CITY OF UNIVERSITY PLACE

Shoreline Restoration Plan Element

Prepared for: **June 2012**

The City of University Place

COASTAL GEOLOGIC SERVICES

ESA

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Regulatory Background 1
1.2 Defining Restoration 3
1.3 Key Elements of Restoration Planning in the SMP Update Process 3
2.0 ASSESSMENT OF FUNCTIONS 4
2.1 Regional Setting 4
2.2 Physical and Ecological Processes 5
2.3 Habitat and Species 6
2.4 Land Use and Public Access 7
2.5 Altered Ecosystem Processes and Functions 8
3.0 RESTORATION PLANNING 17
3.1 Restoration Framework 17
3.2 Existing Plans and Programs 17
3.2.1 Puget Sound Partnership 18
3.2.2 Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) 18
3.2.3 Shared Strategy for Puget Sound: Puget Sound Salmon Recovery Plan 19
3.2.4 Water Resource Inventory Area (WRIA) 12 19
4.0 RESTORATION PRIORITIES AND OPPORTUNITIES 20
4.1 Restoration Priorities 20
4.2 Restoration Opportunities 21
4.2.1 Programmatic Restoration Opportunities 21
4.2.2 Site-specific Restoration Opportunities 23
4.3 Existing Capital Improvement Projects and Other Plans 31
5.0 POLICY DEVELOPMENT 33
6.0 IMPLEMENTATION 36
6.1 Funding and Partnership Opportunities 36
6.1.1 State and Regional Programs 36
6.1.2 Pierce County Programs 37
6.1.3 Other Non-profit Organizations 37
6.1.4 Other Possible Funding Sources 39
6.2 Approach for Public Outreach 40
6.3 Timelines, Benchmarks, and Strategies for Effectiveness 41
6.4 Constraints to Implementation 42
7.0 CONCLUSIONS 43
8.0 REFERENCES 44

List of Tables

Table 1. Restoration Planning Structure 4

Table 2. Summary of Shoreline Functions and Restoration Opportunities -Marine 9

Table 3. Alterations to Ecological Processes and Functions for Marine Shoreline Segments 13

Table 4. Summary of Shoreline Functions and Restoration Opportunities – Freshwater (Chambers Creek) 15

Table 5. Site-Specific Restoration Opportunities, Marine Shorelines 28

Table 6. Existing Capital Improvement Projects 32

List of Figures

Figure 1. Achieving No Net Loss of Ecological Function 2

Figure 2. Restoration Opportunities 25

1.0 INTRODUCTION

This report prepared by ESA and Coastal Geologic Services (CGS) provides the restoration element of the City of University Place's Shoreline Master Program (SMP). Last amended in 2000, the SMP is being updated to comply with the Shoreline Management Act (SMA) requirements (RCW 90.58), and the State's SMP guidelines (Washington Administrative Code [WAC] 173-26, Part III), which went into effect in 2003.

The SMP guidelines require that local governments develop SMP policies that promote "restoration" of impaired shoreline ecological functions. In developing restoration strategies, local governments are directed to make "real and meaningful" use of established policies and programs that contribute to restoration objectives. The City's Shoreline Inventory and Characterization Report (ICR) (ESA Adolfson, 2011) identifies where shoreline ecological functions and ecosystem processes have been impaired. In updating its SMP, the City is required to identify and plan for ways to restore or enhance those functions and processes that have been impaired. In the context of the SMP, planning for shoreline restoration includes establishing goals and policies, working cooperatively with other regional entities, and supporting restoration through other regulatory and non-regulatory programs.

The restoration opportunities discussed in this report are provided at a conceptual level for planning purposes only. Restoration within the shoreline would be accomplished on a voluntary basis as funding becomes available.

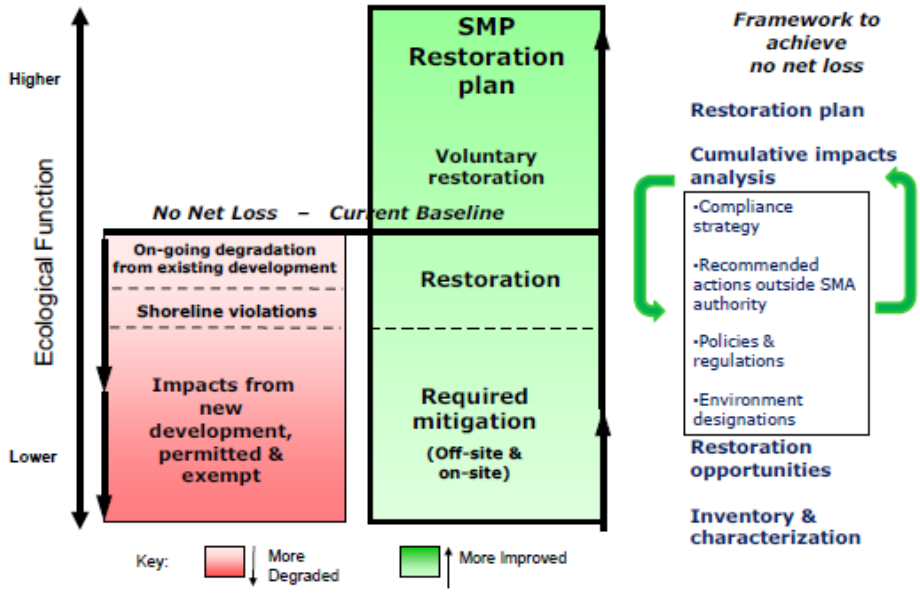
1.1 Regulatory Background

The end goal of restoration planning efforts is that the non-regulatory elements of the SMP, when implemented alongside the regulatory elements of the SMP, will achieve overall improvements in shoreline ecological functions over time when compared to the status upon adoption of the master program." This overarching goal is accomplished primarily through two distinct objectives:

- **Protection** of existing shoreline functions through regulations and mitigation requirements to ensure "no net loss" of ecological functions from baseline environmental conditions; and

- **Restoration** of shoreline ecological functions that have been impaired from past development practices or alterations.

Figure 1 below illustrates the role of the SMP update in achieving no net loss both through mitigation and restoration.



Source: Department of Ecology

Figure 1. Achieving No Net Loss of Ecological Function

The concept of no net loss of shoreline ecological function is embedded in the SMA and in the goals, policies and governing principles of the shoreline guidelines. The State's general policy goals for shorelines of the state include the "protection and restoration of ecological functions of shoreline natural resources." This goal derives from the SMA, which states, "permitted uses in the shoreline shall be designed and conducted in a manner that minimizes insofar as practical, any resultant damage to the ecology and environment of the shoreline area." The governing principles of the guidelines further clarify that protection of shoreline ecological functions is accomplished through the following (WAC 173-26-186):

a) Meaningful understanding of the current shoreline ecological conditions;

b) Regulations and mitigation standards that ensure that permitted developments do not cause a net loss of ecological functions;

c) Regulations that ensure exempt developments in the aggregate do not result in net loss of ecological functions;

d) Goals and policies for restoring ecologically impaired shorelines;

e) Regulations and programs that fairly allocate the burden of mitigating cumulative impacts among development opportunities; and

f) Incentives or voluntary measures designed to restore and protect ecological functions.

It is important to note that the restoration planning component of the SMP is focused on voluntary mechanisms, not regulatory provisions. Restoration planning and project opportunities are contingent upon identifying available funding sources (such as grants), volunteer programs, potential economic incentive opportunities to encourage property owners to take elective restoration actions, and other programs that can contribute to a no net loss strategy based on voluntary actions. However, the restoration framework developed for these non-compensatory mitigation projects can also be applied to compensatory mitigation projects where applicable to offset project impacts. In this way, all efforts to improve ecosystem functioning are coordinated, and will be designed to work together.

1.2 Defining Restoration

There are numerous definitions for "restoration" in scientific and regulatory publications. Specific elements of these definitions often differ, but the core element of repairing damage to an existing, degraded ecosystem remains consistent. In the SMP context, the WAC defines "restoration" or "ecological restoration" as:

> *"…the reestablishment or upgrading of impaired ecological shoreline processes or functions. This 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"* (WAC 173-26-020(27)).

Using the WAC definition of restoration in regard to state shorelines, it is clear the effort should be focused on specific shoreline areas where natural ecological functions have been impaired or degraded. The emphasis in the WAC is to achieve overall improvement in existing shoreline processes or functions, if these functions are impaired. Therefore, the goal is not to restore historically natural conditions, but rather to improve on existing, degraded conditions. In this context, restoration can be broadly implemented through a combination of programmatic measures (such as surface water management; water quality improvement; public education) and site-specific projects (such as bulkhead replacement and/or riparian plantings). It is important to note that the guidelines do not state that local programs should or could require individual permittees to restore past damages to an ecosystem as a condition of a permit for new development (Ecology, 2004). For these reasons, the required restoration planning element focuses on the City as a whole rather than parcel by parcel, or permit by permit.

1.3 Key Elements of Restoration Planning in the SMP Update Process

The State guidelines provide six key elements for shoreline restoration planning as part of a local jurisdiction's master program, as outlined in WAC 173-26-201(2)(f). These elements are summarized below in Table 1, and provide the organization and content for this report.

Table 1. Restoration Planning Structure

Key elements for the shoreline restoration planning process WAC 173-26-201(2)(f)	Section in this report
Identify degraded areas, impaired ecological functions, and sites with potential for ecological restoration.	Assessment of Functions (Sec. 2); Restoration Opportunities (Sec. 4)
Establish overall goals and priorities for restoration of degraded areas and impaired ecological functions.	Policy Development (Sec. 5)
Identify existing and ongoing projects and programs that are currently being implemented that are designed to contribute to local restoration goals (such as capital improvement programs (CIPs) and watershed planning efforts (WRIA habitat/recovery plans).	Existing Plans and Programs (Sec. 3)
Identify additional projects and programs needed to achieve local restoration goals, and implementation strategies including identifying prospective funding sources for those projects and programs.	Assessment of Functions (Sec. 2); Restoration Opportunities (Sec. 4); Implementation (Sec. 6)
Identify timelines and benchmarks for implementing restoration projects and programs and achieving local restoration goals.	Implementation (Sec. 6)
Provide for mechanisms or strategies to ensure that restoration projects and programs will be implemented according to plans and to appropriately review the effectiveness of the projects and programs in meeting the overall restoration goals (e.g., monitoring of restoration project sites).	Implementation (Sec. 6)

2.0 ASSESSMENT OF FUNCTIONS

Shoreline restoration planning begins with the identification of "degraded areas" or areas with "impaired ecological functions." The assessment of existing degraded areas and/or functions relies on the specific functions for University Place as outlined in the *City of University Place's Shoreline Inventory and Characterization* (ESA Adolfson, 2011). The City's inventory and characterization examined marine nearshore and freshwater ecosystem processes that maintain shoreline ecological functions and identified impaired ecological functions. Key findings of the inventory and characterization are summarized below.

