ENHANCEMENT OPPORTUNITIES
(AQUASCAPE II)

2 August 2010

Prepared by

Naval Facilities Engineering Command, Northwest
1101 Tautog Circle
Silverdale, WA 98315-1101

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Acknowledgments

The Navy appreciates the organizations, agencies, and individuals who contributed to this document. A Stakeholder Group was formed in October 2009 to support development of goals and objectives for Sinclair Inlet, provide input and knowledge about on-going actions within the watershed, and contribute ideas and a vision for this document. The Navy would like to acknowledge support provided from representatives of the Suquamish Tribe, U. S. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, U. S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, Washington Department of Natural Resources, Washington Department of Ecology, Kitsap County, City of Bremerton, City of Port Orchard, Puget Sound Restoration Fund, and Washington Sea Grant.

This report satisfies Term and Condition 3.d of the May 8, 2008 Memorandum of Agreement (MOA) between the Suquamish Tribe and the Department of Navy regarding the CVN Maintenance Wharf and Intermediate Maintenance Facility at Naval Base Kitsap, Bremerton. This condition required the Navy to supplement the Sinclair Inlet Existing Conditions Data Compilation (URS Greiner, Inc. and SAIC 1999) with a Restoration Plan containing potential restoration projects.

Table of Contents

List of Figures

Note on hand-drawn maps: renderings are roughly proportional, but not necessarily to scale. Colors do not represent topography or bathymetry.

List of Tables

Appendices

Abbreviations/Acronyms

BMPs	Best Management Practices
CCA	Critical-Contributing Areas
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CMU	Conceptual Management Unit
CSO	Combined Sewer Overflow
DNR	Washington Department of Natural Resources
DOE	Washington Department of Ecology
ENVVEST	ENVironment inVEStment partnership
EPA	Environmental Protection Agency
FC	Fecal Coliform
FSW	Focal Sub-Watersheds
GIS	Geographic Information System
IMF	Intermediate Maintenance Facility
INRMP	Integrated Natural Resource Management Plan
LWD	Large Woody Debris
MOA	Memorandum of Agreement
NAU	Nearshore Assessment Unit
NAVFAC NW	Naval Facilities Engineering Command Northwest
NBK	Naval Base Kitsap
NMFS	National Marine Fisheries Service
NOED	No Observed Effect Dose
NRC	Nodal-Riparian Corridors
NST	Nearshore Science Team
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PIC	Pollution Identification and Correction Program (Kitsap County Environmental District)
POTW	Publicly-Owned Treatment Works
PSAMP	Puget Sound Ambient Monitoring Program
PSNERP	Puget Sound Nearshore Ecosystem Restoration Project
PSNS	Puget Sound Naval Shipyard
RM	River Mile
SASSI	Salmon and Steelhead Stock Inventory
SFI	Sustainable Forestry Initiative
SR	State Route
TMDL	Total Maximum Daily Load
TSV	Tissue Screening Values
U&A	Usual and Accustomed Area
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area

Why Sinclair Inlet?

Long before incorporated cities, the Navy shipyard, paved highways, ferries, businesses, houses, and condominiums, the waters and uplands of Sinclair Inlet provided natural resources that sustained and supported the people and culture of the Suquamish Tribe. Today, Sinclair Inlet remains an important part of the Tribe's usual and accustomed fishing area, and supports current harvesting and resource enhancement efforts.

A drive around Sinclair Inlet reveals an estuary much different than pre-historic times. Many shorelines are extensively developed, with features hardly resembling those once present. Many past (and some current) activities have contaminated waters and sediments. Some species once abundant are rare, while other introduced species are plentiful. Man-made structures designed for human use have modified some systems to the point that they now reduce or exclude non-human use.

But a closer look at Sinclair Inlet shows that all is not lost. Juvenile salmon still migrate along the shoreline under and around docked vessels. During winter months, a variety of birds and waterfowl join year-round populations to feed in Sinclair Inlet waters. As part of the Pacific Flyway, Sinclair Inlet is important to migratory birds. Shellfish communities subsist along the bottom, and marine mammals and invertebrates are observed throughout the inlet. The City of Bremerton owns and maintains thousands of acres of sustainable forest land in the Gorst Creek watershed. Forage fish spawn throughout the inlet. Abundant populations of surf smelt spawn at Ross Point. A rare population of summer chum in Puget Sound begins and ends its life cycle in Blackjack Creek. Monitoring of marine and freshwater quality has shown some improving trends in streams and marine waters.

Although its shorelines and uplands are modified and its resources impacted, Sinclair Inlet continues to have ecological values worth protecting, restoring, and enhancing. The success of efforts to protect and improve Sinclair Inlet, its watershed, and Puget Sound as a whole will not depend on any one person, organization, or action. Rather, overall success will be tied to planning and participation of many. This report provides a first step toward implementing a group of actions to ensure Sinclair Inlet's existing ecological values are not only maintained, but also improved and restored for future generations.

1.0 Introduction

This report presents overall goals and objectives for the future ecological health of Sinclair Inlet, and compiles a list of enhancement opportunities for the Sinclair Inlet watershed, shown in Figures 1 and 2. Development of the list was led by the U.S. Navy, with the assistance and participation of the Suquamish Tribe, National Marine Fisheries Service (NOAA/NMFS), U.S. Fish and Wildlife Service (USFWS), Washington Department of Fish and Wildlife (WDFW), Washington Department of Natural Resources (DNR), Washington Department of Ecology (DOE), Kitsap County, City of

Bremerton, City of Port Orchard, Washington Sea Grant, and Puget Sound Restoration Fund (Stakeholders).

There are numerous existing reports with recommendations for improving Sinclair Inlet. This report compiles existing recommendations as well as new opportunities into a single document. This report does not assign tasks or funding for any listed projects. However, having a consolidated list should increase the likelihood that listed actions will be implemented.

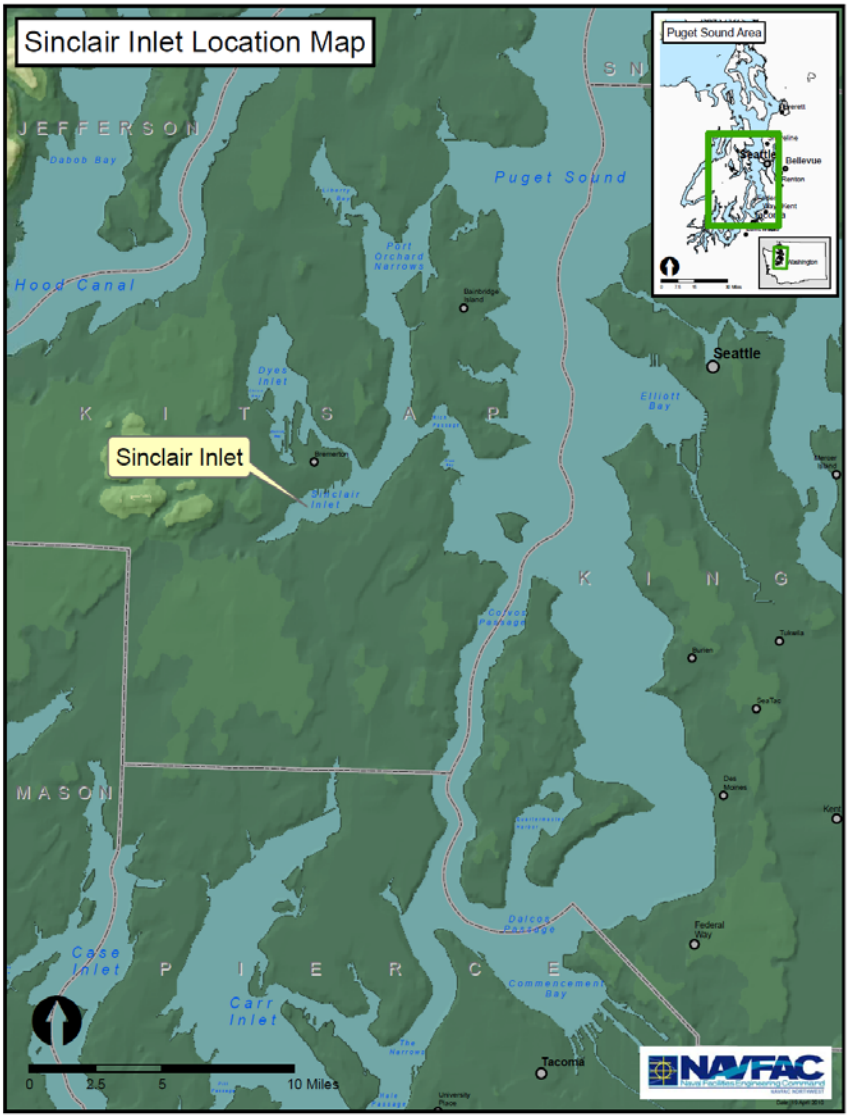


Figure 1 Sinclair Inlet Location

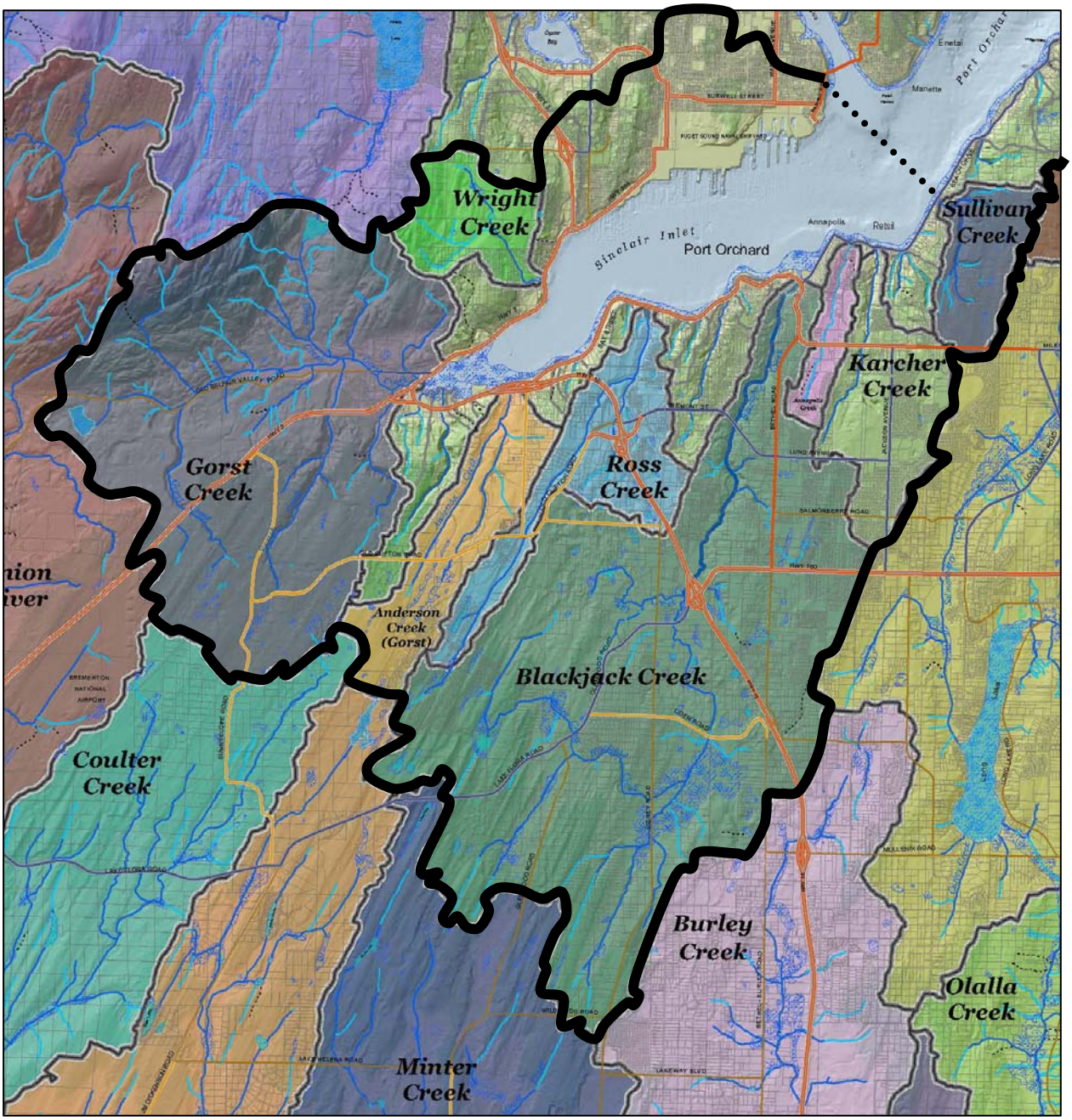


Figure 2 Sinclair Inlet Study Area
(Kitsap County Dept. of Community Development)

Organization of Report

This report begins with an introduction in Section 1.0. Section 2.0 is a general discussion about physical features, biological resources, and land use within Sinclair Inlet. Section 3.0 presents background information about on-going regional and local restoration and improvement actions in Puget Sound, Kitsap County and Sinclair Inlet. Goals and objectives are presented Section 4.0, followed by categories of enhancement opportunities in Section 5.0. Section 6.0, enhancement opportunities, lists potential

actions, grouped by location, then by goal. Reference documents are listed in Section 7.0. Post-1999 reports and studies are summarized in Section 8.0.

2.0 Overview of Sinclair Inlet

Note: Detailed information about the physical and biological characteristics of Sinclair Inlet is contained in Appendix A, the *Sinclair Inlet Existing Conditions Data Compilation* (URS Greiner, Inc. and SAIC 1999).

