spread of invasive plant species could endanger City water infrastructure through heightened bluff erosion.
Project rationale	The project site at the south end of Manzanita Bay is a disturbed pocket estuary, with most of the disturbance caused by clearing of native vegetation and encroachment of non-native invasive plants. Pocket estuaries have been shown to key geomorphic feature to protect to restore salmonid populations. Removing invasive plants and replanting improves riparian function and reduces erosion. Reduced erosion is also important to protect nearby City infrastructure. The project plan should include improved public access to the shoreline.
Functions restored	Native riparian corridor, public access to beach in an area where it is currently lacking.

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Project name	Winslow Ferry Terminal Nonnative Invasive Plant Species Removal & Revegetation
Location	WSDOT Ferry Terminal, Winslow

Project sponsor	WSDOT
Project status	Proposed
Target habitat	Juvenile salmonid migration
Current ownership	WSDOT
Shoreline designation	Urban
Hydrogeomorphic classification	Estuarine
Project size	250+ feet of shoreline
Strategy	Restoration

Existing conditions	Currently more than 250 feet of the shoreline within the Winslow Ferry Terminal on the west side is covered with non-native invasive plant species (mostly Scot's broom) and non-native grasses. While there are a couple trees, they do not constitute an intact riparian zone. The Winslow Ferry Terminal handles nearly a million vehicles a year and it is crucial that an intact riparian zone prevent pollution and buffer Eagle Harbor from the terminal.
Project description	Remove non-native invasive plant species and plant a narrow corridor of native shrub and woody vegetation to maintain a buffer between the parking lot and the beach.
Future threats	Continued pollution of stormwater entering Eagle Harbor from the Ferry Terminal.
Project rationale	Riparian vegetation has been shown to be key component of a healthy nearshore ecosystem. This relatively simple and inexpensive action would have positive benefits to littoral fish species, even though the area would still be compromised due to armoring, fill and development.
Functions restored	An intact riparian corridor, increased food sources for migrating salmon in Eagle Harbor.

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APPENDIX B

Summary of Completed Restoration Projects

SUMMARY OF COMPLETED RESTORATION PROJECTS

To document the progress that the City and its partners have already had restoring shorelines on the island, a summary of completed restoration projects is included below. This list is also helpful for prioritizing and identifying future projects, because building upon past successes and continuing to implement restoration on adjacent areas synergistically increases the productivity of the nearshore ecosystem. This particular approach is discussed at length in the *Programmatic Restoration Opportunities* section of this plan.

Wyckoff Superfund Site Clean-up

The Wyckoff Superfund site is on the eastern side of Bainbridge Island at the entrance Eagle Harbor, in what is now Pritchard Park. The site includes the inactive 57-acre Wyckoff wood-treating facility, contaminated sediments in adjacent Eagle Harbor, and other upland sources of contamination to the harbor, including a former shipyard. The wood-treating facility operated from the early 1900s through 1988, when the plant shut down.

Most of the effort was removing the decades of contamination left over by operation of the facility; however, within the last few years sediment (nourishment) was placed and a beach created on the east side of the site to cover contamination leaking from the ground. While the beach creation through placement of sediment nourishment was not a restorative action per se (i.e., it was a cap [cover] for leaking contamination), it does provide evidence of how restoration projects that include beach nourishment could be successfully implemented to restore ecological functions to Bainbridge Island shorelines (Figure B-1). Through the beach creation, the project restored physical forage-fish (sand lance and surf smelt) spawning habitat on the site. In addition, by becoming a source of sediment, the project also restored forage-fish spawning habitat to adjacent beaches (to the west, primarily) that had been previously lost to past shoreline armoring – even though some of these shorelines remain armored.

Close Property Acquisition

This project acquired the 64-acre Close property that features an active feeder bluff, mature mixed-stand marine riparian forest and a 560-foot mixed-course sediment beach with large woody debris and associated aquatic habitats in 2005. The nearshore portion of the project area has been documented to support a great diversity of salmonid species, including Chinook, chum, coho, pink, cutthroat, and steelhead. It has also been documented to support important prey resources, including sand lance, surf smelt, and herring. The Close Property is a priority conservation area located within an at-risk drift-cell (MacLennan et al. 2010). The project is important to maintaining properly functioning conditions along a drift-cell that contains very sensitive habitats, including a lagoon, a pocket estuary, and forage fish spawning areas. This acquisition also abuts the 318-acre Gazzam Lake Park and Wildlife Preserve, expanding on this large protected area of upland habitat. The property is now

connected to the Gazzam Lake Park and Wildlife Preserve trail system and provides a public shoreline access point.