2.1 Regional Setting

The City of University Place lies entirely within the Chambers Creek – Clover Creek Water Resources Inventory Area (WRIA) 12. WRIA 12 encompasses approximately 115,000 acres within the Puget Lowland eco-region of Pierce County, Washington (Ecology, 2006). Elevations throughout WRIA 12 are at or just above sea level. Streams in WRIA 12 are low gradient, with underlying topography consisting of rolling glacial outwash and till plains. Basins within WRIA 12 include Clover Creek/Steilacoom, American Lake, Chambers Bay, Tacoma West, and portions of Tacoma. The City lies within the Chambers Bay and Tacoma West basins. Spanaway and American Lakes are the major lakes within WRIA 12.

2.2 Physical and Ecological Processes

Marine Shorelines

Much of the City's marine shoreline is comprised of armored bluff backed beaches that historically supplied sediment to the nearshore. However, historical land uses and alterations have altered the physical shoreline processes over time in the City. Most of the shoreline is lined with armor for the BNSF rail revetment, except for the barrier and barrier lagoon beaches of Day Island, narrow areas of residential development fronting the rail corridor at Sunset Beach, and northern inner shore of the barrier estuary of Chamber's Bay. The shores of Day Island and Sunset Beach are heavily armored (bulkheads) to protect dense residential development along both low-lying shorelines.

The leeward shores of Chamber's Bay have been altered by a past gravel mining operation. As a result of the armor, sediment derived from the erosive bluffs that occur along most of the City's shoreline no longer feeds the local beaches. Sediment transport and deposition are also degraded from armored shores infringing on the intertidal as well as cross-shore structures, such as groins. Significant portions of the marine shoreline throughout the City are mapped as Artificial (PSNERP, 2008; ICR Map 15) due to major alterations to upland and intertidal topography resulting from some combination of armor, fill, and mining activities.

Several large areas of fill resulting from the gravel mine at Chamber's Bay have contributed to changes to the historic character of that shoreline. Prior to the construction of the BNSF bridge and causeway, the tide channel that marks the entrance to Chambers Bay was located further landward and was associated with a single barrier that extended northwest across the embayment from the southern shore. The sheltered conditions created by the causeway have reduced wave exposure, particularly along the north shore of the entrance to the bay, where the lack of wave induced erosion has altered local littoral sediment transport patterns and sediment supply.

Chambers Creek Shoreline

Chambers Creek is the outlet of Steilacoom Lake and flows 4.0 miles north and west down a narrow ravine. The Chambers Creek Reach within the City of University Place extends along the right (northern) bank of the lower 2.65 miles of the stream. Chambers Creek is surrounded by undeveloped riparian forest, which is protected within Chambers Creek Canyon Park. This area, which takes up the majority of the City's freshwater shoreline jurisdiction, is characterized by steep ravine slopes, and is mapped with many hill-seep (slope) and riverine wetlands. Outside of this Park, which also extends into the City of Lakewood along the stream's left bank, land use and development along the Chambers Creek shoreline is characterized by primarily moderate density single-family residential development.

Contributing streams to Chambers Creek – including Clover Creek (the primary stream in the upper portion of WRIA 12; drains to American Lake and eventually to Chambers Creek), Flett Creek, Leach Creek, and Peach Creek – drain through highly developed urban areas, including both the City and surrounding areas. Leach and Peach Creeks drain significant portions of the City, with Leach Creek (the larger of the two) generally flowing from north to south from a large

headwater wetland complex. The contributing watershed to Chambers Creek includes highly urbanized sub-basins, with many documented and monitored water quality problems within Leach Creek and Steilacoom Lake, as well as other waters. Chambers Creek itself is listed on the Ecology 303(d) list as a Category 5 water for fecal coliform. Other Chambers Creek 303(d) listings include copper (Category 4A), pH and temperature (both Category 2).

A dam and spillway are located at the mouth of Chambers Creek, where the stream flows into Chambers Bay. Significant sediment accumulation has occurred behind the dam, extending upstream of the Chambers Creek Road crossing.

2.3 Habitat and Species

Marine Shorelines

The Puget Sound nearshore environment provides habitat for a variety of aquatic and terrestrial species. The "nearshore" is generally considered to be an area extending from the top of bluffs across the beach and intertidal zone, to the point where light no longer penetrates the Sound's water. Important features of the nearshore that provide habitat include:

- Marine riparian zones (vegetated bluffs and vegetation overhanging the intertidal zone);
- Bluffs, beaches and backshore (sediment sources, substrate, and storm berms);
- Tidal flats (intertidal or shallow subtidal areas used by juvenile salmonids, shorebirds, and shellfish);
- Eelgrass beds and kelp forests (feeding and rearing habitat for wide variety of marine organisms);
- Tidal marsh and estuarine wetlands; and
- Streams (fish and wildlife corridors and source of fluvial sediment to nearshore)

Within the nearshore marine environment of the City of University Place the dominant intertidal habitats include sand and gravel beaches, patchy eelgrass beds, patchy kelp beds, and estuarine wetlands. According to WDFW PHS data (WDFW 2009a) the marine and freshwater shoreline of University Place is associated with multiple priority habitats, including:

- Cliffs / bluffs;
- Lagoons and Estuaries;
- Urban Natural Open Space;
- Bald Eagle nesting in the vicinity (on Fox Island).

WDFW streamnet data (WDFW 2009b) and the 1998 City Biological Resources Inventory (AAI, 1999), the City's marine shoreline supports the following fish species:

- Potential forage fish habitat;
- Potential forage fish spawning habitat;
- Critical habitat for ESA listed salmonids, including Chinook and coho;
- Demersal groundfish / bottom-dwelling fish habitat;
- Pelagic groundfish;
- Sand lance; and
- Geoduck beds.

Chambers Creek Shoreline

The section of Chambers Creek shoreline within the City is also associated with several WDFW priority species and habitats. Chambers Creek provides habitat for numerous salmonid species. Fish species distribution maps (WDFW, 2009b) indicate that fall Chinook have a documented presence in a segment of the stream adjacent to the Puget Sound, spawning habitat for coho throughout the creek, and a documented presence for summer chum and winter steelhead throughout the creek (Inventory and Characterization Map 6). WDFW StreamNet data also documents use by cutthroat trout.

There are several priority habitat areas associated with Chambers Creek. These habitats include urban natural open space; a large waterfowl concentration area; Chambers Creek riparian corridor habitat; an open lagoon; and estuaries associated with the Chambers Creek confluence with the Puget Sound. A bald eagle nest has been recorded approximately 500 feet southeast of the westernmost segment of Chambers Creek, within the City of Lakewood.

2.4 Land Use and Public Access

Marine Shorelines

Current land uses within the City's marine shoreline areas are primarily characterized by transportation infrastructure, including the Burlington Northern Santa Fe (BNSF) Railroad right-of-way (ROW) and to a lesser extent, residential roads in the Day Island area. Between BNSF-owned properties within the shoreline area and the railroad ROW, approximately 29 percent of the City's marine shoreline area is controlled by the BNSF railroad (ESA Adolfson, 2011). Additional significant uses include public parks areas (Chambers Bay Golf Course and Open Space); approximately 40 percent of the marine shoreline planning area consists of public parks and open space (ESA Adolfson, 2011). Single-family residential uses extend into the shoreline

area around most of Day Island and waterward of the BNSF Railroad ROW at Sunset Beach. Commercial/Industrial uses include the Day Island Marina and the Chambers Creek Regional Wastewater Treatment Plant. Only small areas of the Wastewater Treatment Plant facilities occur within shoreline jurisdiction of Chambers Bay;however facility grounds extend to the shoreline edge.

Chambers Creek Shoreline

The general land use pattern in Chambers Creek SPA is largely open space - both publicly owned in Chambers Creek Canyon Park (part of the Chambers Creek Properties) and in undeveloped areas associated with large residential properties. Approximately 89 percent of the freshwater shoreline consists of public parks and open space (ESA Adolfson, 2011).

Impervious surface coverage in the Chambers Creek reach is low, consistent with the undeveloped nature of the SPA (majority of the area is undeveloped public parks and open space).

2.5 Altered Ecosystem Processes and Functions

Marine Shorelines

Nearshore ecological processes along the City's marine shorelines have been altered primarily by revetment and fill associated with the BNSF ROW, the rail causeway fronting Chambers Bay and other shoreline hardening and modifications (groins, overwater structures) related to shoreline development, both within Chamber's Bay and along the Puget Sound shorelines. The BNSF rail corridor, consisting of a prism of fill armored with rock, infringes or buries the upper intertidal beach and backshore along much of the shoreline. It also breaks the connectivity between bluffs and beaches, degrading sediment supply to the nearshore and altering sediment transport and deposition. In most areas where there is ample beach waterward or landward of the BNSF corridor, other shoreline modifications exist, most commonly fill supporting areas of residential development with bulkheads occurring along the OHWM. The rail causeway across Chambers Bay constrains tidal flow and shore drift cell flows into and out of the embayment at the southern edge of the City's shoreline. The ICR details common impacts to ecological processes and functions associated with shoreline modification.

The following table, developed as part of the Inventory and Characterization effort, identifies the level and scale of alteration across key ecosystem processes and shoreline functions supporting the City's marine shorelines. General conservation and restoration potentials for the City's marine shorelines are identified for each key process / function.