Sinclair Inlet is located on the eastern Kitsap Peninsula within Puget Sound. Named streams draining into the inlet include Wright, Gorst, Anderson, Ross, Blackjack, Annapolis, Karcher (Olney, Retsil), and Sacco (Sullivan) Creeks. For this report, the Sinclair Inlet study area includes the watersheds of these streams as well as marine waters extending eastward to the Manette Bridge in the City of Bremerton and to Sacco Drive on the southern shore. Figure 2 shows limits of the study area.

Freshwater

Most of Sinclair Inlet's freshwater flows are from Gorst and Blackjack Creeks (TetraTech 1988, PSCRBT 1990, Haring 2000). There are four significant salmon-bearing streams in the study area: Gorst Creek at the western head of the inlet, and Anderson, Ross and Blackjack Creeks on the south shore (URS Greiner, Inc. and SAIC 1999). Estuaries are located at the mouths of Wright, Gorst, Ross, Blackjack, and Sacco (Sullivan) Creeks. Water quality in streams ranges from very poor to very good based on fecal coliform bacteria, dissolved oxygen, and pH (Kitsap County Health District 2009). Sections of some streams have been channelized or modified by in-water structures such as culverts, fishways, and armoring. Some stream banks and riparian zones remain in a natural state; others are impacted by residential, agricultural, commercial, and industrial uses.

Marine Waters

Although Sinclair Inlet has no eelgrass, its waters support macroalgae and populations of shellfish, invertebrates, finfish, birds, and marine mammals. Sinclair Inlet waters are impacted by point and non-point pollution sources. Portions of the inlet and some of its tributary streams are currently on the Clean Water Act Section 303(d) list for dissolved oxygen and fecal coliform bacteria. Approximately 50 organic compounds and 34 metals have been detected in sediments from Sinclair Inlet (Tetra Tech 1988). On-going slope stabilization and shoreline armoring have changed beach profiles from shallow, gradual slopes of small gravel and sand to steep rock-lined shorelines.

Human Use

Shoreline uses in the Sinclair Inlet watershed include military, industrial, commercial, and residential developments. Many shorelines have been modified to support these uses, and major highways and roads run adjacent to much of the shoreline. The northeastern shoreline includes urban development in the City of Bremerton and

military/industrial development at Puget Sound Naval Shipyard. West of the shipyard, a Navy railroad and Highway 304 (Charleston Boulevard) are adjacent to the inlet's shoreline. At the west end of the inlet, commercial land uses dominate Gorst, with some mudflats and narrow vegetation bands along the shore. On the southern shore between Gorst and the City of Port Orchard, Highway 166 runs along the shoreline, adjacent to residential and commercial development. Topography in the Ross Point vicinity is steep and unstable. The shoreline in Port Orchard is developed with commercial and marina uses. Most shorelines in the cities of Bremerton and Port Orchard are armored, with steep-sloped intertidal zones. Upland areas within the watershed contain agriculture, forest, single-family homes, and low-intensity commercial uses.

Human use of Sinclair Inlet biological resources has included tribal, commercial, and recreational harvest of salmon, finfish, shellfish, and invertebrates. Due to chemical contamination, the Suquamish Tribe does not allow fishing for resident fish in Sinclair Inlet and prohibits retaining resident fish for sale or consumption from Sinclair Inlet during tribal salmon fisheries. Risk of chemical or bacterial contamination has kept shellfish growing areas in Sinclair listed as Prohibited. The most significant fishery is the tribal harvest of chum and Chinook salmon (URS Greiner, Inc. and SAIC 1999). The Suquamish Tribe operates Chinook rearing ponds and raceways near Gorst Creek in cooperation with WDFW, the City of Bremerton, and volunteers from local sports clubs. Sinclair Inlet has cultural significance to the Suquamish Tribe, and is part of the Tribe's usual and accustomed fishing area (U&A).

3.0 Regional and Local Efforts

Throughout Puget Sound, government organizations, conservation groups, community groups, and individuals have carried out ecological assessments, habitat surveys, flora and fauna studies, and contamination studies. Many of these efforts also proposed actions to maintain existing high value resources, improve existing conditions, clean up pollution, and restore damaged resources. The Stakeholders recognize that actions taken at a local level cannot be isolated from efforts occurring on a broader scale. To ensure consistency with previous and on-going assessments and restoration efforts, the Stakeholders identified, considered, and incorporated other plans, studies, assessments, and reports during preparation of this document.

Puget Sound

The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) is a cost-shared General Investigation Feasibility Study by the U.S. Army Corps of Engineers (USACE) and WDFW. Other state, local governments, agencies and non-governmental organizations also contribute to WDFW's "local sponsor" cost-share. The goals of the General Investigation Study are to identify nearshore ecosystem problems, evaluate potential solutions, and restore, protect, and preserve critical nearshore habitat. It is anticipated that the study will ultimately result in a Puget Sound ecosystem restoration authority and significant federal funding for its implementation by the USACE.

In 2004, the Puget Sound Nearshore Science Team published *Guidance for Protection and Restoration of the Nearshore Ecosystems of Puget Sound* (Fresh et al. 2004). This document presents a framework for a future strategic plan to guide development and selection of nearshore ecosystem recovery projects. The document also contains criteria for developing and selecting recovery projects until the strategic plan is adopted.

The Washington Department of Natural Resources funded an investigation into the historical nearshore environment of the Puget Sound region, presented in *Historical Reconstruction, Classification and Change Analysis of Puget Sound Tidal Marshes* (Collins and Sheikh 2005). Original U.S. Coast and Geodetic Survey topographic sheets (T-sheets) mostly from the period between 1850 and 1890 were used to create a Geographic Information Systems (GIS) database with continuous coverage of the entire Puget Sound shoreline. The authors used this data along with other data sources to reconstruct the historical nearshore environment.

The Puget Sound Partnership is a community-led effort of citizens, governments, tribes, scientists, and businesses working together to restore and protect Puget Sound. The Puget Sound Partnership created and maintains an Action Agenda to integrate scientific assessment with community priorities, and establish a set of actions needed to protect and restore Puget Sound.

Kitsap County

The *East Kitsap County Nearshore Habitat Assessment and Restoration Prioritization Framework* (Borde et al. 2009) was completed in 2009. The authors used a GIS-based model to assess the condition of marine shorelines in East Kitsap County. The effort summarizes the state of the nearshore and identifies priority areas for habitat protection, restoration, enhancement, and creation. The report identifies drift cells and Nearshore Assessment Units (NAUs) throughout East Kitsap County. NAUs are based on geomorphological classification. The assessment delineates 35 NAUs in the Sinclair Inlet Study Area; each unit was scored for dominant physical processes and controlling factors. Dominant physical processes include sediment transport, wave erosion, fluvial deposition, tidal erosion, and wave deposition. Dominant process scores were categorized as high, medium, and low disturbance, as shown in Figure 3. The least disturbed processes in Sinclair Inlet were located in the western inlet near Gorst and at the mouth of Blackjack Creek. Controlling factors include substrate, wave energy, depth/slope, light, disturbance frequency, and water quality. The report recommends general management options for each NAU.

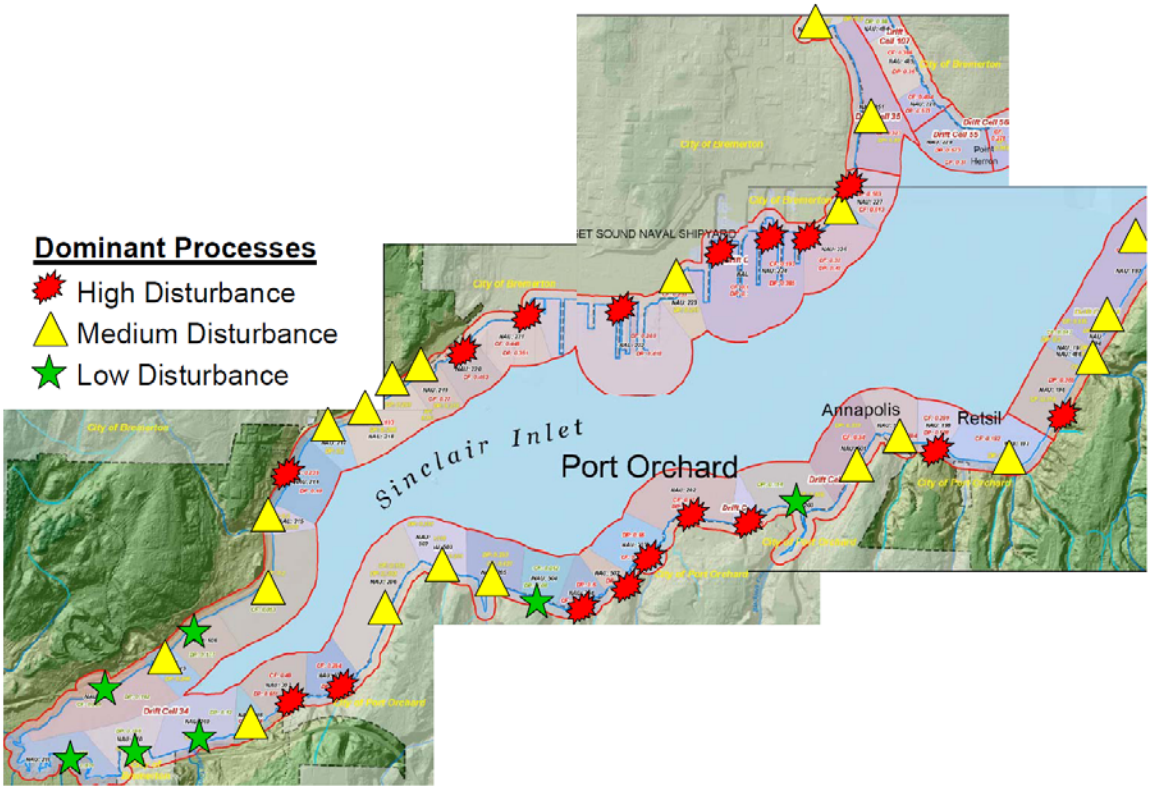


Figure 3 Dominant Physical Process Scores for each Nearshore Assessment Unit *East Kitsap County Nearshore Habitat Assessment and Restoration Prioritization Framework* (Borde et al. 2009)

The *2003 Kitsap Salmonid Refugia Report* (May and Peterson 2003) identifies, describes, and characterizes salmonid refugia areas within Kitsap County. Refugia are areas where environmental conditions have allowed a particular resource to survive even after the same resource has declined or failed to survive in surrounding areas. Refugia are categorized A (highest) through D (lowest). Refugia areas are delineated as Focal Sub-Watersheds (FSW), Nodal-Riparian Corridors (NRC), Nearshore and Estuarine Refugia (NSE), and Critical-Contributing Areas (CCA). No Category A refugia were designated in Sinclair Inlet. Category B refugia include Blackjack Creek headwaters (FSW), Square Creek (FSW), Anderson Creek (NRC), and Blackjack Creek mainstem (NRC). Category C refugia include Gorst Creek mainstem (NRC), and the following FSW: Gorst headwaters, Jarstad Creek, Heins Creek, and Ruby Creek. Category D refugia include Blackjack Creek middle reaches (NRC), Wright Creek (NRC), and the Sinclair Inlet shoreline. May and Peterson (2003) note that Gorst was designated as Category C due to the influence of the hatchery. Without the hatchery influence, portions of this watershed would likely qualify as a Category B refugia. The Suquamish Tribe notes that the hatchery is a rearing facility only, and is not located in the stream channel itself. Gorst Creek still receives wild runs of chum, coho, steelhead, and cutthroat trout (J. Olyer, pers. comm.)

The 2000 *Salmonid Habitat Limiting Factors* report (Haring 2000) examines habitat conditions that support anadromous salmon and steelhead. This report includes formal habitat inventories specifically directed at evaluating fish habitat, other watershed data

not specifically associated with fish habitat evaluation, and personal experience and observations of the watershed experts involved in the Technical Advisory Group. Prioritized habitat action recommendations are provided for each stream in which salmonid presence has been identified, and for each marine area.

Sinclair Inlet

The U.S. Navy funded preparation of the *Sinclair Inlet Existing Conditions Data Compilation* (URS Greiner, Inc. and SAIC 1999) to serve as a basis for future planning efforts in the Sinclair Inlet watershed. The report summarizes existing information about the physical and biological characteristics of Sinclair Inlet, and discusses historical development, land use, environmental quality, human use, and cultural resources. The report identifies eight (8) Conceptual Management Units, which are characterized by similar habitats and physical features. For each Conceptual Management Unit, the report discusses existing challenges and recommends general enhancement actions.

4.0 Goals and Objectives

Guidance for Protection and Restoration of the Nearshore Ecosystems of Puget Sound (Fresh et al. 2004) identifies the development of goals as an important part of recovery planning. Fresh et al. (2004) recommends goals that:

- incorporate both scientific principles and socioeconomic factors;
- are developed to incorporate performance measures;
- are framed to address desired ecosystem processes, structures, and functions necessary to sustain the things we value in the system;
- reflect what is realistic; and
- recognize current and future constraints on the system.

Although it would not be feasible to return Sinclair Inlet to pre-development historical conditions, the system contains numerous opportunities to preserve functioning systems and resources, improve processes, and remove or reconfigure man-made structures. The enhancement goals presented below are broad statements of general intentions. Since it is difficult to implement and measure progress toward broad goals, objectives were developed to provide targets that can be measured and achieved.