Figure B-1. Restored beach at Wyckoff Superfund site.

Schel-Chelb Estuary

The Schel-Chelb Estuary was the site of one of the first habitat restoration projects implemented in the city. In 1997, the culvert over Point Drive NE was replaced with a much wider bottomless box culvert (Figure B-2). Anecdotal accounts describe nearly immediate juvenile salmonid use of the restored estuary. Restoration of the core of this previously lost pocket estuary was a critical step of juvenile salmonid rearing areas on the island. Subsequently property adjacent to the estuary (i.e., the Blossom Properties) was acquired by the City to expand the green belt around the estuary.

Figure B-2. Replaced culvert at entrance to Schel-Chelb Estuary at low tide.

Spargur Property Acquisition (now Hidden Cove Park)

In 2005, the City acquired three contiguous properties totaling six acres on the south shore of Port Madison Bay north of Hidden Cove Road and west of Spargur Loop. The property contains 330 feet of waterfront, tidelands, and an old wooden dock. The property is heavily wooded and includes substantial wetlands, although a portion near the waterfront has been cleared. The property contains salmonberry, ferns, cedars, and other native species, as well as an artesian well. It also provides habitat for other wildlife and birds. It is one of the only portions of Port Madison Bay that has been conserved, despite the bay being a productive spawning area for forage fish. This acquisition is the first phase of a larger effort that is described in detail in Appendix A.

Pritchard Park East Bluff

This project restored historic feeder bluff function and nourished a small beach on the east side of Pritchard Park (Wyckoff Superfund Site) in Eagle Harbor. The access driveway to the Wyckoff Superfund Treatment Plant formerly ran along the top of an unstable bluff and was replaced by a walking path. Native vegetation was planted along the path. The project is updrift of the beach nourishment project in association with the Wyckoff Superfund Site

Clean-up and should serve to continue to nourish that beach. The East Bluff project addresses the critical shortfall of nearshore sediment in the Eagle Harbor Management Area.

Strawberry Plant Park

This project was located near the head of Eagle Harbor on Bainbridge Island. Objectives for the project were to remove approximately 100 piles (mostly creosote-treated wood); remove a float that grounded at low tide; remove approximately 250 feet of shoreline armoring; remove approximately 23,000 square feet (870 cubic yards) of intertidal/estuarine fill and grade; remove concrete, brick, and other debris that were spread throughout the intertidal zone; remove approximately 23,500 square feet of concrete, grade, amend soil, and replant; utilize natural seed recruitment from adjacent native marsh; perform monitoring and maintenance; demonstrate shoreline restoration to the public; and engage community volunteers (Habitat Work Schedule 2011). The project was constructed in 2010. It has improved pocket estuary habitat and restored nearshore geomorphic processes in a critically impaired portion of Eagle Harbor.

Williams Property Acquisition

This 3.81-acre property is located on the south end of Manzanita Bay. The property acquired by the City enables public access to the beach and opportunity to restore the shoreline. During the second site visit performed as part of this restoration plan, the former home was being moved off the site; otherwise no other restoration activities have occurred within this property. The Williams Property acquisition was the first step in restoring and protecting the pocket estuary, a critical environment for salmonid restoration, at the head of Big Manzanita Bay.