Table 2. Summary of Shoreline Functions and Restoration Opportunities -Marine

Process: Function	Level of Alteration and Associated Physical Modifications	Scale of Alteration (Reach, Basin, Watershed)	Conservation / Restoration Potential
Habitat: Estuarine habitat; subtidal and intertidal mudflats and salt marshes within Chambers Bay and the mouth of Crystal Creek provide transition habitat between fresh and salt water environments. Nearshore habitat; subtidal and intertidal beaches, rock reefs, and mud flats provide nearshore habitat for numerous species of shellfish, fish, and birds.	**High** Physical modifications to the Puget Sound shoreline throughout the large majority of all reaches has highly altered habitat functions. The installation of docks, riprap, and bulkheads has tended to disconnect freshwater seeps and wetlands from marine waters. Modifications to the shoreline, the intertidal habitats (dredging) and drainages flowing to the inner waterway (piping) in the Day Island reach limit habitat provided. The Chambers Bay shoreline provides moderate habitat, and the intertidal lagoon areas provide significant habitat for fishes, shellfish, waterfowl, and other wildlife. Habitat in the estuary is altered by the dam and spillway across the mouth of Chambers Creek.	**Reach Scale Alteration** – Direct impacts to Puget Sound shoreline habitat are largely a result of physical modification to the shoreline and associated land uses within the City's shoreline planning area. The Chambers Creek Dam, within the reach is the single most significant impact to Chambers Bay estuarine environment. BNSF railroad ROW is the most significant impact to nearshore habitat, however modifications required for other public and private facilities also impact University Place shoreline habitats. Modification to the Puget Sound shoreline and associated direct impacts to marine nearshore and riparian habitats extend in a similar pattern to adjoining shorelines north and south of the city.	**Low** The extent of physical modifications to the system has been substantial enough to preclude straightforward restoration measures to achieve pre-disturbance levels of ecosystem functioning. There is the potential to better connect freshwater seeps, wetlands, and upland habitats to the marine shoreline, as part of shoreline rehabilitation projects. The BNSF Railroad, however, significantly limits potential for re-connection. Inclusion of provisions in the updated shoreline program to provide such connections where upland habitats, seeps, or wetlands are present will improve the habitat function as redevelopment occurs over time. In addition, restoration planning and inclusion of provisions that encourage the removal of pilings and derelict buildings will improve habitat functions, especially at Sunnyside Beach and Saltar Point

Process: Function	Level of Alteration and Associated Physical Modifications	Scale of Alteration (Reach, Basin, Watershed)	Conservation / Restoration Potential
Hydrology: Attenuation of wave energy	**Moderate to High** The general trend toward a 'harder' shoreline (e.g., bulkheads and revetments) has resulted in less overall wave attenuation than in the pre-disturbance condition. Some portions of the marine shoreline maintain a moderately wide beach area, showing higher function in this area.	**Reach and Watershed Scale Alteration –** South Puget Sound marine area is a dynamic system. Hardening and modification of shorelines within one shoreline reach impacts hydrology (drift cell movement and attenuation of wave energy) along adjacent shorelines.	**Moderate** Encouraging the use of soft-armoring techniques along Day Island and Sunset Beach shoreline areas and support of estuarine wetland restoration efforts can improve wave energy attenuation within the City's nearshore over time.
Sediment Generation and Transport: Sediment delivery from coastal bluffs and streams	**Coastal Bluffs - Moderate** Bluff erosion processes have been modified as structures (e.g. railroads, bulkheads) at the toe have reduced the frequency of tidal and wave interaction with the bluff. In addition, portions of the bluff within the Puget Sound South reach were largely removed during historical gravel mining. The lack of interaction at the toe has reduced smaller-scale erosion. However, larger-scale erosion events (e.g., landslides due to seismic events) still have the potential to contribute significant quantities of sediment to the nearshore. **Coastal Tributary Drainages - High** Sediment generation processes are altered within coastal tributary drainages. Development within contributing areas has modified hydrology, commonly resulting in excessive erosion. Sediment supply from small coastal streams (including Crystal Creek) is impaired by the railroad corridor running parallel to the shoreline.	**Coastal Bluffs: Reach Scale Alteration –**Modifications primarily affecting City shoreline area are those associated with the BNSF railroad and other infrastructure at the base of coastal slopes within University Place, **Streams: Basin and Reach Scale Alteration** – Impairments to stream contributing areas throughout City and surrounding area have caused excess sediment generation and input to the University Place nearshore area. Alterations to pocket estuaries (Chambers Bay Dam, road and railroad crossings) are reach-scale alterations.	**Low** The presence of the BNSF Railroad along the Puget Sound shoreline largely limits the potential for significant improvement to the sediment transport function. Maintenance of existing connections between bluffs and the nearshore, for example along the extensive unarmored shoreline of Chambers Bay, is a high priority. Enhancement of connections between stream mouths and the nearshore, for sediment delivery and other habitat benefits, is also a high priority. Reconnection of feeder bluff function to support nearshore processes is more difficult and expensive where the existing infrastructure protects public and private property, or where the existing infrastructure itself disconnects the bluffs from the nearshore (for example, railroad tracks and roadways).

Process: Function	Level of Alteration and Associated Physical Modifications	Scale of Alteration (Reach, Basin, Watershed)	Conservation / Restoration Potential
Water Quality: Wetland removal of pollutants through sedimentation and adsorption	**Low to Moderate** Reduction in wetland area has reduced contact time of water with soil. This lowers the potential for filtering and cycling of pollutants, which adhere to soil particles.	**Basin and Watershed Scale Alteration –** Development within contributing areas of Chambers Creek Watershed and local basins has reduced wetland areas, although preservation of open space within the City along Chambers Creek and tributary streams, as well as along several Tacoma West basin drainages, moderates alteration at a basin level.	**Low to Moderate** Restoration efforts of Day Island inner waterway area and of Chambers will enhance wetland area functions; potential for restoration somewhat limited by lack of pocket estuary environment over the length of the shoreline area.
Delivery, movement, and loss or removal of nutrients, pathogens, and toxicants; storage of phosphorus and removal of nitrogen and toxins through sedimentation and adsorption.	**High** The delivery, transport, and disposition of nutrients, pathogens, and toxins have been significantly altered from the pre-disturbance condition. Upland sources of these pollutants have increased significantly as a result of urban and industrial land uses within and near the shoreline. Potential storage has decreased through wetland loss and installation of impervious surfaces throughout the majority of the Chambers Creek basin.	**Basin and Watershed Scale Alteration–** Development within contributing areas of Chambers Creek Watershed and local (Tacoma West) basins has brought significant increases in pollutant-generating surfaces (metals and other toxins from street and parking lot runoff) and land use activities (phosphorus from fertilizers).	**Moderate** Source control and remediation efforts have been improved with updated stormwater regulations. Source control efforts should continue and be expanded. Use of low impact development and other water quality improvement techniques, both within the shoreline area and upland, will decrease pollutant loading over time.

Process: Function	Level of Alteration and Associated Physical Modifications	Scale of Alteration (Reach, Basin, Watershed)	Conservation / Restoration Potential
Habitat: Shoreline habitat for wildlife; vegetation provides structure for invertebrates, birds, amphibians, reptiles, and mammals.	**High** Plant communities along the shoreline have been subjected to several phases of disturbance, with ongoing presence and use of the BNSF Railroad, and shoreline residential areas, continuing to limit riparian habitat. Shoreline modifications have also altered intertidal habitats. Highest functioning habitats occur in Chambers Bay, where riparian conditions have recovered along the steeply sloped shorelines.	**Basin and Reach Scale Alteration** Alterations to shoreline vegetation extend throughout the University Place marine shoreline area, as well as along contributing freshwater streams within the City.	**Low** The presence of significant infrastructure, primarily the railroad, limits the potential to improve riparian habitat function. Opportunities include the inclusion of new measures in the updated shoreline program to include habitat features as redevelopment projects occur, and inclusion in the Restoration Plan of a process to identify and prioritize individual projects to expand shoreline habitat. For example, restoration planning and SMP provisions should target enhancement of the marine riparian corridor along the shoreline of Chambers Bay.
Source and delivery of LWD	**High** Removal of mature trees from riparian areas, and from surrounding bluffs has significantly reduced the source of LWD to the nearshore system.	**Watershed, Basin, and Reach Scale Alteration** Alterations to shoreline vegetation, a primary source of large woody debris and other organic inputs, extend throughout University Place's marine shoreline area as well as along contributing freshwater streams within the City. The intact riparian corridor along lower Chambers Creek is functionally disconnected from the estuarine and marine shorelines by Chambers Creek Dam.	**Low** The source of LWD exists; however, restoring the connectivity between the bluff/forest system and the nearshore would require significant removal or modification to existing infrastructure (e.g. Chambers Creek Dam, railroad). Large-scale change to the railroad is not feasible; dam removal plans are being considered.

The key issues related to alterations in each marine shoreline planning segment (as described in the Shoreline Inventory and Characterization Report) are summarized in Table 3 below. The shoreline ecological processes and/or functions that have been impaired or affected as a result of shoreline modifications are also described.

Table 3. Alterations to Ecological Processes and Functions for Marine Shoreline Segments

Shoreline Segment	***Shoreline Modifications***	***Ecological Process / Function Affected***
Day Island	Shore armoring Fill Groins Dredging Roads Several overwater structures Impervious surfaces Vegetation removal Dredging of marina subtidal, Culverted streams.	Sediment supply, transport, and accretion all affected by BNSF revetment (armor and fill), processes also degraded by dredging, fill placement and altered tidal flushing. Tidal hydrology into the Day Island lagoon and stream mouths where culverts and fill constrain openings. Degraded forage fish spawning habitats, salmonid migratory pathways Marine riparian largely eliminated Reduced water quality Detritus import/export
Puget Sound - North	BNSF rail causeway, including fill prism with rock armor, Fill and shore armor at Sunset Beach,	Sediment supply, transport, and accretion all affected by BNSF revetment (armor and fill), Degraded forage fish spawning habitats, and salmonids migratory pathways, Marine riparian vegetation waterward of the RR largely eliminated, which also eliminates detritus import/export,
Puget Sound – South	BNSF rail causeway, including fill prism with rock armor, and tidal barrier across mouth of Chamber's Bay Topographic alteration associated with gravel mine and spilled mining material Overwater structures Derelict structures/piles Fish weir at head of Chamber's Bay Tidal barrier at mouth of inlet	Sediment supply, transport, and accretion all affected by BNSF revetment (armor and fill), Tidal hydrology into Chamber's Bay. Degraded forage fish spawning habitats, and salmonids migratory pathways , Marine riparian vegetation largely eliminated, which also eliminates detritus import/export, Degraded subtidal habitat due to overwater structures (shading of water column).

Chambers Creek Shoreline

The City's Chambers Creek shoreline area is generally undeveloped open space that is publically owned by the City and Pierce County. These open space areas provide high functioning riparian conditions throughout the majority of the City's freshwater shoreline. Use and protection as open space is expected to continue into the future. Key impairments to freshwater shoreline functions are primarily associated with extensive urbanization and impairment within Chamber Creek's contributing basins, as well as the dam structure located at the mouth of the stream.

The following table, developed as part of the Inventory and Characterization effort, identifies the level of alteration and scale of alteration across key ecosystem processes and shoreline functions supporting the Chambers Creek shoreline areas within the City. Conservation and restoration potentials are identified for each.