Table 1 Goals and Objectives

GOALS	OBJECTIVES	MEASURES OF SUCCESS
Protect intact ecosystem processes, structures, and functions	Purchase lands or easements for conservation.	Percentage of priority areas purchased and preserved.
	Evaluate lands through DNR Aquatic Reserve program.	Percentage of priority areas preserved.
	Evaluate lands through WDFW Marine Protected Areas.	Percentage of priority areas preserved.
	Update and implement ecosystem protection measures in Comprehensive Plans, Zoning Designations, Critical Areas Ordinances, and Shoreline Master Programs.	Priority areas designated for protection/conservation.
	New regulations to reduce/restrict adverse environmental impacts.	Success measures to be developed on case-by-case basis.
	Increase voluntary stewardship.	Percentage of privately-owned property within priority areas with voluntary preservation agreements.
Restore impaired ecosystem processes, structures, and functions	Remove shoreline armoring and restore natural shoreline profile.	Percentage of high priority shoreline armoring removed and shoreline restored.
	Soften shoreline armoring (where complete removal infeasible).	Percentage of high priority shoreline armoring softened.
	Remove or reconfigure in-water structures to ensure fish migration corridors.	• Migration corridor area regained (acres or square feet). • Percentage of priority migration corridors restored.
	Create or improve forage fish spawning habitat in appropriate locations.	Acres of forage fish spawning habitat sustained five years after restoration.
	Enhance or improve riparian, wetland, and estuarine buffers.	Acres of buffers enhanced or improved.
	Create or improve fish passage.	Percentage of known fish barriers improved/restored.
	Restore native plant populations.	Percentage of priority habitat areas restored with native plants.
Reduce watershed pollution	Remove or contain contaminated sediment.	• Acres of contamination removed or contained. • Percentage of known contamination remediated.
	Reduce contaminant loading.	• Kg of contaminant loads reduced (U.S. Navy et. al. 2000, ENVVEST 2006).
	Prevent sediment and water contamination.	• Water quality monitoring shows no new contamination. • Monitoring shows improving trends.

GOALS	OBJECTIVES	MEASURES OF SUCCESS
Protect/Restore sustainable fish and wildlife populations	Restore and enhance native shellfish populations.	• Acres of harvestable shellfish. • Sustainable population trends.
	Sustainable fish populations.	• Diversity of appropriate fish species. • Positive population trends.
	Healthy wildlife and bird populations.	• Diversity of appropriate wildlife and bird species. • Positive population trends.
	Healthy marine mammal populations.	• Diversity of appropriate marine mammal species. • Positive population trends.
	Healthy invertebrate populations.	• Diversity of appropriate invertebrate species. • Positive population trends.
Public Involvement	Educate the public about Sinclair Inlet's benefits and challenges.	• Positive media coverage. • Number of participants in interpretive walks, public presentations, etc. • Public support of ecosystem conservation and management.
	Community assistance with enhancement projects.	• Numbers of volunteers participating in enhancement projects.

5.0 Categories of Enhancement Opportunities

The enhancement opportunities in this report are arranged into six categories. The first five categories (protect, restore, reduce pollution, sustainable fish and wildlife populations, and public involvement) are based on the goals presented in Section 4.0. The sixth category (assess) includes collecting information where data gaps exist.

Category definitions

1. Protect. This category includes both protection and conservation, as defined by Borde et al. (2009):
    a. Protection actions exclude disturbance, and are recommended where physical site disturbance is low and processes are functional.
    b. Conservation actions maintain the current level of biodiversity, and are recommended where physical site disturbance is low and processes are functional.

2. Restore. This category includes restoration, enhancement, and/or creation, as defined by Borde et al. (2009):
    a. Restoration is recommended when process functions are moderately functional and disturbance is moderate, and where a site can be brought back to historical conditions.
    b. Enhancement is recommended when disturbance is moderate to high. Enhancement actions improve the site beyond current conditions, but not necessarily to historical levels.
    c. Creation is recommended under the highest levels of disturbance. Creation actions develop habitat or functions that did not formerly exist.

3. Reduce Pollution. This category includes actions to address and correct sources of freshwater and marine water pollution.

4. Sustainable Fish and Wildlife Populations. This category includes actions to assure viable populations of fish and wildlife.

5. Public Involvement and Education. This category includes public education, promotion of compatible outdoor recreational opportunities, and public participation in restoration efforts.

6. Assess. This category includes studies and assessments to create baseline data where none exists, investigate problems or challenges, make recommendations for corrective actions, and support adaptive management.

6.0 Enhancement Opportunities

Arrangement. This section lists a wide variety of opportunities to preserve and improve processes, habitats, and species. Actions are grouped by geographic location, consistent with the *Sinclair Inlet Existing Conditions Data Compilation* (URS Greiner, Inc. and SAIC 1999), then grouped by goal. Boundaries between areas are shown in Figure 4. The action list begins in the central basin and watershed-wide, and proceeds counter-clockwise around the inlet starting at the City of Bremerton. The list includes actions that have not yet been completed.

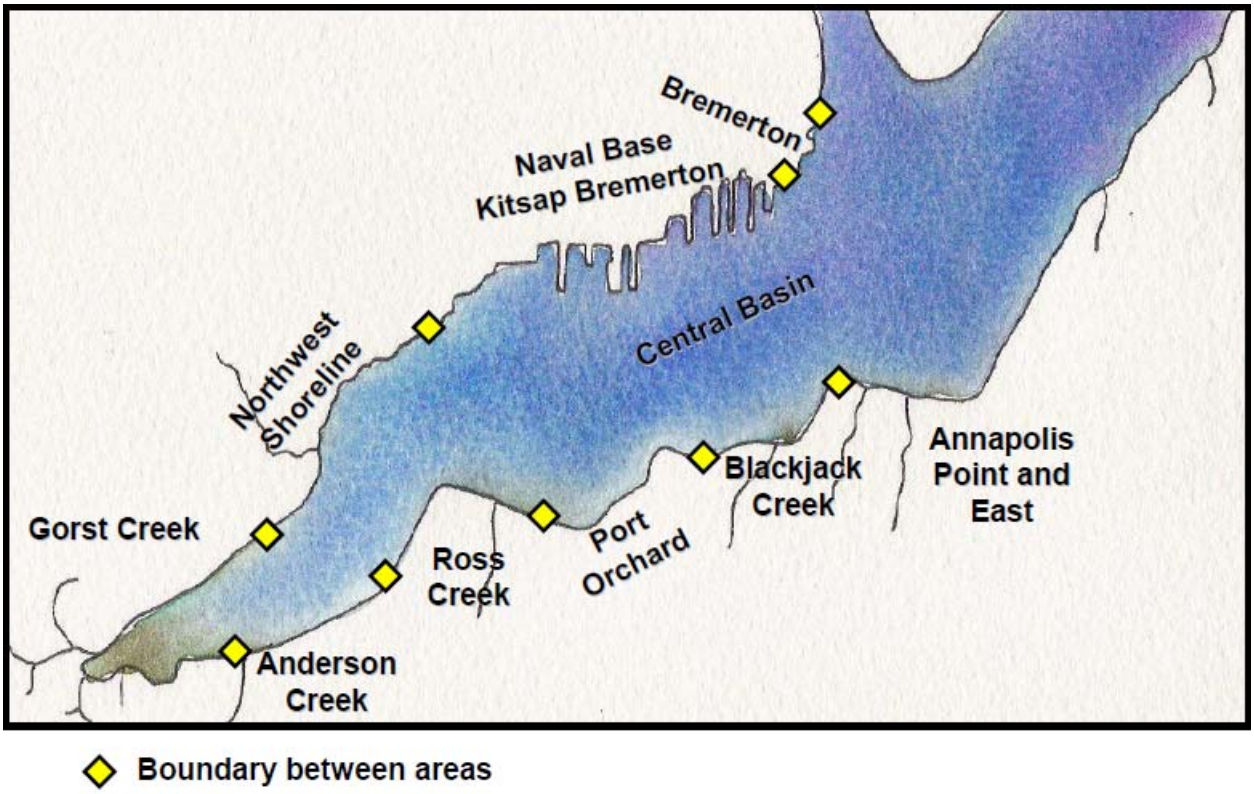


Figure 4 Locations and Boundaries

Table 2 is a summary list of all potential actions. Details about each potential action are presented in sections 6.1 through 6.10.

Priority. In Table 2, actions are prioritized as Highest, High, or Moderate. Since implementation details are unknown for many of the listed projects, specific numerical rankings were not developed at this time. The prioritization is based upon a group multi-voting session, where each stakeholder indicated projects they determined were most important. Actions added after the voting exercise are designated NR (not ranked).

On-Going Actions. Numerous on-going actions are not included in the list, but are identified here to recognize the importance of existing efforts to improve the health of Sinclair Inlet. These on-going actions are grouped by goal.

GOAL: Protect processes, structures, functions

- *Integrated Natural Resource Management Plan (INRMP), Naval Base Kitsap*. In cooperation with the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Washington Department of Fish and Wildlife, the U.S. Navy developed this plan for integrating and coordinating natural resource programs on Navy-owned lands. The INRMP establishes long-term natural resource goals and management actions to achieve these goals.

GOAL: Restore processes, structures, functions

- *Gorst Creek Watershed Plan*. The City of Bremerton received an Environmental Protection Agency (EPA) grant to fund a Comprehensive Watershed Plan for Sustainable Development and Restoration of the Gorst Creek Watershed. The project will be a joint effort between the City of Bremerton and Kitsap County, with assistance from Ecology, WDFW, the Kitsap County Health District, and other stakeholders.

GOAL: Reduce pollution

- *CERCLA Remediation Actions*. These actions are required to remediate sediments under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

    - In a June 2000 Record of Decision for Operable Unit B Marine in Sinclair Inlet, the Navy agreed to perform specific actions to reduce polychlorinated biphenyls (PCBs) in marine sediment and fish tissue. Dredging and capping actions were completed in 2004. In the 2007 Five Year Review, the Navy identified new information about mercury concentrations in rockfish and tribal seafood ingestion rates. The Navy is currently evaluating health risks due to mercury contamination.

    - In a January 1997 Record of Decision for Operable Unit A, the Navy agreed to perform specific actions to contain contamination in the Charleston Beach area. In addition, habitat restoration on Charleston Beach was planned as mitigation to a Pier D upgrade. The habitat restoration on Charleston Beach was completed in 2002, and repaired in 2008. On-going maintenance is anticipated.

- *The ENVironment inVEStment (ENVVEST) Partnership* is a collaboration between Puget Sound Naval Shipyard and Intermediate Maintenance Facility, Washington Department of Ecology, U.S. Environmental Protection Agency, and local stakeholders. The ENVVEST partnership began conducting a comprehensive water quality improvement project for the watersheds of Sinclair Inlet and Dyes Inlet in

2000. ENVVEST working groups have contributed to improving the environmental quality of the Sinclair Inlet and Dyes Inlet watersheds by providing data to support Total Maximum Daily Loads (TMDLs) of priority constituents and developing alternative methods for development and implementation of environmental regulations (U.S. Navy *et. al*. 2000).

- *Kitsap County Health District, Environmental Health Program Pollution Identification and Correction Program (PIC).* The District protects public health by identifying Kitsap County surface waters impaired by bacterial contamination and prioritizing them for clean-up, as well as conducting pollution identification and correction projects to identify and correct sources of pollution.

- *Kitsap County Conservation District* administers programs to conserve natural resources. The District is a non-regulatory, local government agency that works with private landowners (mainly within the agricultural community) to reduce soil erosion and impacts to water quality. Through voluntary cooperation with individual landowners, the Kitsap Conservation District promotes Best Management Practices (BMPs) that achieve protection for water quality and prevention of soil erosion.

- *Gorst Sewer Project*. In February 2010, the City began construction of a sewer collection system throughout Gorst. The system, scheduled to be completed in October 2010, will connect to existing homes. A total of 102 existing residential septic systems will be abandoned. Once the system is completed, the Kitsap County Health District will work with businesses to connect to the system.

- *City of Bremerton Combined Sewer Overflow (CSO) Reduction Program*. This program was established to reduce CSO events and discharges to Sinclair and Dyes Inlets. A focus on CSO planning began in 1989 in response to DOE regulations to limit CSOs into state waters. As of 2008, Bremerton has completed more than ninety-five percent of the CSO reduction projects (City of Bremerton, Department of Public Works and Utilities 2009).

GOAL: Protect/Restore sustainable fish and wildlife populations

- *Suquamish Tribe Fish Rearing Facility*. Chinook salmon from the Tribe's Grovers Creek hatchery are reared at the Gorst facility. No fish returning to Gorst Creek are used for hatchery production. Adult Chinook returning to the Gorst facility are scanned for coded wire tags but are not allowed to migrate and/or spawn upstream. In the early 2000s, the Tribe's hatchery program was reviewed by the Hatchery Scientific Review Group (HSRG), an independent scientific review panel. All recommendations of the HSRG (2003) were implemented, including evaluation of competitive interactions with wild/naturally spawning populations of salmon in Sinclair Inlet's nearshore. The Gorst facility is managed to minimize interactions between hatchery bred Chinook salmon and naturally reproducing chum, coho, steelhead, and cutthroat trout that spawn and/or rear in Gorst Creek and the marine waters of Sinclair Inlet.