APPENDIX C

Maps of Shoreline Modifications

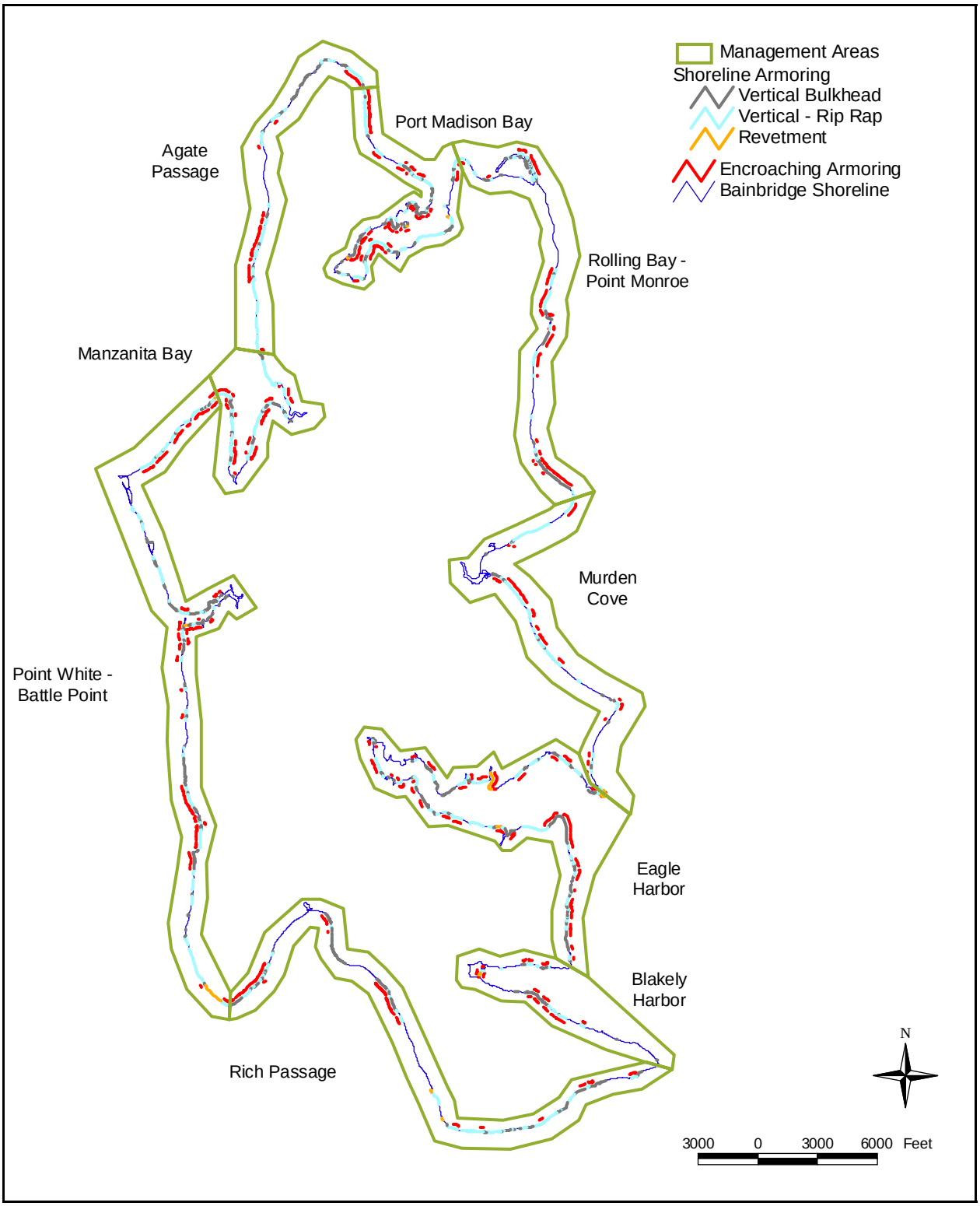
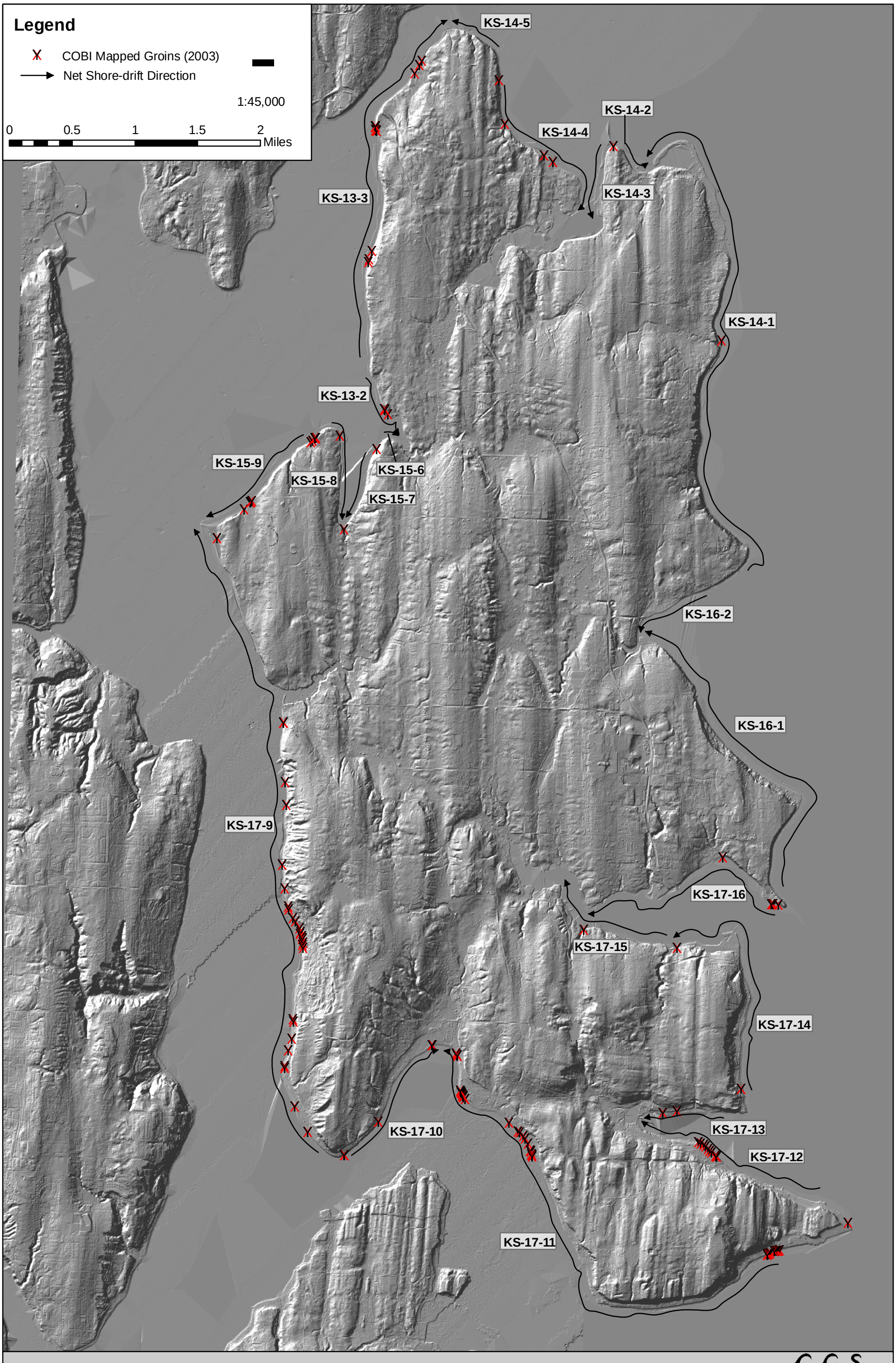