Table 4. Summary of Shoreline Functions and Restoration Opportunities – Freshwater (Chambers Creek)

Ecosystem Process / Shoreline Function	Level of Alteration and Associated Physical Modifications	Scale of Alteration (Reach, Basin, Watershed)	Conservation / Restoration Potential
Hydrology Bank stability, groundwater and tributary inputs, flow regime, and floodplain connectivity	**Moderate.** Runoff generated in the City of University Place flows to Chambers Creek and its major tributaries with varying levels of flow control. The Chambers Bay basin, and significant areas of the Chambers Creek Subbasin are highly developed. Chambers Creek is low elevation, and therefore rain dominated, with rain discharging relatively rapidly to headwater wetlands and streams throughout the Chambers Bay Basin, as well as the rest of WRIA 12. Headwater wetlands around Leach Creek improve hydrologic functions, as do significant wetland and riparian areas within the floodplain elevation of Chambers Creek.	**Basin and Watershed.** Significant impairments to Chambers Creek occur within the Chambers Bay basin and surrounding subbasins. Hydrologic modifications stemming from surrounding development also extend throughout the upper basins of WRIA 12 (Clover Creek, Spanaway Creek) and throughout the entire watershed.	**Moderate.** There is moderate potential to restore a more natural rainfall to runoff relationship within the City of University Place. Retrofitting stormwater management measures could reduce flashiness of storm flows and reduce pollutant loading. Conservation has been implemented and there is additional potential to preserve existing functioning riparian forest and forest lands in the contributing basin. Conservation potential is high for the Leach Creek headwater wetlands and the Chambers Creek riparian corridor, due to CAO protections and corridor's public ownership.

Ecosystem Process / Shoreline Function	Level of Alteration and Associated Physical Modifications	Scale of Alteration (Reach, Basin, Watershed)	Conservation / Restoration Potential
Hyporheic functions Maintaining seasonal baseflows, floodplain connectivity, supporting water quality maintenance functions.	**Low.** Lack of road and infrastructure near the stream and lack of residential development has maintained a high functions channel plan form, with active areas of channel movement at this elevation.	**Reach.** Likely intact hyporheic functions along the City's reach of Chambers Creek are largely due to lack of development and channel plan form modifications within the reach.	**Low to Moderate.** High levels of existing function somewhat limit further potential for restoration. Conservation of area is somewhat ensured by public ownership, although any recreational development of site should consider avoiding impacts to hyporeheic functions.
Shoreline Vegetation Source and delivery of LWD; Native plant communities, especially within riparian zone provide food sources and structure for invertebrates, birds, amphibians, reptiles, and mammals.	**Low.** Riparian forest throughout wetland and steep slope areas exists along the large majority of the lower portion of Chambers Creek, including areas within the City.	**Reach:** Alteration and/or preservation of shoreline (riparian) vegetation is largely dependent on use or conservation of lands within shoreline area. Chambers Creek riparian areas are preserved under public (City and County) ownership.	**Moderate.** Additional conservation potential is somewhat limited by existing public ownership, although additional acquisition or trust agreements could be pursued on undeveloped portions of residential properties. Restoration potential is low, focused on expanding the width of riparian forest in places and enhancing habitat conditions.
Habitat Sources and delivery of LWD; riparian zones; organic inputs to aquatic environments;habitat connectivity; stream / floodplain interaction	**Moderate to high.** Reduced in-stream habitat diversity due to reduction in LWD and loss of pool habitat, likely due to impacts of development in upstream basin (Shared Strategy for the Puget Sound, 2006).	**Reach and Basin**. Impervious surfaces in the contributing basin likely impact instream habitat structure and function. Public ownership of much of the existing riparian forest allows for a natural source of LWD in the long-term.	**High**. High potential to improve habitat diversity and key habitat quality through restoration projects.

3.0 RESTORATION PLANNING

3.1 Restoration Framework

A great deal of attention and resources have been focused on Puget Sound restoration activity in recent years. These efforts stem from the listing of Puget Sound salmonid species as threatened and endangered, as well as a more broad awareness and concern for the overall ecological health of Puget Sound. Within the Sound, the nearshore environment – where the land meets the water - is considered a critical element of the Puget Sound ecosystem. The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) is a multi-agency regional entity whose mission is to protect and restore the functions and natural processes of the Puget Sound nearshore ecosystem. PSNERP has developed strategic principles and concepts intended to guide ecosystem recovery (PSNP, 2004). The principles and concepts, summarized briefly below, provide a framework for the City of University Place's shoreline restoration planning.

- **Purpose and Need**. Potential restoration projects should be consistent with overarching goals and objectives.

- **Restoration Principles**. Restoration planning should be strategic and restoration design should be based on carefully developed goals and objectives. Follow-through, or monitoring, should be employed, including development of performance criteria and use of adaptive management in project development.

- **Monitoring Principles**. Three types of monitoring are defined: 1) implementation monitoring to track which potential programs and projects are carried out; 2) effectiveness monitoring to determine if habitat objectives of the program or project have been achieved; and 3) validation monitoring to confirm whether proposed restoration actions are achieving the overall objectives for restoration. Monitoring should be driven by specific questions, goals, and objectives and should be used as the basis for determining if restoration goals are being met. Monitoring should be long-term and interdisciplinary. Another component of monitoring is information management; data should be well documented and available to others.

- **Adaptive Management Principles**. Adaptive management is a process that uses research and monitoring to allow projects to proceed, despite inherent uncertainty and risk regarding its consequences. Adaptive management is best accomplished at a regional or watershed scale, but can be used at a project level to increase knowledge about ecosystems and how they respond to restoration actions.

3.2 Existing Plans and Programs

A number of regional and Puget Sound-wide planning efforts have been developed to address water resource management, water quality, and salmon habitat recovery. These existing plans and programs provide a framework of goals, policies, and in some cases, funding mechanisms.

The goals, policies, and actions identified in this restoration plan should coordinate and be consistent with this broader framework of conservation and restoration work in the Puget Sound region.

3.2.1 Puget Sound Partnership

In 2007 the Washington Legislature passed the Engrossed Substitute Senate Bill 5372, creating the Puget Sound Partnership (PSP), an entity charged with developing and coordinating an environmental agenda for recovery of the health of Puget Sound by the year 2020. The PSP was preceded by the Puget Sound Action Team, which laid the foundation for the work now being undertaken by the PSP. The *2007-2009 Puget Sound Conservation and Recovery Plan* was the last biennial plan produced by the Puget Sound Action Team and continues to guide PSP's work as the 2020 Action Agenda is created (PSP, 2007).

The PSP has identified the following four initial strategic priorities to guide development of the 2020 Action Agenda:

- Ensure that activities and funding are focused on the most urgent and important problems facing the Sound.
- Protect the intact ecosystem processes that sustain Puget Sound.
- Restore ecosystem processes that will sustain Puget Sound.
- Prevent the sources of water pollution.

These recovery efforts have a combined state agency budget of almost $460 million dollars, which is linked to accomplishing specific goals associated with the core priorities.

3.2.2 Puget Sound Nearshore Ecosystem Restoration Project (PSNERP)

As described above, the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) is a large-scale, multi-agency initiative to address habitat restoration needs in the Puget Sound basin. Nearshore Project goals are to identify significant ecosystem problems, evaluate potential solutions, and restore and preserve critical nearshore habitat. PSNERP represents a partnership between the U.S. Army Corps of Engineers (Corps), state and federal government organizations, Indian tribes, industries and environmental organizations.

A General Investigation Reconnaissance Study conducted by the U.S. Army Corps of Engineers in 2000 (USACOE, 2000) identified a direct link between healthy nearshore habitat and the physical condition of the shoreline. The study identified several actions that would be central in restoring nearshore processes to a more natural state:

- Providing marshes, mudflats, and beaches with essential sand and gravel materials;

- Removing, moving and modifying artificial structures (bulkheads, rip rap, dikes, tide gates, etc.);
- Using alternative measures to protect shorelines from erosion and flooding; and
- Restoring estuaries and nearshore habitat such as eelgrass beds and kelp beds (USACOE, 2000; PSNP, 2002).

PSNERP also provides outreach and guidance materials related to nearshore ecosystem restoration principals, concepts, and methods of implementation.

PSNERP has identified Chambers Bay as a regionally significant restoration opportunity. Details on conceptual restoration at this location can be found at the PSNERP website under ID #1801.

3.2.3 Shared Strategy for Puget Sound: Puget Sound Salmon Recovery Plan

Shared Strategy for Puget Sound (Shared Strategy) is a collaborative effort between local stakeholders and regional leaders to protect and restore salmon runs across Puget Sound that was initiated as a result of Endangered Species Act (ESA) listings of salmonid species in the Puget Sound region. Shared Strategy engages local citizens, tribes, technical experts and policy makers to build a practical, cost-effective recovery plan endorsed by the people living and working in the watersheds of Puget Sound.

Shared Strategy has developed a salmon recovery plan (Shared Strategy, 2007) that provides a blueprint for salmon recovery strategies throughout Puget Sound and incorporates, by reference, local watershed plans for salmon recovery. Amongst other strategies described in the plan, Shared Strategy describes their 'Top 10 Actions Needed for Salmon Recovery', many of which have additional beneficial impacts for humans.

Shared Strategy was the non-profit organization that drafted the Puget Sound Salmon Recovery Plan, adopted by NOAA in January 2007. The Puget Sound Partnership took over responsibility for the implementation of the salmon recovery plan in January 2008. NOAA revises this recovery plan each year with an updated 3 Year Work plan for each of the 14 geographic chapters.

3.2.4 Water Resource Inventory Area (WRIA) 12

The City of University Place is in the Chambers-Clover Watershed: Water Resource Inventory Area (WRIA) 12. The Chambers-Clover Planning Unit completed a draft watershed plan in September 2004, but was unable to reach consensus, and as a result, the plan was not approved.

Pierce County is the Lead Entity agency for salmon recover in WRIA 10 and 12. The 2010 3-year watershed implementation priorities list for Chambers-Clover Watershed was updated from the 2009 3-year list, with input from project sponsors and the Technical Advisory Group (TAG) and the Citizens Advisory Committee (CAC) of the Pierce County (WRIAs 10 and 12). The 2010 list includes updates for the Chambers Bay Estuarine and Riparian Enhancement and the

Chambers Beach Reconstruction and Riparian Enhancement. The Chambers Bay project would involve restoration and enhancement of estuarine and riparian habitat within Chambers Bay through removal of the dam, day-lighting of Garrison Springs, removal of shoreline armor and fill, salt marsh/riparian plantings and addition of woody structure. The Chambers Beach project would involve reconstruction of a natural beach profile along Chambers Beach through removal of derelict structures, active nourishment of degraded areas and reconstruction of back beach berm where the bank is unstable. Restoration of the riparian corridor through removal of invasive species and planting of native vegetation would also be conducted.