GOAL: Public involvement

- *Kitsap County Stream Team* is a public involvement element of Kitsap County's Department of Community Development and Surface and Stormwater Management Program. The Stream Team conducts stream and salmon monitoring, educates the community about the environment through a variety of programs and events, and implements local watershed restoration projects.

Table 2 Summary Table, Enhancement Opportunities

Goal	Action	Summary	Priority[1]
Central Basin / Overall Watershed			
Protect	1. Preserve Bathymetric Depressions	Preserve bathymetric depressions in central inlet.	Mod
Restore	2. Removal of Existing Shoreline Highways and Relocation of Railroad	Construction of a bridge on west end of Sinclair Inlet could provide opportunity for large-scale removal of existing shoreline highways and relocation of railroad. Removal and/or relocation of existing infrastructure could allow substantial shoreline restoration of the western inlet, such as restoration of Gorst estuary and reconnection of the northern shoreline with uplands and feeder bluffs.	High
Reduce Pollution	3. Point and Non-Point Pollution Identification and Action	Identify point and non-point pollution sources and take actions to reduce/remove/remediate.	High
Assess	4. Determine Priority Areas in Sinclair Inlet Watershed	Determine priority areas through evaluation of processes, structures, and functions. Obtain feedback from stakeholder group.	Highest
	5. Update Limiting Factors Analysis	Update Limiting Factors Analysis for streams on Sinclair Inlet's south side. The current document is dated 2000.	High
	6. Monitor Water, Sediment, and Biota Quality	Continue monitoring and assessment of environmental performance metrics.	NR
	7. Olympia Oyster Reef(s)	Evaluate suitability for and feasibility of establishing Olympia oyster reef(s) in central Sinclair Inlet.	Mod
	8. Artificial Reefs	Evaluate whether artificial reefs would enhance fish populations in Sinclair Inlet central basin.	Mod
Bremerton Waterfront			
Restore	9. Shoreline Enhancement, Bremerton Marina	Enhance shoreline during marina improvements.	Mod
	10. Restore Natural Habitats, Trails and Paths	Restore natural habitats along Bremerton waterfront public access trails and paths.	Mod

Goal	Action	Summary	Priority[1]
Naval Base Kitsap (NBK) Bremerton			
Protect	11. NBK Kitsap Process Improvement, Pollution Prevention, and Disaster Planning	Continuous process improvement for pollution prevention, pollution abatement, and best management practices, including, but not limited to, industrial processes and stormwater runoff. Continue to plan for and practice emergency response and clean-up actions for oil spills and other disasters.	High
	12. Puget Sound Naval Shipyard (PSNS) Drydock Operations	Continue to implement measures to preclude entrainment of fish into PSNS drydock areas.	Mod
Restore	13. Beach Restoration Extension, Charleston Beach	Extend Charleston Beach Restoration (completed in 2002) to create more fish habitat. Add fish habitat substrate mixture to intertidal area south of the restored beach. Restore beach profile in manner that is sustainable over time.	Highest
	14. Beach Habitat Diversification and Contaminant Isolation, Charleston Beach	Add beach nourishment in a more protected environment, landward of a jetty/rock groin with a "habitat bench," salt marsh, and backshore vegetation enhancement.	High
Assess	15. Shore Building by Pier 8	Evaluate potential to daylight marine waters under building north of Pier 8. Historic maps show this area was originally a marsh.	Mod
Northwest Shoreline			
Restore	16. Estuary Enhancement, Wright Creek	Protect integrity of the only natural estuary remaining on north shore, with replacement of culverts under SR 3 and railroad with bridges to allow more intertidal mixing and daylight.	Highest
	17. Restore Beach Profile along Railroad	Remove the riprap revetment between the Navy railroad tracks and Sinclair Inlet. The revetment could be replaced with a sheet pile wall and beach profile restored.	High
	18. Shoreline Improvements, Northwest Shoreline	Seek opportunities to make parts of shoreline more gradual and natural.	Mod
	19. Beach Nourishment, Wright Creek Windy Point	Beach nourishment of a 3,500-4,000 ft long reach of shore extending from a short distance southwest of Windy Point northeastward toward the State Hwy 3/304 interchange.	Mod
Reduce Pollution	20. Low Impact Development, Wright Creek	Implement low impact development throughout the watershed, including stormwater quantity control and water quality treatment for runoff. Retrofit existing development to state-of-the-art best management practices, ensure that stormwater from future development is fully addressed at the time of construction.	High
Public Involve-ment	21. Bicycle/Pedestrian Trail, Gorst to Bremerton	Build bicycle/pedestrian trail along Sinclair Inlet to connect Gorst and Bremerton. Create public access to shoreline.	Highest

Goal	Action	Summary	Priority[1]
Assess	22. Baseline Stream Assessment, Wright Creek	Assess existing physical and biological stream channel conditions, historical changes, and processes that shape the channel over time.	Mod
	23. Shellfish Populations, Assess, Enhance	Assess current shellfish populations, determine need for and feasibility of population enhancement, establishment, and/or re-establishment.	Mod
Gorst Creek			
Protect	24. Continue Sustainable Forestry, Gorst Watershed	Promote continued sustainable forestry throughout the watershed.	Highest
	25. Purchase Development Rights / Sustainable Forestry Initiative (SFI) Certification	The City of Bremerton could sell development rights within Gorst by selling a perpetual conservation easement. SFI Certification: Bremerton could manage the Gorst watershed in a way that earns them certification under the Sustainable Forestry Initiative.	High
	26. Development Restrictions, City of Bremerton	Maintain development restrictions in City of Bremerton property in perpetuity.	Mod
	27. Special Protective Measures, Gorst Creek Mainstem	Develop and implement special protective measures to ensure healthy upstream sediment processes. Sandy substrate in Gorst mainstem is vulnerable to impacts from upstream sediment.	Mod
	28. Special Protection Measures, Parish Creek	Ensure development in Parish Creek watershed incorporates special protection measures to avoid potential of increasing the amount of slide activity or erosion of fine sediment to the watercourse; Parish Creek naturally contributes high levels of fine sedimentation to downstream areas, affecting sediment quality and fish production potential.	Mod
Restore	29. Estuary, Channel, and Riparian Restoration, Lower Gorst Creek	Restore estuarine function. Will likely require acquisition of historic floodplain/estuary from the mouth to Jarstad Park. Remove bulkheads, armoring. Reconnect estuarine component north of Gorst Creek that was cut off by construction of the rail line. Restore natural channel configuration and floodplain function in the lower 0.8 mile of Gorst Creek; seek removal or relocation of approximately six businesses and 10-12 residences that encroach into the natural floodplain. Restore functional riparian zones from the mouth of Gorst Creek to the old diversion site at River Mile (RM) 0.8.	Highest
	30. Culvert/Crossings Replacement, Old Belfair Highway, Lower Gorst Creek	• Replace culvert at Old Belfair Highway and lower Gorst Creek with a bridge. • Replace crossing at Parish Creek and Old Belfair Highway with bridge or bottomless culvert to improve fish passage.	High

Goal	Action	Summary	Priority[1]
Restore	31. Culvert Replacement, Jarstad Creek	The existing Jarstad Creek Navy Railroad culvert has been identified as a fish passage barrier. Replacement of the culvert would allow unimpeded fish access to the upper portions of Jarstad Creek.	Mod
	32. Landfill, Upper Gorst Creek	Assess condition and life expectancy of 600-foot long culvert under landfill just upstream of SR 3; develop and implement remedial measures to prevent culvert collapse and ensure fish passage. Evaluate water quality; implement any needed cleanup actions.	Highest
	33. Fish Passage Barrier, Upper Gorst Creek	Repair/replace culvert under Old Belfair Hwy just below golf course, which is a major hindrance to fish passage into the Upper Gorst watershed.	High
	34. Culvert Improvement, Heins Creek	Assess, repair/replace first culvert on Heins Creek. Existing 60" pipe has flow under and around the base of culvert.	NR
	35. Diversion Dam, Gorst Creek	Purchase and remove or reconfigure diversion dam or assure long-term maintenance of fishways.	High
	36. Estuary Enhancement, Viking Fence Pocket Estuary	Remove the existing culvert under the Navy railroad tracks and replace with a larger culvert to allow more tidal exchange. Remove fill at the west side and possibly portions of the west and south shore, plant salt marsh species, plant additional native shrubs and trees.	Highest
	37. Large Woody Debris (LWD), Gorst Creek	Develop and implement a short-term LWD strategy for Gorst Creek, from the mouth to RM 2.3 to provide LWD presence and habitat diversity until full riparian function is restored.	Mod
	38. Trash Removal, Parish Creek	Remove large accumulation of tires from wetland complex in the headwaters of Parish Creek.	Mod
	39. Navy Railroad Crossings, Gorst Watershed	• Evaluate replacement of Heins Creek and other culverts with larger culverts or bridges. • Continue to clean sediment and debris from fish ladder on routine basis.	NR
Reduce Pollution	40. Low Impact Development, Gorst Creek	Implement low impact development throughout the watershed, particularly on Parish Creek, including stormwater quantity control and water quality treatment for stormwater runoff. Retrofit existing development to state-of-the-art stormwater quality and quantity best management practices, particularly those areas located just upstream of SR 3 and the Sunny Slope development adjacent to Parish Creek.	Highest
	41. Fecal Coliform and Dissolved Oxygen, Gorst Creek	Identify and correct sources of fecal coliform contamination. Monitor dissolved oxygen levels downstream of Gold Mountain Golf Course, and on Jarstad Creek downstream of Bremerton Forest Road; correct problems as warranted.	High

Goal	Action	Summary	Priority[1]
Public Involvement	42. Jarstad Park Expansion	Jarstad Park is owned by the City of Bremerton. Lands to the west, north, and east of the park are also owned by the City of Bremerton, lands to the south are privately owned. The park could be expanded through designation of other City land as parkland, or purchase of private properties to the south.	High
	43. Public Involvement and Education, Gorst Creek	Invest in public involvement, education, and watershed monitoring.	Mod
Assess	44. Baseline Stream Assessment, Gorst Creek	Assess existing stream channel conditions, historical changes, and processes that shape the channel over time.	NR
Anderson Creek			
Protect	45. Purchase and Preserve Property, Anderson Creek	Identify and purchase property for conservation.	Highest
Restore	46. Daylight Lower Reach, Anderson Creek	Daylight stream in lower reach, install bridge under Highway 16 to restore natural channel configuration, estuarine function, and natural sediment transport through the SR 166/16 corridor.	Mod
	47. Remove Concrete, Anderson Creek	Remove concrete at RM 0.25 and restore natural channel configuration and floodplain function through the City of Bremerton water property.	Mod
Reduce Pollution	48. Low Impact Development, Anderson Creek	Implement low impact development, including stormwater quantity control and water quality treatment for stormwater runoff. Retrofit existing development in watershed to state-of-the-art stormwater quality and quantity best management practices.	Highest
Public Involvement	49. Citizen-Based Watershed Management, Anderson Creek	Fund citizen-based watershed management efforts.	Mod
Assess	50. Baseline Stream Assessment, Anderson Creek	Assess existing stream channel conditions, historical changes, and processes that shape the channel over time.	NR
Ross Creek			
Protect	51. Purchase and Preserve Property, Ross Creek	Identify and purchase property for conservation.	Highest

Goal	Action	Summary	Priority[1]
Restore	52. Culvert Replacement and Restore Estuary Functions, Ross Creek at Hwy 166	Replace culvert at the SR 166 crossing with bridge or a much larger culvert that will restore saltwater tidal influence upstream and flush accumulated sediments into Sinclair Inlet, restore estuary functions.	Highest
	53. Purchase and Remove or Relocate Restaurant, Ross Creek	Purchase restaurant, remove or relocate buildings and pavement, remove invasive species.	Highest
	54. Remove Bulkhead, Add Beach Nourishment, Ross Point	Remove bulkhead, add gravel nourishment along edges of surf smelt spawning zone and monitor for spawning expansion.	Highest
	55. Remove Old Foundations and Piles, Ross Point	Remove old homesite foundations and piles on intertidal area south of Ross Point.	High
	56. Remove Creosote Piling and Derelict Vessels, Ross Point	Remove old creosote pilings just south of barge anchorage. Remove derelict vessels and unauthorized moorage.	High
	57. Remove Barge Anchorages, Ross Point	Remove existing barge anchorages at Ross Point.	Mod
	58. Beach Nourishment, Barge Anchorage, Ross Point	Beach nourishment adjacent to barge anchorage. Maintain beach nourishment through adaptive management.	Mod
	59. Large Woody Debris (LWD), Ross Creek	Develop and implement a short-term LWD strategy to provide LWD presence and habitat diversity until full riparian function is restored.	High
	60. Riparian Buffers, Ross Creek	Eliminate or reduce encroachment from existing development and establish functional riparian buffers.	High
	61. Remove Invasive Species, Ross Creek	Remove invasive plant species in Ross Creek.	Mod
	62. Trash Removal, Ross Creek	Remove accumulated garbage and debris in Ross Creek.	Mod
Reduce Pollution	63. Low Impact Development, Ross Creek	Implement low impact development, including stormwater quantity control and water quality treatment for stormwater runoff. Retrofit existing development in watershed to state-of-the-art stormwater quality and quantity best management practices.	Highest
	64. Fecal Coliform and Dissolved Oxygen, Ross Creek	Identify and correct sources of fecal coliform contamination. Monitor dissolved oxygen levels, correct problems as warranted.	Highest
Public Involve-ment	65. Citizen-Based Watershed Management, Ross Creek	Fund citizen-based watershed management efforts.	Mod
Assess	66. Baseline Stream Assessment, Ross Creek	Assess existing stream channel conditions, historical changes, and processes that shape the channel over time.	NR