Figure C-1. Bainbridge Island Shoreline Armoring and Armoring Encroachment.



Map 15. City of Bainbridge Island field mapped groins (2003) of Bainbridge Island.
Bainbridge Island Current and Historic Coastal Geomorphic Mapping.
Puget Sound LiDAR Consortium, LiDAR hillshade.

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Figure C-2

Legend

X Potential Restoration Sites

1:24,000

0 0.25 0.5 0.75 1 Miles

Map 16. Potential restoration sites of northern Bainbridge Island.
Bainbridge Island Current and Historic Coastal Geomorphic Mapping.
USGS topographic quadrangles with Puget Sound LiDAR Consortium LiDAR hillshade.

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Figure C-3

Legend

X Potential Restoration Sites

1:24,000

0 0.25 0.5 0.75 1 Miles

KS-16-2 KS-16-1 KS-17-16 KS-17-15 KS-17-14 KS-17-13 KS-17-12 KS-17-11 KS-17-10

8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39

Murden Cove
Fernciff
Commodore Bainbridge Sch.
High Sch
Yeomalt
Yeomalt Point
Winslow
Bainbridge Island
Wing Point Golf Club
Wing Point Golf and Country Club
Eagledale
McDonald Sch.
Lynwood Center
West Blakely
Port Blakely
Port Blakely Cemetery
Pleasant Beach
Point Glover
Wautauga Beach
Middle Point
Orchard Rocks
Beans Point
South Beach
Tyee Shoal
Wing Point
Blakely Rock
EAGLE HARBOR
BAINBRIDGE ISLAND

Map 17. Potential restoration sites of southeastern Bainbridge Island.
Bainbridge Island Current and Historic Coastal Geomorphic Mapping.
USGS topographic quadrangle with Puget Sound LiDAR Consortium LiDAR hillshade.

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Figure C-4

Map 18. Potential restoration sites of southwestern Bainbridge Island.
Bainbridge Islands Current and Historic Coastal Geomorphic Mapping.
USGS topographic quadrangles with Puget Sound LiDAR Consortium LiDAR hillshade.

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Figure C-5

APPENDIX D

Information Sources for Restoration Plan

INFORMATION SOURCES FOR RESTORATION PLAN

The following information sources were examined and used to determine and evaluate possible restoration actions:

- Ph.D. dissertation describing the geomorphology of Puget Sound beaches (Finlayson 2006)
- A study of Puget Sound bluffs (Shipman 2004)
- Historical shoreline maps (T-sheets) developed by the U.S. Coast and Geodetic Survey (U.S. Coast and Geodetic Survey 1872, 1881, 1916)
- Historical bathymetric surveys (H-sheets) developed by the U.S. Coast and Geodetic Survey (U.S. Coast and Geodetic Survey 1868, 1885, 1900, 1912, 1935)
- A statement of recent funding of restoration projects by the Estuary and Salmon Restoration Program (ESRP)
- A regional database of past, current and future restoration projects (Habitat Work Schedule 2011)
- Past summaries of restoration on the island by the West Sound Watersheds Council (West Sound Watersheds Council 2008, 2009)
- A recent high-resolution geologic map of the island (Hagerud 2005)
- A nearshore restoration prioritization analysis of East Kitsap County, not including Bainbridge Island (Borde et al. 2009)
- Recent mapping of feeder bluffs and historical shoreline conditions on the island (MacLennan et al. 2010)
- A series of restoration assessments that Herrera has performed both on Bainbridge Island and in similar environments (Herrera 2004, 2005, 2009)
- A study outlining the importance of marine riparian vegetation (Brennan et al. 2009)
- A summary of science regarding shoreline development and recent addenda (Williams et al. 2003, Herrera 2011)
- A series of shoreline characterization reports (Williams et al. 2004)
- A series of publications on expected climate change in the Pacific Northwest, its ecological implications and impact on restoration projects (Canning 2005; National Wildlife Federation 2007; Battin et al. 2007; U.S. Army Corps of Engineers 2009)

- A study of sediment transport in Rich Passage (Curtiss et al. 2009)
- A series of white papers prepared by Herrera for the Washington Department of Fish and Wildlife (WDFW) and Thurston County describing the ecological impacts of various shoreline activities (Herrera 2005, 2007a-b, 2008)
- Water Resource Inventory Area (WRIA) 15 documents available from the Washington Department of Ecology (Ecology) (Ecology 2010a), which includes a limiting factors analysis (Haring 2000)
- Washington Coastal Atlas, a map-driven database maintained by Ecology (Ecology 2010b)
- Websites of potential funding agencies and organizations (Alliance for Puget Sound Shorelines 2011; BILT 2011)
- The City of Bainbridge Island Comprehensive Plan (City of Bainbridge Island 2004)
- The Bainbridge Island Comprehensive Park, Recreation & Open Space Plan (2008-2014) (BIMPRD 2006)
- The Bainbridge Island Community Forest Management Plan (City of Bainbridge Island 2006)
- The Bainbridge Island Open Space Study (EDAW|AECOM 2008)
- The Bainbridge Island Wildlife Corridor Network report (Self et al. 2000)