4.0 RESTORATION PRIORITIES AND OPPORTUNITIES

4.1 Restoration Priorities

The Salmon Habitat Protection and Restoration Strategy, WRIA 10 Puyallup Watershed, WRIA 12 Chambers/Clover Creek Watershed (Pierce County, 2008) provides a watershed scale approach to prioritizing restoration efforts. This work is focused on salmon recovery and highlights the restoration of primary estuarine systems (including Chambers Bay) as one of the high priority restorations.

Watershed scale restoration actions can be a long and expensive process, therefore preserving and protecting existing high quality habitat is critical to achieving long term recovery goals. Restoration strategy begins with preserving and protecting existing habitat and areas where shoreline ecological functions are intact. Within this larger watershed context, a preliminary qualitative (high, medium, low) project ranking system is employed when considering restoration opportunities in University Place. This ranking system is applied to the opportunities identified to-date, as described in Table 4 below.

High priority projects will typically:

a) Address multiple ecosystem processes and/or functions (e.g., habitat and sediment transport process);

b) Have opportunity for multiple funding sources;

c) Include freshwater tributary channels and their nearshore estuaries; and/or

d) Not require additional property acquisition.

Medium priority projects will typically:

a) Address limited ecosystem functions;

b) Be eligible for multiple funding sources; and

c) Require property acquisition or be outside of the City's control (e.g., UGA).

Low priority projects will typically:

a) Benefit single ecosystem functions;

b) Will be used as mitigation to offset impacts elsewhere;

c) Not be eligible for multiple funding sources; or

d) Require property acquisition or be outside of the City's control (e.g., UGA).

4.2 Restoration Opportunities

4.2.1 Programmatic Restoration Opportunities

Certain restoration actions should be broadly and comprehensively implemented on a programmatic basis to help achieve restoration goals. The following programmatic actions are recommended for shorelines within University Place.

Education and Incentives:

a) Educate property owners about proper vegetation/landscape maintenance (including preservation of native vegetation along stream mouths/nearshore riparian corridors) to promote shore stabilization and protect water quality.

b) Encourage low impact development practices for shoreline property owners.

c) Educate private property owners about the negative impacts of shore armoring and over-water structures and encouraging soft shore protection where shore protection is unavoidable.

d) Educate boaters about proper waste disposal methods, anchoring techniques, and other best boating practices to minimize habitat damage and prevent water quality contamination.

e) Where shorelines have been modified, provide incentives to encourage redevelopment activities to include salmonid habitat restoration. Incentives could be built into development regulations or permitting systems – such as opportunity for reduced setback requirements when existing structural shoreline stabilization is replaced with bioengineered approaches, or opportunity for 'fast-track' permit processing where shoreline restoration is provided.

Marine Nearshore:

a) Develop beach nourishment or landslide side-casting program along shore with rail revetment.

b) Preserve existing marine riparian areas.

c) Preserve existing upper beach areas waterward of BNSF ROW. Enhance marine riparian vegetation where adequate area is available.

d) Remove armoring and bulkheads from publicly owned marine sites including parks, wherever feasible.

e) Design overwater structures to allow light penetration for protection of aquatic habitat.

f) Encourage removal of creosote pilings, docks or other contaminants or derelict structures from the nearshore environment.

g) Revegetate marine riparian areas where possible. Eradicate invasive species.

h) Treat storm water prior to flowing into intertidal areas, particularly from impervious surfaces/parking lots.

Freshwater (Chambers Creek):

a) Continue to protect and conserve stream riparian areas and native vegetation throughout shoreline jurisdiction.

b) Eradicate invasive plant species, and provide educational materials to reduce human-derived vectors of invasive species introduction.

c) Treat storm water prior to flowing into riparian areas, tributary streams, and associated wetlands, particularly from impervious surfaces/parking lots.

Infrastructure:

a) Inspect, maintain, and repair leaking or unauthorized septic systems to prevent nutrient and bacteria loading in streams and bays. Where possible, public sewer systems should be installed to replace on-site septic systems.

b) Retrofit stormwater systems using Low Impact Development (LID) strategies.

Planning and Coordination:

a) Match mitigation, including off-site and compensatory mitigation, to appropriate restoration and enhancement activities as identified in salmon recovery, watershed management plans and the SMP restoration plan.

b) Coordinate SMP restoration with other projects prioritized in WRIA 12.

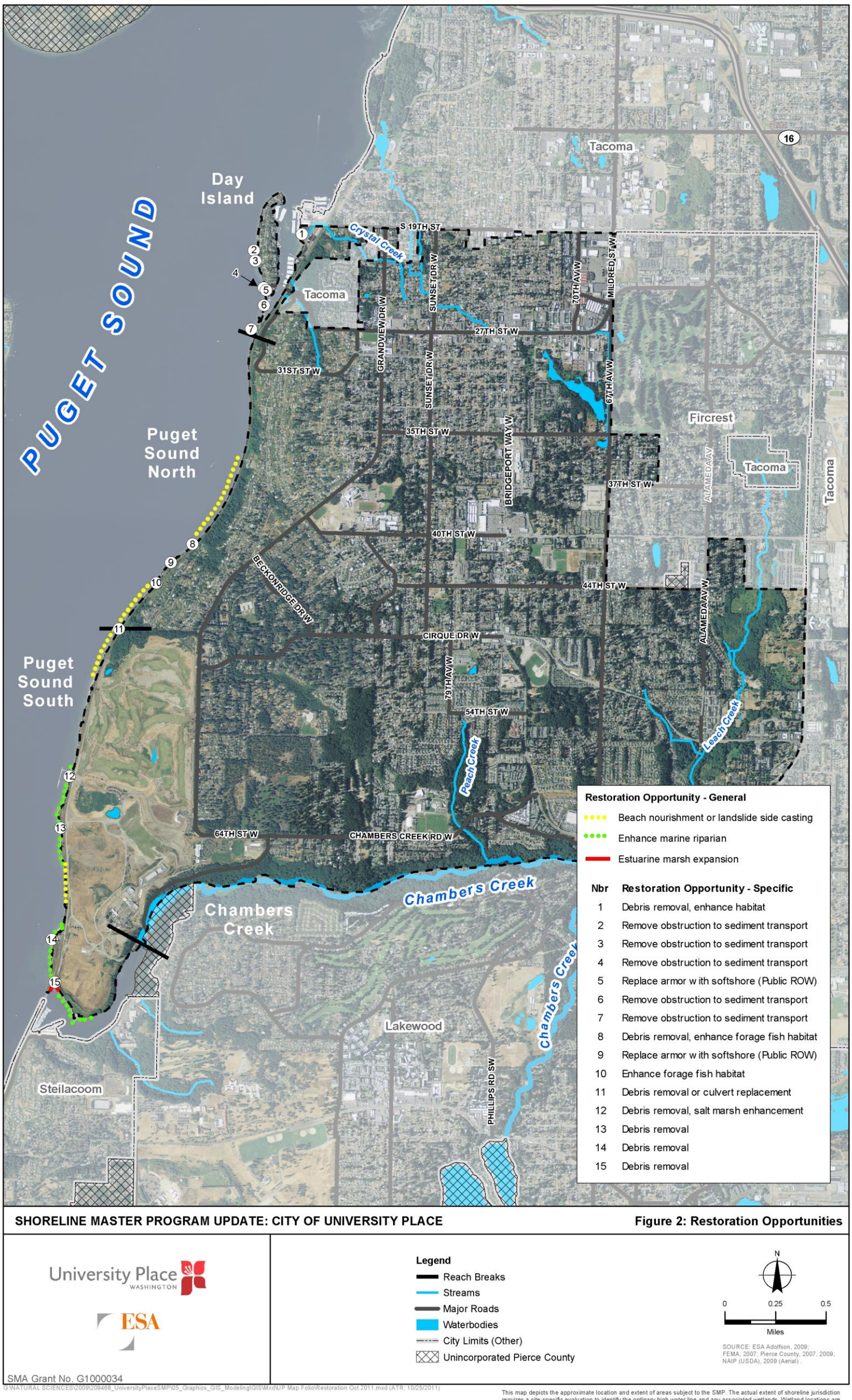
c) Improve water quality to provide safe water for swimming by coordinating with Tacoma-Pierce County Health Department and University Place Public Works – Surface Water Management.

4.2.2 Site-specific Restoration Opportunities

Puget Sound and Chambers Bay Shorelines

Table 5 below summarizes marine shoreline protection and restoration opportunities as described in the Shoreline Inventory and Characterization Report (ESA Adolfson, 2011). General and site-specific restoration opportunities are identified on Figure 2. The opportunities described are generally considered to be site-specific but may cover many parcels. For example, an opportunity may be appropriate at several locations, but may be implemented on individual parcels over time. Table 3 also provides an assessment of the scale and potential length of time required to implement restoration opportunities. For each identified opportunity, the table identifies whether the project is of a short term, medium term, or long term nature. As detailed restoration assessment and prioritization occurs consistent with this plan, the initial assessment of timelines should be re-focused to create detailed schedules and benchmarks for those actions and areas with the greatest restoration potential.

Figure 2. Restoration Opportunities



Short term (ST) (approximately 1-3 years) restoration projects include those that could be implemented by local landowners and volunteers and that would benefit the areas that are most in need. Short term restoration efforts include habitat restoration and enhancement efforts in publically owned areas of the City's shorelines. These projects could be implemented in the near term, depending on grant cycles and coordination with volunteer and community organizations.

Medium term (MT) (approximately 3-5 years) restoration projects could include those that enhance The City of University Place shorelines that have been designated or acquired previously. These could also be implemented where there are public access lands that are not likely to be developed in the near future.

Long term (LT) (approximately 5-10 years) restoration projects could be those that require coordination with other jurisdictions or that cover larger land areas. These projects may be more difficult to implement and would likely require more planning and permitting.