Goal	Action	Summary	Priority[1]
Port Orchard			
Restore	67. Intertidal Enhancement, Port Orchard Boat Launch	Add gravel/cobble to intertidal area around the boat launch where the slope of the bottom is ideal for surf smelt spawning.	Mod
Assess	68. Investigate Enhancement Opportunities at Port Orchard Marina and Sinclair Marina	Determine need and feasibility of enhancing existing pocket beach. Pocket beach is highly productive surf smelt spawning area.	Mod
	69. Investigate Transportation Alternatives and Improvements to Reduce Highway Use	Investigate transportation alternatives and improvements to reduce highway use. For example, water taxi service between Port Orchard and Bainbridge Island could reduce reliance on existing highways.	Mod
Blackjack Creek			
Protect	70. Acquire and Protect High Quality Habitat along Blackjack Creek	Identify and protect high quality riparian habitat on Blackjack Creek through purchase and/or easements. Continue protection and development restrictions in lower Blackjack Creek canyon. Protect high quality riparian habitat on Blackjack Creek just upstream of Sidney Road. Protect/preserve/acquire as much of Square Creek upstream of Sidney Road as possible. Protect as much of Ruby Creek upstream of Sidney Road as possible.	High
Restore	71. Estuary Improvement, Blackjack Creek	Rebuild the Blackjack Creek outlet and sub-estuary. Remove or relocate commercial development within the former Blackjack Creek estuary. Remove channel and rip rap, add more riparian vegetation. Protect and restore estuarine habitat (particularly upstream of Bay Street), including restoration of riparian function and reduction of commercial encroachment, where feasible.	High
	72. Channel and Riparian Improvements, Blackjack Creek	Restore natural channel configuration and floodplain function on Blackjack Creek through the channelized agricultural area upstream of Sedgwick Road, and through the agricultural area of Ruby Creek downstream of Glenwood Road. Restore functional riparian zones throughout the watershed, with particular emphasis on Blackjack Creek upstream of Sedgwick Road, Unnamed 15.0206, and Square Creek.	Highest
	73. Agricultural Improvements, Blackjack Creek	Reduce habitat impacts on agricultural lands upstream of SR 16, including development and implementation of farm plans that restore stream functions. Identify and correct areas in the watershed that have unrestricted livestock access.	Highest

Goal	Action	Summary	Priority[1]
Restore	74. Upstream Fish Passage and Habitat Improvement, Blackjack Creek	Improve fish passage and upstream habitat at two culverts in the Ruby Creek drainage and at the Sidney Road crossing of Square Creek.	High
	75. Pocket Beach Improvement, Blackjack Creek	Improve pocket beach for baitfish spawning at north edge of mall parking lot next to informal parking lot. Remove informal parking lot and replace with riparian vegetation. Meet with motel owners and operators to gain cooperation with shoreline vegetation restoration program in pocket beaches and specific locations.	High
	76. Remove Asphalt, Blackjack Creek Shoreline	Remove concrete and asphalt along road end near hotel and revegetate with native trees and shrubs.	High
	77. Large Woody Debris (LWD), Blackjack Creek	Develop and implement a short-term LWD strategy for lower two miles of Blackjack Creek and Square Creek, to provide LWD presence and habitat diversity until full riparian function is restored.	High
	78. Trash Removal, Blackjack Creek	Remove accumulated garbage and debris in Blackjack Creek.	Mod
Reduce Pollution	79. Low Impact Development, Blackjack Creek	Implement low impact development, including stormwater quantity control and water quality treatment for stormwater runoff; remediate existing stormwater impacts to the channel.	Highest
	80. Fecal Coliform and Dissolved Oxygen, Blackjack Creek	Identify and correct sources of fecal coliform contamination. Monitor dissolved oxygen levels downstream of Sedgwick Road and on Ruby Creek downstream of Sidney Avenue, correct problems.	Highest
Public Involvement	81. Viewing Platform, Blackjack Creek	Construct a viewing platform at the estuary to promote public awareness and education. Locate platform to avoid estuary impacts.	High
	82. Public Involvement, Blackjack Creek	Fund citizen-based watershed monitoring groups and landowner education programs. Fund public access and interpretive program.	Mod
Assess	83. Baseline Physical Stream Assessment, Blackjack Creek	Assess existing stream channel conditions, historical changes, and processes that shape the channel over time.	NR
	84. Biological Stream Assessment, Blackjack Creek	Perform continued stream assessments on Blackjack Creek to closely monitor its health and viability as a salmon stream.	High
Annapolis Point and East			
Restore	85. Culvert Replacement and Floodway Restoration, Annapolis Creek	Replace undersized restrictive culvert, Annapolis Creek at Beach Drive and restore floodway.	High
	86. Culvert Replacement, Karcher (Olney, Retsil) Creek at Beach Drive	Replace culvert, Karcher (Olney, Retsil) Creek at Beach Drive.	High

Goal	Action	Summary	Priority[1]
Restore	87. Estuary Restoration, Sacco (Sullivan) Creek	Relocate roads away from estuary edge and allow marsh re-establishment.	Highest
	88. Riparian Improvements, Annapolis Creek	Restore functional riparian zones throughout the watershed, particularly through the high school property and along Arnold Avenue. Remove small-hydro dam at the high school, and restore natural channel configuration and functional habitat conditions. Assess, prioritize, and correct fish passage barriers upstream of the high school, as warranted.	Mod
	89. Remove Invasive Vegetation, Karcher (Olney, Retsil) Creek	Remove invasive vegetation.	Mod
	90. Large Woody Debris (LWD), East Port Orchard	Develop and implement a short-term LWD strategy to provide LWD presence and habitat diversity until full riparian function is restored.	Mod
	91. Remove Riprap and Restore Natural Shoreline	Remove riprap at the site of the former Annapolis boat ramp and restore natural shoreline.	Mod
	92. Beach Nourishment, East Port Orchard	Beach nourishment at appropriate locations.	Mod
Reduce Pollution	93. Low Impact Development, Annapolis Creek	Implement low impact development throughout the watershed, including stormwater quantity control and water quality treatment for stormwater runoff. Retrofit existing development to state-of-the-art stormwater quality and quantity best management practices.	High
	94. Fecal Coliform and Dissolved Oxygen, Annapolis Creek	Identify and correct sources of fecal coliform contamination. Monitor dissolved oxygen levels, correct as warranted.	High
Assess	95. Baseline Stream Assessment, Annapolis/Karcher (Olney, Retsil)/Sacco (Sullivan) Creeks	Assess existing stream channel conditions, historical changes, and processes that shape the channel over time.	NR

[1] Actions are prioritized as Highest, High, or Mod (Moderate). Actions designated NR (not ranked) were added after the voting exercise and were not ranked by the stakeholders.

6.1 Details - Enhancement Opportunities, Sinclair Inlet Central Basin and Overall Watershed

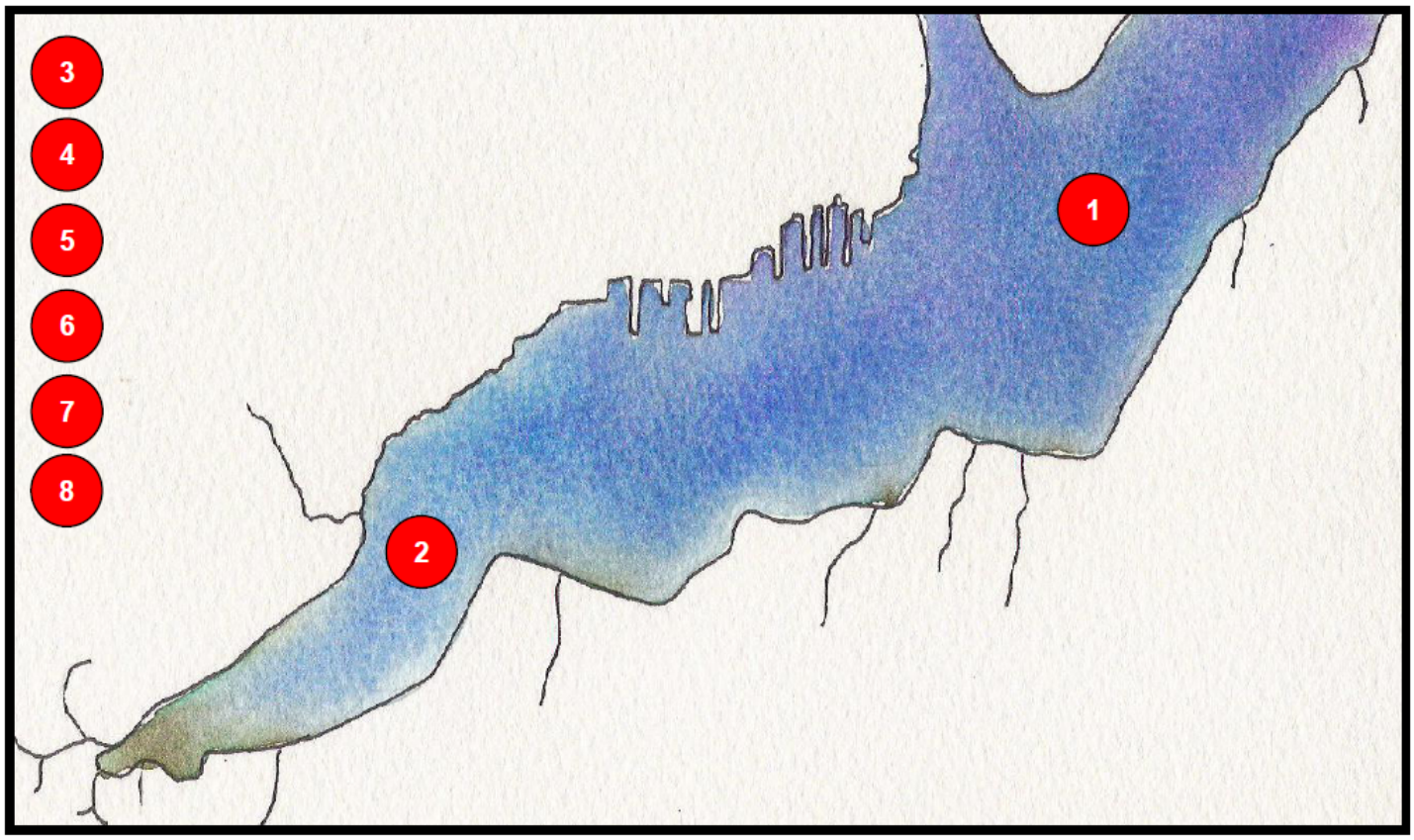


Figure 5 Central Basin and Watershed Actions

Values

- Shallow and deep water habitats
- Anadromous fish runs

Challenges

- Multiple point and non-point pollution sources
- “Sediment starved” Impaired sediment transport processes

GOAL: Protect processes, structures, functions

1.	**Preserve Bathymetric Depressions**	Preserve bathymetric depressions in central inlet.
	Ecological Benefits:	N/A
	Process Improvements:	Preserve, protect and perpetuate fish, shellfish, and other marine species.
	Public Benefits:	Provide sustainable recreational opportunities.
	Issues:	Potential impacts on fishing.
	Cost:	Unknown
	Likelihood of Success?	N/A
	Maintenance Needed?	N/A
	References:	URS Greiner, Inc. and SAIC 1999.

GOAL: Restore processes, structures, functions

2.	**Removal of Existing Shoreline Highways and Relocation of Railroad**	Construction of a bridge on west end of Sinclair Inlet could provide opportunity for large-scale removal of existing shoreline highways and relocation of railroad. Removal and/or relocation of existing infrastructure could allow substantial shoreline restoration of the western inlet, such as restoration of Gorst estuary and reconnection of the northern shoreline with uplands and feeder bluffs.
	Ecological Benefits:	Reduced highway impacts on shoreline, increased restoration opportunities for the Gorst Estuary, reconnect northern shoreline with the uplands and feeder bluffs.
	Process Improvements:	Hydrology, sediment transport.
	Public Benefits:	Transportation options.
	Issues:	The current plan for 8 lanes between Bremerton and Gorst would also require major mitigation and eliminate any chance of restoring the estuary or northern shoreline of the Inlet.
	Cost:	Unknown
	Likelihood of Success?	Unknown
	Maintenance Needed?	Yes
	References:	Stakeholder Meeting 13 Jan 10.

GOAL: Reduce Pollution

3.	**Point and Non-Point Pollution Identification and Action**	Identify point and non-point pollution sources and take actions to reduce/remove/remediate.
	Ecological Benefits:	Improved water quality.
	Process Improvements:	Water quality.
	Public Benefits:	Improved water quality.
	Issues:	Evaluate methods to prohibit use of copper-treated piling within Sinclair Inlet.
	Cost:	To be determined.
	Likelihood of Success?	Moderate to high, with appropriate actions, monitoring, and maintenance.
	Maintenance Needed?	Will depend on actions taken.
	References:	URS Greiner, Inc. and SAIC 1999.

GOAL: Assess

4.	**Determine Priority Areas in Sinclair Inlet Watershed**	Determine priority areas through evaluation of processes, structures, and functions. Obtain feedback from stakeholder group.
	Ecological Benefits:	N/A
	Process Improvements:	N/A
	Public Benefits:	Public education and awareness of valuable resource areas.
	Issues:	Kitsap County is developing a list of priority conservation areas. Scoring of priority conservation areas to be based on habitat quality and marine/water quality from a conservation perspective.
	Cost:	Unknown
	Likelihood of Success?	N/A
	Maintenance Needed?	N/A
	References:	Stakeholder Meeting 13 Jan 10.

Figure 6 Sinclair Inlet

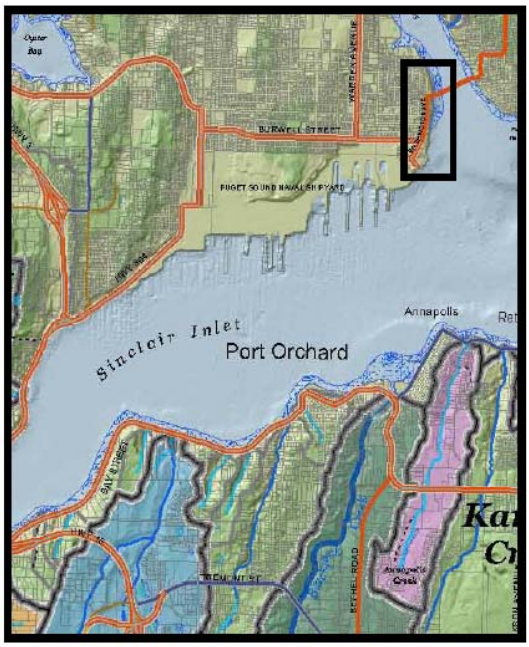
5.	**Update Limiting Factors Analysis**	Update Limiting Factors Analysis for streams on Sinclair Inlet's south side. The current document is dated 2000.
	Ecological Benefits:	N/A
	Process Improvements:	N/A
	Public Benefits:	Public education and awareness of values and challenges.
	Issues:	None identified.
	Cost:	Unknown
	Likelihood of Success?	N/A
	Maintenance Needed?	N/A
	References:	Stakeholder Meeting 13 Jan 10.

GOAL: Assess (continued)

6.	**Monitor Water, Sediment, and Biota Quality**	Continue monitoring and assessment of environmental performance metrics.
	Ecological Benefits:	Maintain and improve water quality and marine habitat quality.
	Process Improvements:	Water and environmental quality.
	Public Benefits:	Increase safety of seafood harvested from inlet.
	Issues:	Multiple sources of impact and jurisdictions.
	Cost:	$300-700K/yr
	Likelihood of Success?	High
	Maintenance Needed?	N/A
	References	Johnston et al. 2009
7.	**Olympia Oyster Reef(s)**	Evaluate suitability for and feasibility of establishing Olympia oyster reef(s) in central Sinclair Inlet.
	Ecological Benefits:	Enhanced shellfish populations, water quality improvement.
	Process Improvements:	Sediment transport/deposition.
	Public Benefits:	Increased shellfish populations.
	Issues:	May not be suitable for all areas within central basin.
	Cost:	Unknown
	Likelihood of Success?	High, if established in suitable area.
	Maintenance Needed?	Likely
	References	Stakeholder Meeting 13 Jan 10.
8.	**Artificial Reefs**	Evaluate whether artificial reefs would enhance fish populations in Sinclair Inlet central basin.
	Ecological Benefits:	To be determined.
	Process Improvements:	N/A
	Public Benefits:	Artificial reefs could provide recreational diving opportunities, increase tourism.
	Issues:	• Artificial reefs would interfere with tribal fishing. • Artificial reefs have had mixed success elsewhere in Puget Sound. • To be determined whether the action would be desirable and/or feasible.
	Cost:	Unknown
	Likelihood of Success?	Unknown, artificial reefs have had mixed success elsewhere in Puget Sound.
	Maintenance Needed?	Unknown
	References:	URS Greiner, Inc. and SAIC 1999. Stakeholder Meeting 13 Jan 10.

Figure 7 Shells, Southern Inlet Shore

6.2 Details - Enhancement Opportunities, Bremerton Waterfront



Values

- Public shoreline access
- Scenic views
- Marine bird and mammal observation points

Challenges

- Shorelines armored and steeply sloped
- Urban setting

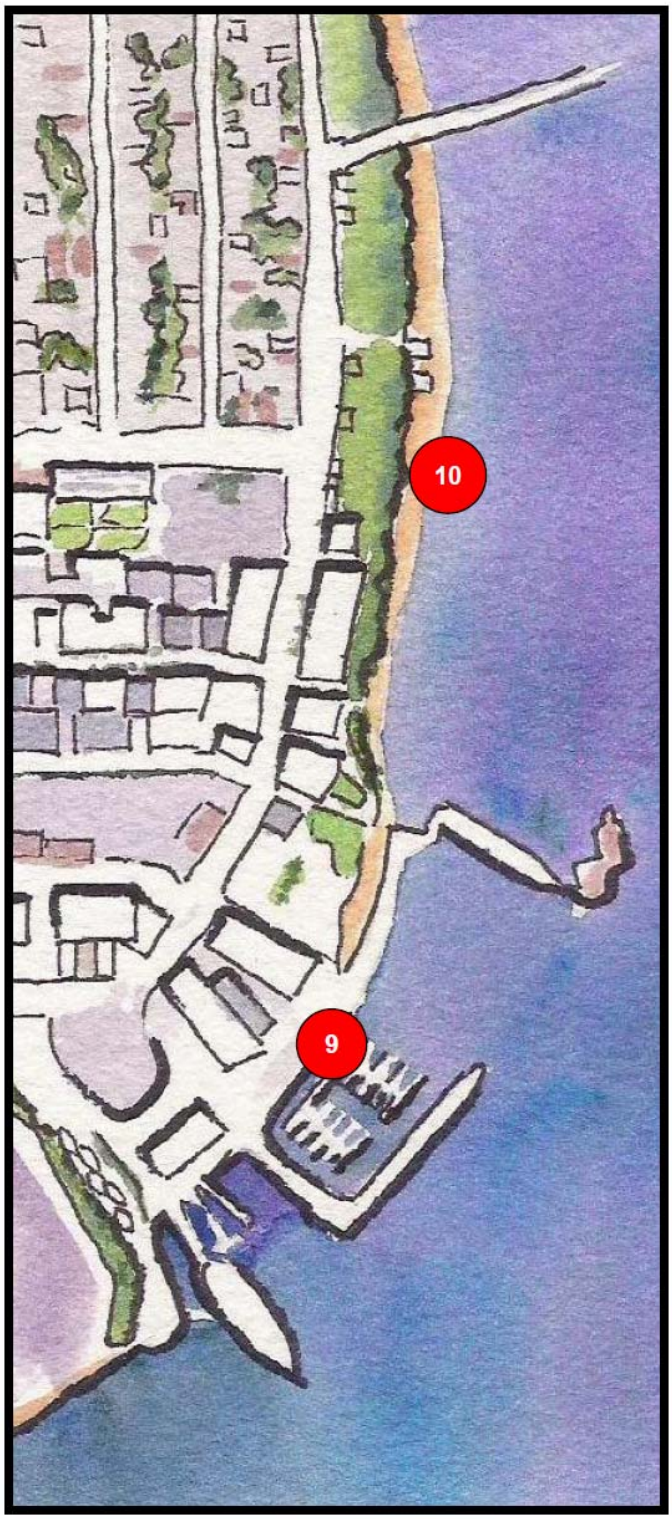


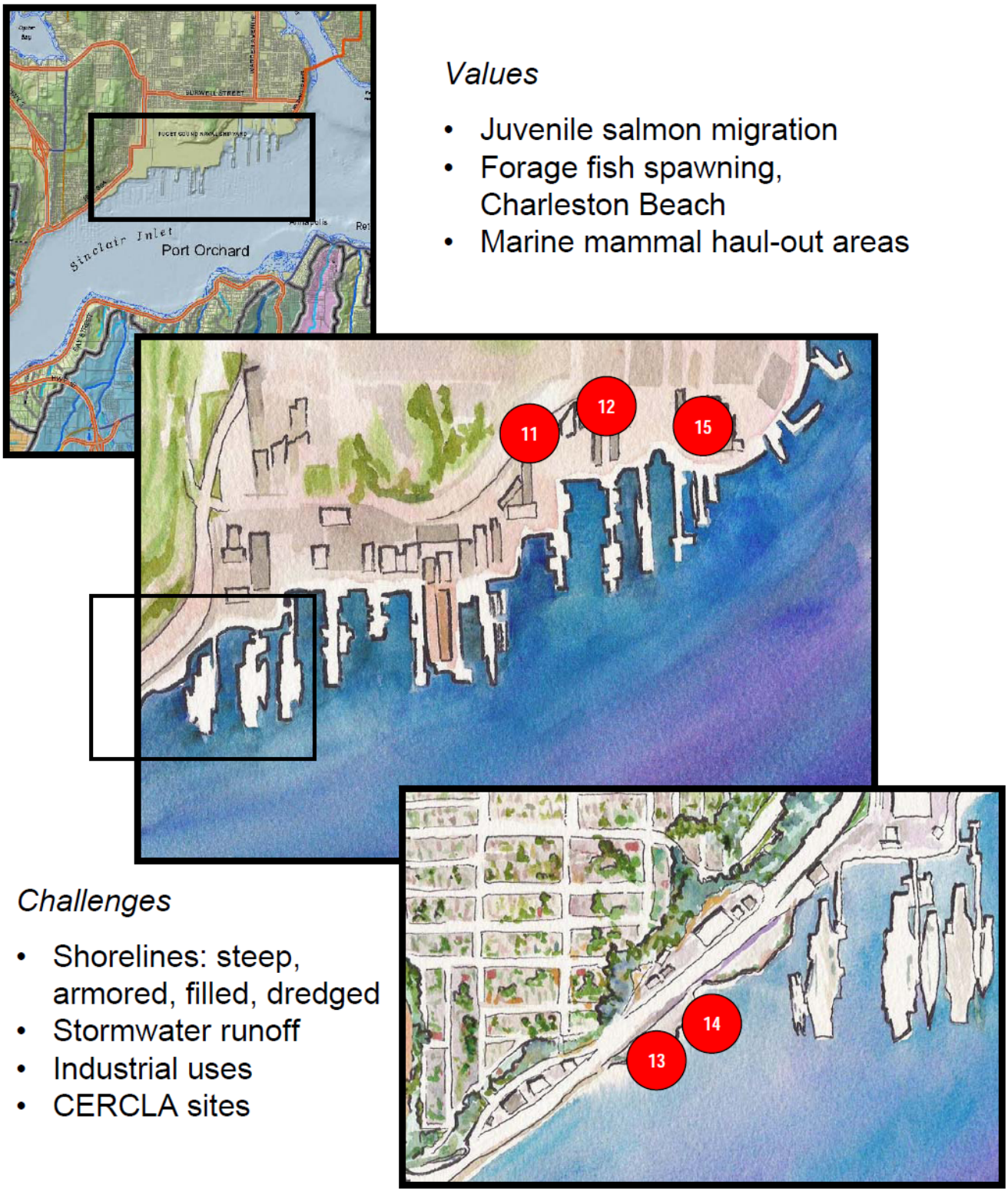
Figure 8 Bremerton Waterfront Actions

GOAL: Restore processes, structures, functions

9.	**Shoreline Enhancement, Bremerton Marina**	Enhance shoreline during marina improvements.
	Ecological Benefits:	Improved natural shoreline habitat.
	Process Improvements:	Augment sediment transport with removal of armoring and addition of appropriate substrate and vegetation.
	Public Benefits:	Aesthetic improvement, increased wildlife observation opportunities.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	Moderate to high, with long-term maintenance.
	Maintenance Needed?	Yes, if other shoreline sections in this area remain armored.
	References:	URS Greiner, Inc. and SAIC 1999.
10.	**Restore Natural Habitats, Trails and Paths**	Restore natural habitats along Bremerton waterfront public access trails and paths.
	Ecological Benefits:	Improved natural shoreline habitat.
	Process Improvements:	Augment sediment transport with removal of armoring and addition of appropriate substrate and vegetation.
	Public Benefits:	Aesthetic improvement, increased wildlife observation opportunities.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	Moderate to high, with periodic maintenance.
	Maintenance Needed?	Likely, if other shoreline sections in this area remain armored.
	References:	URS Greiner, Inc. and SAIC 1999.

Figure 9 Harborside Fountain Park, Bremerton

6.3 Details - Enhancement Opportunities, Naval Base Kitsap Bremerton



Values

- Juvenile salmon migration
- Forage fish spawning, Charleston Beach
- Marine mammal haul-out areas

Challenges

- Shorelines: steep, armored, filled, dredged
- Stormwater runoff
- Industrial uses
- CERCLA sites

Figure 10 Naval Base Kitsap Bremerton Actions

GOAL: Protect processes, structures, functions

11.	**NBK Kitsap Process Improvement, Pollution Prevention, and Disaster Planning**	Continuous process improvement for pollution prevention, pollution abatement, and best management practices, including, but not limited to, industrial processes and stormwater runoff. Continue to plan for and practice emergency response and clean-up actions for oil spills and other disasters.
	Ecological Benefits:	Maintain and improve water quality and marine habitat quality.
	Process Improvements:	Water and environmental quality.
	Public Benefits:	Increased safety of seafood harvested from inlet.
	Issues:	Process improvement without impacting mission and cost.
	Cost:	TBD
	Likelihood of Success?	High, with long-term implementation.
	Maintenance Needed?	Ongoing maintenance and implementation anticipated.
	References:	Stakeholder Meeting 13 Jan 10.
12.	**Puget Sound Naval Shipyard (PSNS) Drydock Operations**	Continue to implement measures to preclude entrainment of fish into PSNS drydock areas.
	Ecological Benefits:	Prevent fish mortality.
	Process Improvements:	Facilitate fish movement.
	Public Benefits:	Prevent fish mortality.
	Issues:	None identified.
	Cost:	N/A, part of existing Navy operations.
	Likelihood of Success?	High, with long-term implementation.
	Maintenance Needed?	On-going monitoring and maintenance needed.
	References:	Haring 2000.