Table 5. Site-Specific Restoration Opportunities, Marine Shorelines

Planning Segment	Opportunity Area (# on Figure 2)	Description	Ecological Functions/Processes Addressed	Preliminary Ranking	Timeline
Day Island	Mouth of Crystal Cr. (1)	Enhance culvert at mouth or daylight Crystal Creek, remove some riprap, creosote piles, and adjacent fill where possible, regrade and replant marine riparian vegetation.	Habitat loss, degraded juvenile salmon migratory pathways, vegetation loss, detritus import/export	High	MT
	Day Island west shore (2)	Remove or shorten cement pier that infringes low on intertidal, restore sediment transport processes, recover habitat suitable for forage fish spawning down-drift of obstruction, replant marine riparian vegetation and restore habitat for juvenile salmon migration pathway.	Degraded sediment transport processes, forage fish spawning habitat loss, degraded fish migratory pathways, vegetation loss.	Med	LT
Day Island Cont	Day Island west shore (3)	Remove or shorten failing cement wall and boat ramp that infringes low on intertidal, restore sediment transport processes, recover habitat suitable for forage fish spawning down-drift of obstruction, replant marine riparian vegetation, and restore habitat for juvenile salmon migration pathway.	Degraded sediment transport processes, forage fish spawning habitat loss, degraded fish migratory pathways, vegetation loss.	Med	LT
	South Day Island (4)	Remove or reconfigure walled lot that infringes low on intertidal, restore sediment transport processes, recover habitat suitable for forage fish spawning, replant marine riparian vegetation, and restore habitat for juvenile salmon migration pathway.	Degraded sediment transport processes, forage fish spawning habitat loss, degraded fish migratory pathways, vegetation loss.	Med	LT
	South Day Island (5)	Remove rock armor from public Right-Of-Way, recover habitat for forage fish spawning, replant marine riparian vegetation, and restore habitat for juvenile salmon migration pathway.	Habitat loss, degraded fish migratory pathways, vegetation loss.	High	ST
	South Day Island (6)	Remove walled lot that infringes low on intertidal, restore sediment transport processes, recover habitat suitable for forage fish spawning, replant marine riparian vegetation, and restore habitat	Habitat loss, degraded fish migratory pathways, vegetation loss.	Med	LT

Planning Segment	Opportunity Area (# on Figure 2)	Description	Ecological Functions/Processes Addressed	Preliminary Ranking	Timeline
		for juvenile salmon migration pathway.			
	South Day Island (7)	Remove "L" shaped groin low on intertidal, replant marine riparian vegetation, and restore habitat for juvenile salmon migration pathway.	Habitat loss, degraded fish migratory pathways, vegetation loss.	Med	LT
Puget Sound - North	North of Sunset Beach	Nourish beach or initiate landslide colluvium side-casting program with BNSF to mitigate for lost sediment supply northward of Sunset Beach to benefit down-drift forage fish spawning areas.	Degraded sediment supply and transport processes, forage fish spawning habitat loss, degraded fish migratory pathways.	Med	MT
	North of Sunset Beach (8)	Remove derelict structures and debris from vacant lot (may have to acquire 3 vacant parcels), restore sediment transport processes, recover habitat suitable for forage fish spawning, replant marine riparian vegetation, and restore habitat for juvenile salmon migration pathway.	Degraded sediment transport processes, forage fish spawning habitat loss, degraded fish migratory pathways, vegetation loss.	Med	MT
	Sunset Beach (9)	Remove concrete wall shoreline armor from public Right-Of-Way, recover habitat for forage fish spawning, replant marine riparian vegetation, and restore habitat for juvenile salmon migration pathway.	Habitat loss, degraded fish migratory pathways, vegetation loss.	Med	MT
	South of Sunset Beach (10)	Recover habitat for forage fish spawning, replant marine riparian vegetation, and restore habitat for juvenile salmon migration pathway.	Degraded forage fish spawning habitat, vegetation loss, degraded salmon migratory pathways.	Med	MT
	South of Sunset Beach (11)	Remove or replace culvert from the beach (appears to be derelict), recover beach habitat in this area.	Debris on beach, habitat loss.	Med	MT
	South of Sunset Beach	Nourish beach or conduct landslide colluvium side-casting program with BNSF to mitigate for lost sediment supply caused by rail causeway. Material would naturally transport northward to benefit down-drift forage fish spawning areas.	Sediment supply, transport and deposition, juvenile salmonid migratory pathways.	High	MT

Planning Segment	Opportunity Area (# on Figure 2)	Description	Ecological Functions/Processes Addressed	Preliminary Ranking	Timeline
Puget Sound - South	Gravel Mine (12)	Remove derelict structures and creosote pilings on beach, enhance habitat and riparian marine vegetation.	Degraded habitat, vegetation loss.	High	MT
	Gravel Mine (13)	Remove derelict structures and creosote pilings on beach, enhance habitat and riparian marine vegetation.	Degraded habitat, vegetation loss.	High	MT
	Gravel Mine (14)	Remove derelict dock, boat ramp and creosote pilings on beach, enhance habitat and riparian marine vegetation.	Degraded habitat, vegetation loss.	High	MT
	Gravel Mine	Nourish beach or initiate landslide side-casting program. Nourishment or side-casting volumes should be lower in volume and placed on the upper beach.	Sediment supply, transport and deposition, juvenile salmonid migratory pathways.	Mod	MT
	Chambers Bay (15)	Remove derelict pilings, recover habitat, enhance habitat salt marsh and riparian marine vegetation.	Degraded habitat, vegetation loss, enhance salmon migratory pathways.	High	MT
	Chambers Bay	Estuarine marsh expansion. Excavate additional estuarine shore and shallow water habitat within low-lying shore adjacent to the railway. Preliminary design plans created for the South Puget Sound Salmon Enhancement Association	Increase juvenile salmonid habitat	Med	LT
	Chambers Bay	Enhance marine riparian buffer along north shore, particularly southernmost shore.	Marine riparian, detritus input and export	Med	ST

Chambers Creek Shoreline

Due to existing high-functioning conditions within the City's Chambers Creek shoreline planning area, limited opportunities for site-specific restoration have been identified. That said, programmatic restoration opportunities can be applied to a site specific level, providing a framework to improve habitat functions, control invasive species, and improve water quality along Chambers Creek in the future. The following restoration objectives should be applied on a site specific level in planning for and implementing freshwater shoreline restoration within University Place:

- **Increase of riparian forest cover and habitat diversity.** Existing riparian conditions along Chambers Creek is generally high, with contiguous forest and shrub communities extending throughout the majority of shoreline jurisdiction. Restoration should identify and implement site-specific opportunities to enhance riparian conditions, with projects focused on improving habitat structure and diversity.

- **Control of invasive weeds.** Although there is no comprehensive assessment of the extent of invasive weeds along the Chambers Creek shoreline, throughout the City's freshwater shoreline patches of non-native invasive weeds such as Himalayan blackberry, Japanese knotweed, and reed canarygrass likely occur. For restoration efforts entirely focused on control and removal of invasive plants, removal of Japanese knotweed should be prioritized over the more established invaders (blackberry and reed canarygrass). Watershed-wide knotweed control efforts generally place higher priority on upstream areas; however, City efforts to control the spread of knotweed within the mainstem of Chambers Creek and along tributary streams will help control the prevalence of knotweed throughout the University Place landscape. Native plant installation and establishment of a native canopy and understory should be the primary approach to suppress invasive species growth and prevent recolonization.

- **Improve stormwater detention and treatment in contributing basins through facility retrofits and development.** Stormwater and tributary waters entering the City's reach of Chambers Creek is commonly impaired with pollutants and contaminants from surrounding urban development and use. Poor water quality conditions are exacerbated by deficient treatment and detention of stormwater runoff. Restoration of stormwater facilities will almost always occur at sites outside of the City's freshwater shoreline planning area, however should be implemented in order to improve water quality along Chambers Creek. Restoration should be focused on improving long standing water quality deficiencies identified by Ecology (for example, Chambers Creek is listed as a Category 5 water for fecal coliform; see Section 2.2 for additional information).

4.3 Existing Capital Improvement Projects and Other Plans

In addition to the opportunities described above, the development of the Chambers Bay Properties (owned by Pierce County) has planned and initiated several capital improvement projects near the shoreline. Some projects incorporate restoration elements directly, while others

may provide an opportunity for restoration coupled with the design and implementation of the primary capital improvement (Table 6).

Table 6. Existing Capital Improvement Projects

Project	Projected Year	Cost	Primary Funding Source	Status and Shoreline Benefits
Chambers Bay Properties Master Plan / Pierce County Sewer Utility 2009-2014 Capital Facilities Plan[1]				
Restoration activity associated with the North Dock Pedestrian Overpass	2009	Full project cost: $2.9 million; Restoration component: unknown	Sewer Utility	Complete; nearshore wildlife habitat improvements
WDFW Fish Count Station/Trail Link	2010 / 2011	~$240,000	Sewer Utility	Aquatic wildlife monitoring and riparian enhancement
Beach Clean-up and Invasive Plant Removal	2011	~$120,000	Sewer Utility	Nearshore wildlife habitat improvements; invasive species control
North dock improvements (restoration incorporated into renovation of derelict dock)	2009 – 2012	Full project cost: $5.4 million; Restoration component: unknown	Sewer Utility	Nearshore wildlife habitat improvements

Stormwater Management Plan: The City recently developed a Stormwater Management Program consistent with Phase II NPDES requirements (City of University Place, 2008), and is in the process of developing an Operations and Maintenance Program to formalize management and maintenance of the City's stormwater systems. The plan includes goals and polices to improve stormwater infrastructure, including existing facilities (Section 4), and includes an inventory of drainage basins throughout the City. The adopted plan, however, does not identify specific capital improvements projects (stormwater retrofits).

TMDL for Chambers Creek: According to the 2008 Washington State Combined Water Quality Assessment (Ecology, 2008), Chambers Creek has one 303(d) listing (Category 5 listing) for impaired water quality: fecal coliform. Category 5 waters require establishment of a TMDL (total maximum daily load) and implementing plan to manage and improve the water quality impairment.

The contributing watershed to Chambers Creek includes highly urbanized subbasins, with many documented and monitored water quality problems within Leach Creek and Steilacoom Lake, as

[1] For more information, see Pierce County Sewer Utility webpage: http://www.co.pierce.wa.us/pc/abtus/ourorg/pwu/sewer/projects/cfpsip.htm

well as other waters. In addition to the fecal coliform listing, over the last several years, Ecology has been monitoring Leach Creek for copper and mercury (Ecology, 2009). Testing has been done due to previous reports of high mercury levels in the stream waters, especially during wet weather periods. Copper testing was additionally done due to salmonid sensitivity to trace amounts of the metal. Testing in 2007 and 2008 showed that ambient mercury and copper levels may not exceed Category 5 listing criteria, however an ongoing program of monitoring was recommended to occur through this year.

5.0 POLICY DEVELOPMENT

Given the nature and scale of alterations to the Puget Sound nearshore in The City of University Place and its UGA, it is important that the City work with other regional entities to pursue significant restoration opportunities. While the City may be able to pursue some restoration or enhancement opportunities without regional partners, these types of projects will typically be smaller scale, lower priority actions (e.g., native plantings).

Five general policies have been identified that the City could adopt to promote the goal of restoring ecosystem function within the Puget Sound nearshore ecosystem – these policies are incorporated directly into the Draft SMP. The policies are not listed in order or priority.

Policy 1. Restoration actions should restore shoreline ecological functions and processes as well as shoreline features and should be targeted towards meeting the needs of sensitive and/or locally important plant, fish and wildlife species as well as the biologic recovery goals for local species and populations.

> *Intent*: Encourage the identification of high-priority restoration projects that will result in lasting benefits to shoreline functions, habitats, and species.

Policy 2. Restoration and enhancement should be integrated with other natural resource management efforts such as the Puget Sound Salmon Recovery Plan and the University Place Comprehensive Plan.

> *Intent:* Encourage the City to support restoration efforts throughout the watershed and throughout its UGA.

Policy 3. Restoration actions outside of the shoreline jurisdiction that have a system-wide benefit should be considered.

> Intent: Focusing restoration where it is most beneficial; for example, stormwater facilities restoration would most often occur outside of shoreline jurisdiction.

Policy 4. When prioritizing restoration actions, the City should give highest priority to measures that have the greatest chance of re-establishing shoreline ecological functions and processes.

Intent: Encourage the identification of high-priority restoration projects which the City can lead. Such projects may be smaller scale or address site-specific habitat improvements within the context of larger ecosystem restoration efforts.

Policy 5. Incorporate restoration and enhancement measures into the design and construction of new uses and development, public infrastructure (e.g., roads and utilities), and public recreation facilities.

Intent: Lead by example by incorporating culvert replacements, bulkhead replacements, riparian plantings, and other habitat enhancement measures into publicly funded projects that are located or pass through the nearshore environment.

Three additional policies have also been identified that should be considered in restoration planning and implementation. The City could consider incorporating these policies into the SMP as well.

Additional Policy A. Use this restoration framework to integrate compensatory mitigation projects into the broader restoration vision for the City.

Intent: Recognize that future development allowed under the SMP may have unavoidable adverse impacts to shoreline functions. In those cases, the restoration planning element of the SMP should help inform development of appropriate mitigation for those adverse impacts.

Additional Policy B. Educate landowners and encourage public involvement in the restoration of the shoreline.

Intent: Provide outreach and technical support to shoreline landowners to better inform and support voluntary restoration of native vegetation and alternative bank stabilization techniques on private property. Present effective stormwater management techniques to landowners to help improve the water quality of Puget Sound. These techniques would be provided during the City's administration of the Phase 2 National Pollution Discharge Elimination System (NPDES) permit. This policy is also intended to provide opportunities for the citizens of University Place to take part in, and learn about, the restoration of the City's shorelines. Example events could include: clean-up Day, invasive species removal, native plantings, monitoring projects, and low impact development techniques.

Additional Policy C Improve water quality in the City of University Place through the use of low impact development (LID) techniques; vegetation restoration; treatment and removal of hazardous materials; and stormwater management, and improved sanitary sewage pump-out facilities for recreational boaters.

Intent: Encourage developers and property owners to utilize the low impact development techniques in the City-adopted King County Surface Water Design Manual, and provide increased access to sanitary sewage pump-out facilities for recreational boaters. Encourage the City to move towards objectives included in

the Stormwater Management Program, developed consistent with Phase II NPDES requirements (City of University Place, 2008).

6.0 IMPLEMENTATION

6.1 Funding and Partnership Opportunities

Funding opportunities for restoration projects include both federal and state grants and legislative funds administered by state agencies. For potential projects in the City of University Place, the greatest likelihood of obtaining funding would result from participation in the South Sound Action Area local integrating organizations and/or strategic partnering with Pierce County and state and federal agencies. Targeting funding requests to address bulkhead replacement with soft-shore alternative bank stabilization projects would fit well into the scientific and restoration plans/goals of the organizations listed below. There are also opportunities to partner with non-profit organizations that can help to secure grant funding and recruit volunteers. A few of these programs and organizations most relevant to the City of University Place are described below.

6.1.1 State and Regional Programs

6.1.1.1 Puget Sound Partnership (PSP)

The state legislature has appropriated a total of $460 million for state agencies and university education programs for implementing the *2020 Action Agenda*. The City of University Place falls within the South Sound Action Area, one of seven action areas identified by PSP.

6.1.1.2 Puget Sound Watershed Protection & Restoration Grant Program

The Environmental Protection Agency through the Washington Department of Ecology is offering watershed grants to applicants within the 14 Puget Sound Salmon Recovery Planning Areas. The South Sound Action Area Council would be the recipient of these funds, coordinated by the Puget Sound Partnership. Local governments, tribes, watershed entities and non-profit groups are eligible for these grants. The focus of the grants is to identify opportunities and barriers for the protection and restoration of water quality, water quantity, habitat protection and habitat restoration within the Puget Sound Basin.

6.1.1.3 Salmon Recovery Funding Board (SRFB)

With the listing of salmonid species under the Endangered Species Act in 1999, the Legislature created the Salmon Recovery Funding Board. Composed of citizens appointed by the Governor and five state agency directors, the Board provides grant funds to protect or restore salmon habitat and assist related activities. The SRFB works closely with local watershed groups and has helped finance over 500 projects.

6.1.1.4 South Puget Sound Salmon Enhancement Group

The South Puget Sound Salmon Enhancement Group is a 501(c)(3) non-profit organization that works to protect and restore South Puget Sound salmon populations and aquatic habitat through

scientifically informed projects, community education, and volunteer involvement. The group works in cooperation with landowners and other organizations to help plan, fund, carry out, and monitor fishery enhancement and habitat restoration projects. Over 100 projects have been completed since the group formed in 1990.

The Washington State Legislature formed salmon enhancement groups in 1990 as a means of directly involving communities, citizen volunteers, and landowners in salmon recovery. Enhancement groups are funded by surcharges on sport and commercial fishing licenses and the sale of eggs and carcasses from state hatcheries.

6.1.2 Pierce County Programs

6.1.2.1 Conservation Futures Program

Conservation Futures is a Pierce County land preservation program intended to protect open space, timber lands, wetlands, critical habitats, and farm lands within the county. This program is funded through a State authorized county property tax. Taxes collected, identified as Conservation Futures, are used to acquire land, or the rights to future development of lands, for conservation purposes. Lands identified in the University Place SMP as future restoration or conservation sites can be nominated by the City, or an agency, for purchase through this County-sponsored program.

6.1.2.2 Open Space-Public Benefit Rating System-Tax Program

Pierce County's Public Benefit Rating System (PBRS) provides for a reduction in property taxes for lands containing various open space features, such as streams, wetlands, estuaries, wooded areas, etc. These features are scored and the number of PBRS points correlates to a percent of market value reduction during the period of continued eligibility. This program can help property owners conserve ecologically important areas while reducing their tax burden. (http://www.co.pierce.wa.us/pc/abtus/ourorg/at/open_space.htm)

6.1.3 Other Non-profit Organizations

6.1.3.1 Cascade Land Conservancy

Cascade Land Conservancy is a non-profit organization working to conserve land in Pierce, King, Mason, Kittitas, and Snohomish Counties. The Conservancy has led the conservation of more than 150,000 acres over the last decade including approximately 20 properties in Pierce County. The Conservancy works with landowners using tools such as land purchase or donation, conservation easements, and stewardship endowments to preserve high-quality ecosystems. (http://www.cascadeland.org/)

6.1.3.2 Friends of Pierce County

Friends of Pierce County is a nonprofit organization that involves the people of Pierce County in preserving and restoring the natural environment and promotes more livable communities. The

organization seeks to serve as an interactive link coordinating communities, business, government, and other entities; educate and empower communities through public outreach; direct growth of community attributes that promote a sensible and sustainable balance of environment, equity, and economics; preserve and restore the natural ecosystem; promote livable communities with linked and shared resources; and advocate for responsible and adaptive land use and transportation planning, watershed planning and natural resource management, and environmentally friendly planning, techniques, and policies. (http://www.friendsofpiercecounty.org/about.htm)

6.1.3.3 National Fish and Wildlife Foundation

The National Fish and Wildlife Foundation (NFWF) distributes grants to non-profit organizations, local, state or federal government agencies for community-based projects that improve and restore native salmon habitat, remove barriers to fish passage, or for the acquisition of land/ conservation easements on private lands where the habitat is critical to salmon species. NFWF has established local partnerships throughout Washington State through the Community Salmon Fund program to engage landowners, community groups, tribes, and businesses in stimulating smaller-scale, community-oriented habitat restoration and protection projects to aid in salmon recovery. Grants made under this program are administered by NFWF. There are currently three Community Salmon Fund partnership programs. NFWF has partnered with the Washington State Salmon Recovery Funding Board (SRFB) to administer a statewide Community Salmon Fund program that is coordinated with the individual Lead Entity groups. In addition to this SRFB Community Salmon Fund program, NFWF has partnered with both King and Pierce Counties to administer county-specific Community Salmon Fund programs in those counties. (www.nfwf.org)

6.1.3.4 People for Puget Sound

People for Puget Sound is a non-profit organization founded in 1991 to protect the health of Puget Sound. Key programs address community-based restoration, oil spill prevention, stormwater management, toxics, septic systems, public involvement and education. People for Puget Sound has worked with thousands of volunteers to restore over 40 miles of shoreline and 20 salt marshes, beaches, and estuaries. (http://pugetsound.org/)

6.1.3.5 Pierce County Biodiversity Alliance

The Pierce County Biodiversity Alliance includes a cross-section of conservation agencies and organizations that share an interest in conserving the biodiversity of Pierce County. The Alliance includes Pierce County Planning and Land Services, Washington Department of Fish and Wildlife, University of Washington, Cooperative Fish & Wildlife Unit, Metro Parks Tacoma, National Wildlife Federation, Puyallup River Watershed Council, Pierce County Conservation District, Crescent Valley Alliance (CVA), and Friends of the Lower White River (FLWR).