Figure 11 Aerial View of Naval Base Kitsap Bremerton, 2009

GOAL: Restore processes, structures, functions

13. Beach Restoration Extension, Charleston Beach	Extend Charleston Beach Restoration (completed in 2002) to create more fish habitat. Add fish habitat substrate mixture to intertidal area south of the restored beach. Restore beach profile in manner that is sustainable over time.
Ecological Benefits:	• Feeding and refuge habitat for migrating salmon in a heavily developed area. • Improved forage fish spawning areas.
Process Improvements:	Augment sediment transport with addition of appropriate substrate.
Public Benefits:	Improved public views from the water or highway.
Issues:	• Existing CERCLA site (upland hazardous waste landfill clean up). • Potential permit issues due to contamination and hazardous waste issues. • Navy owned and controlled area. • Fish mix could be further expanded to the south, but only a few hundred feet to the property boundary. It is unknown if other locations to the north will be proposed for removal in the future. • The Navy is currently studying a number of alternatives to address contamination and habitat at the Charleston Beach site as part of the OU A CERCLA remedy. A wave and current study was completed, as well as a characterization of contaminants and extent of fill. These studies should provide a better picture of feasibility and cost for a range of alternatives when all analyses are complete.
Cost:	$4.4 million for 0.5 acres or $8.8 million per acre (Navy 2008).
Likelihood of Success?	Moderate, would require long-term monitoring and maintenance.
Maintenance Needed?	Would require periodic maintenance and substrate replacement.
References	Navy 2008.

Figure 12 Charleston Beach, Naval Base Kitsap Bremerton

GOAL: Restore processes, structures, functions (continued)

14. Beach Habitat Diversification and Contaminant Isolation, Charleston Beach	Add beach nourishment in a more protected environment, landward of a jetty/rock groin with a "habitat bench," salt marsh, and backshore vegetation enhancement.
Ecological Benefits:	Increased beach width. More saltmarsh. Expanded forage fish spawning area to west. New juvenile salmonid pocket estuary.
Process Improvements:	Capture very minor amount of material drift from southwest-west.
Public Benefits:	Improvement of regional ecology and fisheries support. No public access.
Issues:	• See Johannessen 2009 for conceptual site plan. • Navy coordination/cooperation required. • Could have permitting issues, as action involves substantial in-water fill and a rock jetty. • Increasing beach depth may be prohibitive except where longshore material drift is already naturally filling portion of the beach. • Current studies show high level of longshore material transport.
Cost:	Fairly high cost per lineal foot of shore.
Likelihood of Success?	Moderate in short term, would require long-term maintenance.
Maintenance Needed?	Current efforts are underway to develop solutions requiring maintenance for no less than 10-20 year replenishment cycles.
References:	Johannessen 2009.

GOAL: Assess

15. Shore Building by Pier 8	Evaluate potential to daylight marine waters under building north of Pier 8. Historic maps show this area was originally a marsh.
Ecological Benefits:	Enhanced natural lighting in marine waters to support marine flora and fauna.
Process Improvements:	Restore natural processes requiring natural daylight.
Public Benefits:	The area is not open or visible to the public.
Issues:	Building is currently in use, the Navy has no plans to remove or replace the building.
Cost:	Unknown
Likelihood of Success?	Unknown
Maintenance Needed?	N/A
References:	Stakeholder Meeting 13 Jan 10.

6.4 Details - Enhancement Opportunities, Northwest Shoreline

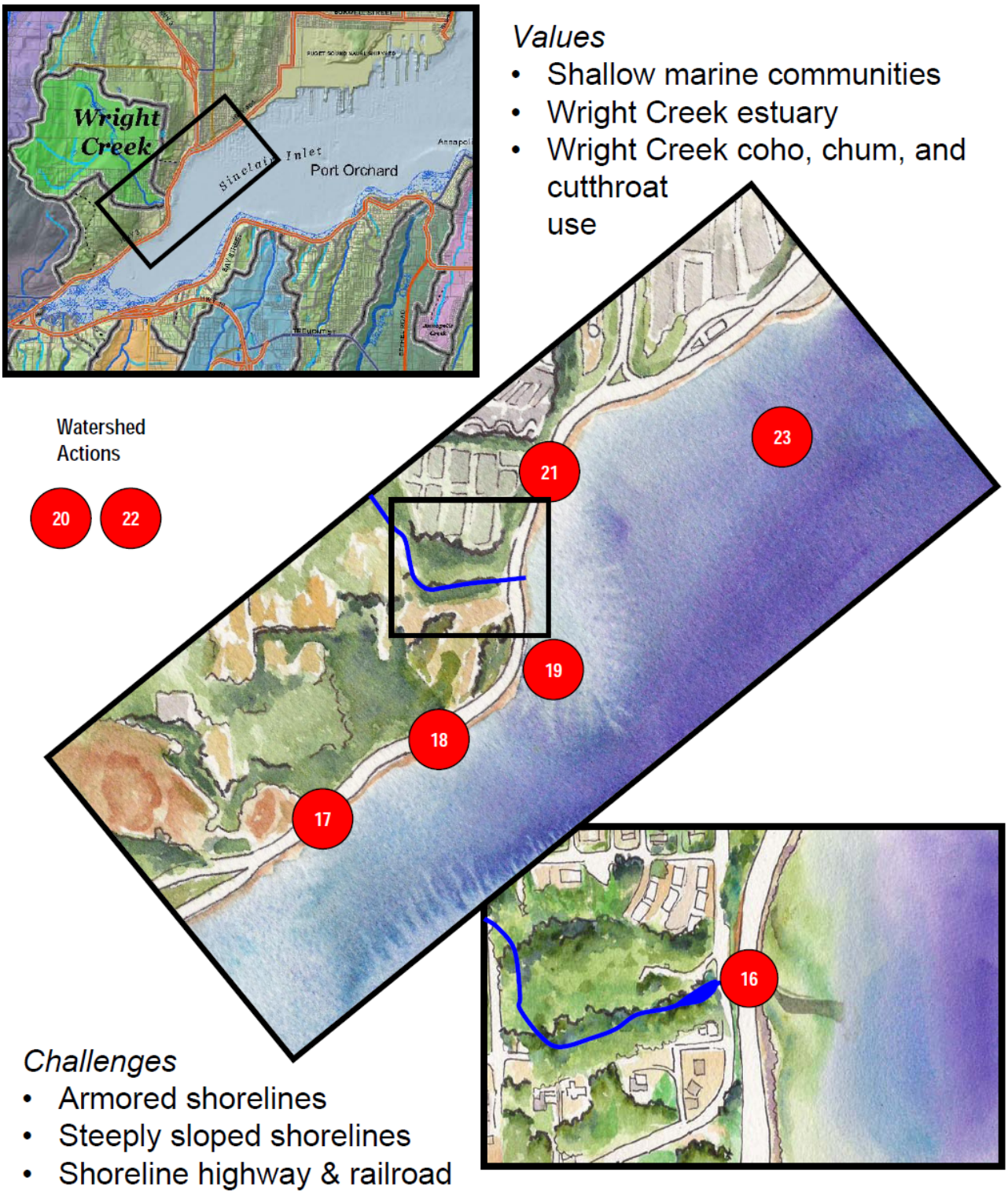


Figure 13 Northwest Shoreline Actions

GOAL: Restore processes, structures, functions

16. Estuary Enhancement, Wright Creek	Protect integrity of the only natural estuary remaining on the north shore, with replacement of culverts under SR 3 and railroad with bridges to allow more intertidal mixing and daylight.
Ecological Benefits:	Improved fish access and sediment transport.
Process Improvements:	Sediment transport and hydrology.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	• Should conduct Baseline Stream Assessment prior to implementing action. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design, installation, and maintenance.
Maintenance Needed?	Yes
References:	Haring 2000. Bates et al. 2003.

Figure 14 Wright Creek Estuary

17. Restore Beach Profile along Railroad	Remove the riprap revetment between the Navy railroad tracks and Sinclair Inlet. The revetment could be replaced with a sheet pile wall and beach profile restored.
Ecological Benefits:	Feeding and refuge habitat for migrating salmon.
Process Improvements:	Wave erosion/deposition improvements.
Public Benefits:	The area is within the Navy railway right of way and is not open to the public. The public could view the site from the highway or by water. Aesthetics will be improved over existing conditions, providing better views of more natural looking shoreline.
Issues:	• Contamination along the shoreline not anticipated. • Navy-owned and controlled area along the railroad right of way. • Proposed vertical sheet pile wall may have more impacts than the existing rip rap revetment in the form of beach scour from wave refraction. • Could be combined with Shoreline Improvements, Northwest Shoreline.
Cost:	$5 million for 0.8 acres or $6.3 million per acre (Navy 2008).
Likelihood of Success?	Unknown.
Maintenance Needed?	Yes, due to overall impaired sediment transport processes in Sinclair Inlet.
References:	Navy 2008.

GOAL: Restore processes, structures, functions (continued)

18. Shoreline Improvements, Northwest Shoreline

Seek opportunities to make parts of shoreline more gradual and natural.

Ecological Benefits:	More productive shoreline habitat. Better survival of migrating juvenile salmon.
Process Improvements:	Enhance sediment transport processes.
Public Benefits:	Aesthetic improvement with more natural shoreline.
Issues:	• Could be combined with Restore Beach Profile along Railroad. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	Unknown.
Maintenance Needed?	Yes, due to overall impaired sediment transport processes in Sinclair Inlet.
References:	Haring 2000. URS Greiner, Inc. and SAIC 1999.

19. Beach Nourishment, Wright Creek Windy Point

Beach nourishment of a 3,500-4,000 ft long reach of shore extending from a short distance southwest of Windy Point northeastward toward the State Hwy 3/304 interchange.

Ecological Benefits:	Greater diversity of habitats within inner Sinclair Inlet. Expanded surf smelt spawning beach, enhanced nearshore migratory corridor for juvenile salmon and other fish and wildlife.
Process Improvements:	Augment sediment transport with addition of appropriate substrate.
Public Benefits:	Project could provide recreational beach use opportunities where none exist.
Issues:	• See Johannessen 2009 for conceptual site plan. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Very rough estimate: $750,000 to $1,500,000
Likelihood of Success?	Low to moderate, with long-term maintenance.
Maintenance Needed?	Periodic maintenance likely required on the decadal scale to maintain some portions of this beach.
References:	Johannessen 2009.

GOAL: Reduce Pollution

20. Low Impact Development, Wright Creek

Implement low impact development throughout the watershed, including stormwater quantity control and water quality treatment for stormwater runoff. Retrofit existing development to state-of-the-art stormwater quality and quantity best management practices, ensure that stormwater from future development is fully addressed at the time of construction.

Ecological Benefits:	Improved water quality.
Process Improvements:	Increased stormwater retention and infiltration.
Public Benefits:	Action would contribute to water quality improvement.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and implementation.
Maintenance Needed?	Routine maintenance would be required.
References:	Haring 2000.

GOAL: Public Involvement

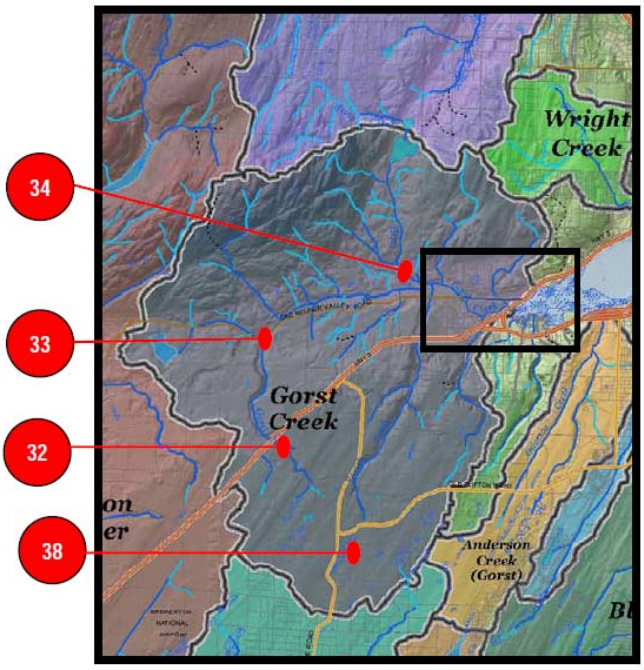
21. Bicycle/Pedestrian Trail, Gorst to Bremerton	Build bicycle/pedestrian trail along Sinclair Inlet to connect Gorst and Bremerton. Create public access to shoreline.
Ecological Benefits:	N/A
Process Improvements:	N/A
Public Benefits:	Public access to shoreline. Increased bicycle use could reduce automobile traffic. Bird/fish/marine mammal viewing.
Issues:	Would require agreement with land owners: U.S. Navy and the Washington State Department of Transportation.
Cost:	Unknown
Likelihood of Success?	High
Maintenance Needed?	Anticipated maintenance required.
References:	Sinclair Inlet Design Charrette, 24-25 Apr 09.