The Alliance has identified a Biodiversity Network of 16 biologically rich areas known as "biodiversity management areas" and connecting corridors (buffered connectors) that cover

nearly 268,000 acres of land. The Puget Sound shoreline of University Place is included in the buffered connector mapping. Landowners in Pierce County BMAs are eligible for reduced property taxes. The Alliance has involved landowners and citizens in learning and stewardship through rapid biological inventory (BioBlitz), data collection (NatureMapping), and community planning. (http://www.biodiversity.wa.gov/ourbiodiversity/updatewhite_river.html)

6.1.4 Other Possible Funding Sources

a) Aquatic Lands Enhancement Account – WA Department of Natural Resources

b) Aquatic Lands Restoration Funding – WA Department of Natural Resources

c) Bring Back the Natives – National Fish and Wildlife Foundation

d) Coastal Protection Account – WA Department of Ecology

e) Community-Based Restoration Program - NOAA

f) City Fish Passage Barrier, Stormwater and Habitat Restoration Grant Program - WA Department of Transportation

g) Embrace-A-Stream – Trout Unlimited

h) Estuary and Salmon Restoration Program (ESRP) – Puget Sound Nearshore Ecosystem Restoration Project

i) Five-Star Restoration Program - Environmental Protection Agency

j) Habitat Conservation - U.S. Fish and Wildlife Service Coastal Program

k) Landowner Incentive Program – Washington Department of Fish and Wildlife

l) Matching Aid to Restore States Habitat (MARSH) - Ducks Unlimited

m) Non-point Source Implementation Grant (319) Program, Centennial Clean Water Fund, and State Revolving Loan Fund - Environmental Protection Agency, WA State Department of Ecology

n) Pacific Grassroots Salmon Initiative - National Fish & Wildlife Foundation

o) Partners for Fish and Wildlife – U.S. Fish & Wildlife Service

p) Puget Sound Program - U.S. Fish & Wildlife Service

q) Puget Sound Wetland Restoration Program - Washington State Department of Ecology

r) Section 206: Aquatic Ecosystem Restoration Program - U.S. Army Corps of Engineers

s) Transportation Equity Act for the 21st Century (TEA-21) - Washington Department of Transportation

t) Washington State Ecosystems Conservation Program - U.S. Fish and Wildlife Service

u) Washington Wildlife Recreation Program – Interagency Committee for Outdoor Recreation

v) Wetland Protection, Restoration, and Stewardship Discretionary Funding - Environmental Protection Agency

6.2 Approach for Public Outreach

Public education and involvement in restoration efforts is essential when implementing programmatic and site-specific opportunities located on privately-owned property. The City could consider using the public education and outreach requirement of the City's National Pollutant Discharge Elimination System (NPDES) Phase 2 Municipal Stormwater Permit to reach out to the University Place community. The NPDES permit requires an education program be put into place that is aimed at residents, businesses, industries, elected officials, policy makers, and planning staff. The goal of the program is to reduce or eliminate behaviors that cause or contribute to adverse stormwater impacts. The following are subject areas required to be in the program which could relate to the protection and restoration of shoreline areas:

- Impacts from impervious surfaces
- Source control BMPs and environmental stewardship actions and opportunities in the areas of pet waste, vehicle maintenance, landscaping and buffers.
- BMPs for use and storage of pesticides and fertilizers.
- Low Impact Development techniques, including site design, pervious paving, retention of forests and mature trees.

When preparing the program that addresses these subject areas, the City could incorporate information that relates to shoreline restoration, specifically as it relates to improving water quality. Public outreach for subject areas that do not relate to stormwater impacts would have to be conducted outside the NPDES program. However, the approach used for the NPDES program could be similarly applied and implemented to ensure efficient use of City staff resources.

6.3 Timelines, Benchmarks, and Strategies for Effectiveness

In the context of the SMP update, restoration planning is a long-term effort. As stated earlier, the SMP guidelines include the general goal that local master programs "include planning elements that, when implemented, serve to improve the overall condition of habitat and resources within the shoreline area" (WAC 173-26-201(c)). The guidelines for restoration planning state that local programs should "…appropriately review the effectiveness of the projects and programs in meeting the overall restoration goals" (WAC 173-26-201(2)(f)). The Puget Sound Nearshore Partnership restoration framework described previously (PSNP, 2004) provides a general roadmap for assessing restoration actions and revising the approach to meeting restoration goals. It includes the following objectives:

- Monitor post-restoration conditions;
- Adaptively manage restoration projects; and
- Use monitoring and maintenance results to inform future restoration activities.

As a long-range policy plan, it is difficult to establish meaningful timelines and measurable benchmarks in the SMP by which to evaluate the effectiveness of restoration planning or actions. Nonetheless, the legislature has provided an overall timeframe for future amendments to the SMP. In 2003, Substitute Senate Bill 6012 amended the Shoreline Management Act (RCW 90.58.080) to establish an amendment schedule for all jurisdictions in the state. Once the City of University Place updates its SMP, the City is required to review, and amend if necessary, its SMP once every seven years (RCW 90.58.080(4)). During this review period, the City could document progress toward achieving shoreline restoration goals. The review could include:

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

Another mechanism that may serve to establish timelines and benchmarks would be establishment of a shoreline restoration program organized like or integrated with the City's capital improvement program (CIP). Similar to an infrastructure CIP, a shoreline restoration CIP would be evaluated and updated regularly. The shoreline CIP would be focused on site-specific projects and could be funded through grants or a fee-in-lieu program developed as part of the shoreline permitting process. Further, other CIP projects, such as stormwater facility improvements, could be evaluated to determine if their design could advance shoreline restoration goals.

Finally, the City could develop performance criteria for monitoring shoreline restoration and mitigation projects. A GIS-based database to document and track projects could be developed as well. This would assist in future evaluations (once every seven years) of the SMP program in terms of meeting restoration and "no-net-loss" goals.

6.4 Constraints to Implementation

There are a number of potential complicating factors between the development of a City-wide shoreline restoration plan and on-the-ground implementation of its programs and projects. Some of these challenges are briefly summarized below:

a) Lack of funding: Designing, carrying out, and monitoring the success of restoration efforts can be an expensive undertaking, particularly at larger (e.g., watershed or reach) scales. In general, funding for restoration is limited and competition for funds extensive.

b) Landowner participation: Restoration opportunities which are located on private property can be more challenging to implement than opportunities located on public property. The property owners would need to be interested in working with the City since restoration is not a regulatory requirement. Property owners would need to fund and complete the projects on their own, or if public funding were available the City would have to negotiate with the private property owners to purchase the property or an easement on the property to accomplish the project. Such voluntary interest may not occur until shoreline landowners are educated on the benefits of restoration projects or meaningful incentives are established.

c) Project permitting: Obtaining necessary permits from local, state, and federal regulatory agencies can require substantial time and effort. Although encouraged and allowed by the SMP, complicated restoration projects may take a year or more to permit.

d) Climate change: Rising temperatures and sea levels have the potential to dramatically impact the City of University Place's shoreline jurisdiction, processes, and functions over time. Depending on the scale of change and time period over which changes occur, restoration priorities could shift substantially within a relatively short period of time. Beach nourishment will be required to prevent habitat loss due to the coastal squeeze along all armored shores. Relocating the rail causeway may be necessary to preserve the nearshore food web and control costs associated with engineering and intertidal revetment. Future restoration should be designed to consider sea level rise and future water elevations in shoreline areas of University Place.

7.0 CONCLUSIONS

The City of University Place's Puget Sound and Chambers Bay shorelines have been historically altered and developed to varying degrees throughout the City. The BNSF Railroad grade represents the largest constraint to restoration within the shoreline environment. Historical alterations have also included dramatic changes in shoreform along the Puget Sound South marine shoreline reach. In this area, shoreline developed for a variety of public facilities altered the shoreline, and extensive gravel mining eliminated what once was a high coastal bluff, and resulted in a lower bank,. However, the shoreline still maintains ecological processes and provide important habitat functions to a variety of fish and wildlife species.

On the other hand, much of the shoreline along Chambers Creek remains undeveloped and provides a high level of ecological functions. Recent public access and restoration projects associated with the county-owned parcels (Chambers Bay Properties) have improved conditions along the shoreline. For Chambers Creek, significant restoration effort must be focused in management of land use, redevelopment, and stormwater in the surrounding contributing basins – areas outside of the shoreline planning area.

The high priority opportunities identified in this report will likely require grant funding, voluntary participation in the restoration action, and public outreach and education efforts. Removing, limiting, and/or replacing traditional shore armoring will require substantial public education efforts and potentially use of incentives.

8.0 REFERENCES

ESA Adolfson. 2011. *City of University Place Shoreline Inventory and Characterization*. Seattle, Washington.

Johannessen, J. and A. MacLennan. 2007. Beaches and Bluffs of Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-04. Report No. 2007-04. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington.

Nightingale, B. and C. Simenstad. 2001. *Overwater structures: Marine issues*. Prepared for Washington Department of Fish and Wildlife, Washington Department of Ecology, and Washington Department of Transportation. University of Washington. Seattle, WA.

Pierce County (WRIA 10/12) Lead Entity. 2008. Salmon Habitat Protection and Restoration Strategy, WRIA 10 Puyallup Watershed, WRIA 12 Chambers/Clover Creek Watershed.

Puget Sound Nearshore Project (PSNP). 2002. *Overview of Puget Sound Nearshore Project*. Fact sheet available online: www.pugetsoundnearshore.org

Puget Sound Nearshore Project (PSNP). 2004. *Guiding Restoration Principles: Technical Report 2004-03*. Olympia, Washington.

Puget Sound Partnership (PSP). 2007. *Puget Sound Conservation and Recovery Plan 2007-2009*. Olympia, Washington.

Shared Strategy for Puget Sound (Shared Strategy). 2007. *Puget Sound Salmon Recovery Plan*. Submitted by Shared Strategy Development Committee. Seattle, Washington.

United States Army Corps of Engineers (USACOE). 2000. Section 905(b) Analysis: General Investigation Reconnaissance Study, Puget Sound Nearshore, Washington. Seattle, Washington.

Washington Department of Fish and Wildlife (WDFW). 2009a. Priority Habitats and Species database information.

Washington Department of Fish and Wildlife (WDFW). 2009b. SalmonScape data. Olympia, Washington. Available: http://wdfw.wa.gov/mapping/salmonscape/index.html

Washington Department of Ecology (Ecology). 2004. *Restoration Planning and the 2003 Shoreline Management Guidelines*. Ecology Publication No. 04-06-022. Olympia, Washington.

Washington State Department of Ecology (Ecology). 2006. Washington State Water Resource Inventory Area (WRIA) Maps. Accessed November 2009 at: http://www.ecy.wa.gov/services/gis/maps/wria/wria.htm#Information:

Washington State Department of Ecology (Ecology). 2009. 2008 Washington State's Water Quality Assessment [303(d)]. Accessed November 2009 at: http://www.ecy.wa.gov/Programs/wq/303d/2008/index.html