GOAL: Assess

22. Baseline Stream Assessment, Wright Creek	Assess existing physical and biological stream channel conditions, historical changes, and processes that shape the channel over time. Assessment should include: • Processes that influenced past and current channel morphology and habitats. • Current channel conditions including morphology and stability. • Probable future channel morphology. • Potential constraints to recovery and restoration. • Biological value of Wright Creek watershed. • Evaluate causes of elevated stream temperature.
Ecological Benefits:	Understand driving forces of channel morphology to increase likelihood of success for habitat restoration, streambank protection, and other instream construction projects.
Process Improvements:	Understand causes of change prior to designing/implementing projects to mimic or alter natural channel processes.
Public Benefits:	Increase public education / awareness of stream processes and challenges.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Access would require land ownership, easement or agreement with owner.
Cost:	Unknown
Likelihood of Success?	N/A
Maintenance Needed?	N/A
References:	Haring 2000. URS Greiner, Inc. and SAIC 1999. Saldi-Caromile et al. 2004.
23. Shellfish Populations, Assess, Enhance	Assess current shellfish populations, determine need for and feasibility of population enhancement, establishment, and/or re-establishment.
Ecological Benefits:	Enhanced shellfish populations, water quality improvement.
Process Improvements:	Sediment transport/deposition.
Public Benefits:	Increased shellfish populations.
Issues:	
Cost:	Unknown
Likelihood of Success?	Moderate to high.
Maintenance Needed?	Anticipated maintenance required.
References:	Stakeholder Meeting 13 Jan 10.

6.5 Details - Enhancement Opportunities, Gorst Creek

Tributaries: Jarstad Creek, Heins Creek, Parish Creek



Values

- Forested upper watershed
- Chinook, chum, coho, steelhead and cutthroat use

Challenges

- Concrete-lined channel sections
- Fish passage barriers
- Commercial and residential development

Watershed Actions

24 37
25 40
26 41
27 43
28 44

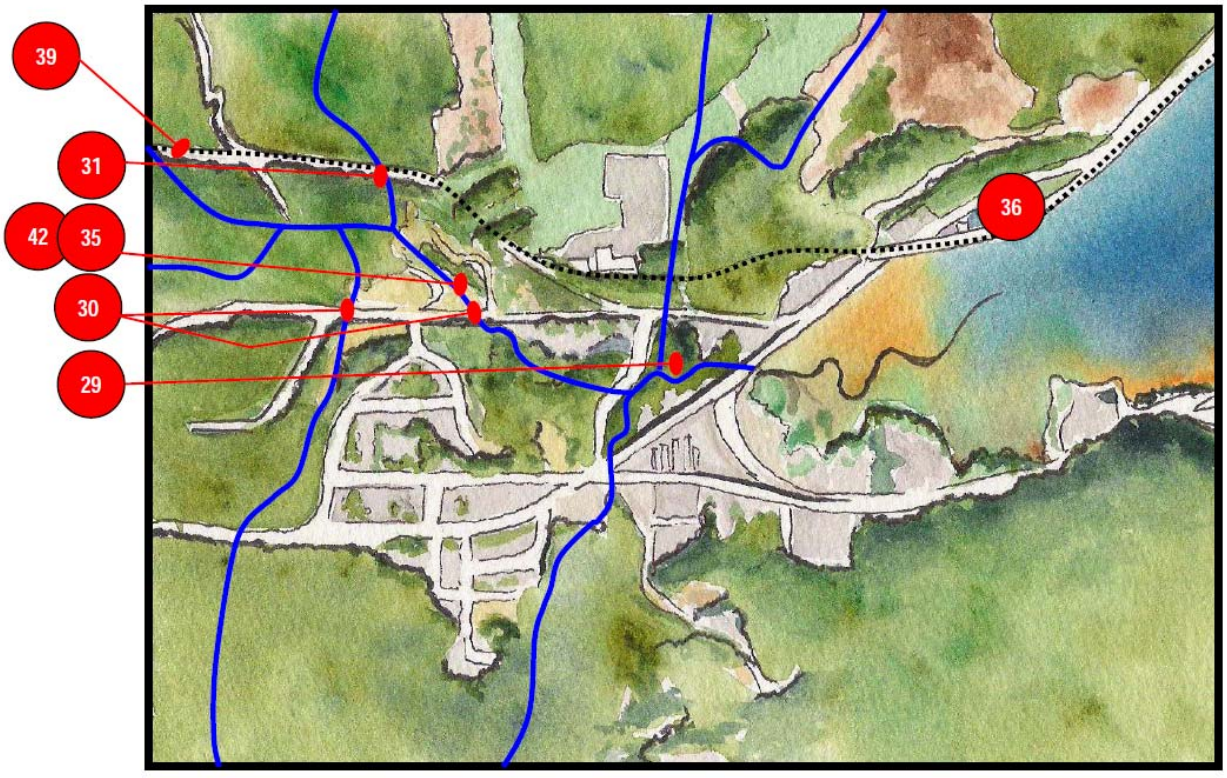


Figure 15 Gorst Creek Actions

GOAL: Protect processes, structures, functions

24.	**Continue Sustainable Forestry, Gorst Watershed**	Promote continued sustainable forestry throughout the watershed.
	Ecological Benefits:	Preserve existing habitat and water quality.
	Process Improvements:	N/A
	Public Benefits:	Conservation of forestry values, insurance against further development.
	Issues:	Could be combined with Purchase Development Rights/Sustainable Forestry Initiative (SFI) Certification.
	Cost:	Unknown
	Likelihood of Success?	High
	Maintenance Needed?	Yes
	References:	Haring 2000.

25.	**Purchase Development Rights/Sustainable Forestry Initiative (SFI) Certification**	The City of Bremerton could sell development rights within Gorst by selling a perpetual conservation easement. SFI Certification: Bremerton could manage the Gorst watershed in a way that earns them certification under the Sustainable Forestry Initiative.
	Ecological Benefits:	Prevent future disturbance and changes.
	Process Improvements:	N/A
	Public Benefits:	Conservation of forestry values, insurance against further development.
	Issues:	• Could be combined with Continue Sustainable Forestry, Gorst Watershed. • DNR has recently done this for much of their holdings.
	Cost:	Unknown
	Likelihood of Success?	High
	Maintenance Needed?	Unknown
	References:	Stakeholder Meeting 13 Jan 10.

Figure 16 Sign at Lower Gorst Creek

GOAL: Protect processes, structures, functions (continued)

26. Development Restrictions, City of Bremerton	Maintain development restrictions in City of Bremerton property in perpetuity.
Ecological Benefits:	Preserve existing undisturbed land within City limits.
Process Improvements:	N/A
Public Benefits:	Perpetual preservation, insurance against further development.
Issues:	• The City of Bremerton received an EPA grant to fund a Comprehensive Watershed Plan for Sustainable Development and Restoration of the Gorst Creek Watershed. As part of this study, the City will develop Land Use Plan and Development Regulations to provide the tools necessary to ensure that future development protects and maintains the ecological function of the 97 percent of watershed that is currently undeveloped. The City will also develop a Planned Action EIS to analyze impacts of planned development of the Gorst Watershed in compliance with adoption of Land Use and Development Regulations. • Could be combined with Special Protective Measures, Gorst Creek Mainstem and Special Protection Measures, Parish Creek.
Cost:	Unknown
Likelihood of Success?	High
Maintenance Needed?	N/A
References:	URS Greiner, Inc. and SAIC 1999.
27. Special Protective Measures, Gorst Creek Mainstem	Develop and implement special protective measures to ensure healthy upstream sediment processes. Sandy substrate in Gorst mainstem is vulnerable to impacts from upstream sediment.
Ecological Benefits:	Improved stream spawning habitat.
Process Improvements:	Sediment transport.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	Could be combined with Development Restrictions, City of Bremerton and Special Protection Measures, Parish Creek.
Cost:	Unknown
Likelihood of Success?	Unknown
Maintenance Needed?	N/A
References:	Stakeholder Meeting 13 Jan 10.
28. Special Protection Measures, Parish Creek	Ensure development in Parish Creek watershed incorporates special protection measures to avoid potential of increasing the amount of slide activity or erosion of fine sediment to the watercourse; Parish Creek naturally contributes high levels of fine sedimentation to downstream areas, affecting sediment quality and fish production potential.
Ecological Benefits:	Sediment transport
Process Improvements:	Action would contribute to water quality and healthy and sustainable salmonid populations.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	Could be combined with Development Restrictions, City of Bremerton and Special Protection Measures, Gorst Creek Mainstem.
Cost:	Unknown
Likelihood of Success?	Unknown
Maintenance Needed?	N/A
References:	Haring 2000.

GOAL: Restore processes, structures, functions

29. Estuary, Channel, and Riparian Restoration, Lower Gorst Creek	Restore estuarine function. Will likely require acquisition of historic floodplain/estuary from the mouth to Jarstad Park. Remove bulkheads, armoring. Reconnect estuarine component north of Gorst Creek that was cut off by construction of the rail line. Restore natural channel configuration and floodplain function in the lower 0.8 mile of Gorst Creek; seek removal or relocation of approximately six businesses and 10-12 residences that encroach into the natural floodplain. Restore functional riparian zones from the mouth of Gorst Creek to the old diversion site at RM 0.8.
Ecological Benefits:	Improved fish and wildlife habitat. Improved riparian habitat diversity.
Process Improvements:	Restore hydrology, natural estuary functions, shoreline sediment transport processes.
Public Benefits:	Aesthetic improvement, increased wildlife observation opportunities.
Issues:	• Should conduct Baseline Stream Assessment prior to implementing action. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	Moderate to high, with appropriate design and implementation.
Maintenance Needed?	Maintenance likely, particularly if all actions not accomplished at one time.
References:	Borde et al. 2009. Haring 2000.
30. Culvert/Crossings Replacement, Old Belfair Highway, Lower Gorst Creek	• Replace culvert at Old Belfair Highway and lower Gorst Creek with a bridge. • Replace crossing at Parish Creek and Old Belfair Highway with bridge or bottomless culvert to improve fish passage.
Ecological Benefits:	Access to feeding, reproduction and refuge for migrating salmon.
Process Improvements:	Sediment transport and hydrology.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design, installation, and maintenance.
Maintenance Needed?	Yes
References:	Haring 2000. Bates et al. 2003.

GOAL: Restore processes, structures, functions (continued)

31. Culvert Replacement, Jarstad Creek	The existing Jarstad Creek Navy Railroad culvert has been identified as a fish passage barrier. Replacement of culvert with a bottomless arched culvert or box-culvert bridge would allow unimpeded fish access to upper portions of Jarstad Creek. Culvert is a 3-foot concrete pipe with 30-inch corrugated-metal piping attached to each end (267 ft in length). There is also a downstream partial barrier (2-foot concrete box) at the City of Bremerton access road.
Ecological Benefits:	Access to feeding, reproduction and refuge habitat for migrating salmon.
Process Improvements:	Sediment transport and hydrology.
Public Benefits:	The area is not open to the public. The rail line should not be accessed by unauthorized personnel. Aesthetics will be improved over existing conditions by creating more natural creek system.
Issues:	• Sections of structure are failing on the upstream side of railroad. Construction may be difficult due to limited access to the project and the need to keep the rail line open. • Navy owns and controls most of the project area. There may be easement issues with adjacent property owners.
Cost:	$0.9 million for 0.2 acres or $4.5 million per acre (Navy 2008).
Likelihood of Success?	High, with appropriate design, installation, and maintenance.
Maintenance Needed?	Yes
References:	Navy 2008. May et al. 2004. Bates et al. 2003.

Figure 17 Jarstad Creek Culvert under Railroad (May et al. 2004)

GOAL: Restore processes, structures, functions (continued)

32. Landfill, Upper Gorst Creek	Assess condition and life expectancy of 600-foot long culvert under landfill just upstream of SR 3 (address: 4275 SR 3); develop and implement remedial measures to prevent culvert collapse and ensure fish passage. Evaluate water quality; implement any needed cleanup actions.
Ecological Benefits:	Assure fish passage, improved water quality.
Process Improvements:	Sediment transport and hydrology.
Public Benefits:	Improved water quality.
Issues:	• Current land use is "abandoned" and is located next to an auto wrecking business. • Approximately 600 feet of Gorst Creek is routed through an 18-24 inch culvert under a privately operated landfill just upstream of SR 3 (WDFW Site ID 15.0216 3.6). Culvert is total fish passage barrier, blocking access to 0.5-1.0 mile of habitat upstream. The culvert is also corroding (Dorn). There is potential for slope failure at the face of the landfill, which would cause major road failure and debris flow (Small). • The City of Bremerton received an EPA grant to fund a Comprehensive Watershed Plan for Sustainable Development and Restoration of the Gorst Creek Watershed. As part of this study, the City will develop a Capital Improvement and Corrective Action Plan to correct existing deficiencies and ensure development of the necessary infrastructure to accommodate growth. This plan will include an Engineering Estimate and Cost Analysis for correction of the Private Landfill. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	High
Likelihood of Success?	High, with appropriate design, installation, and maintenance.
Maintenance Needed?	Yes
References:	Haring 2000. Bates et al. 2003.

33. Fish Passage Barrier, Upper Gorst Creek	Repair/replace culvert under Old Belfair Hwy just below golf course, which is a major hindrance to fish passage into the Upper Gorst watershed.
Ecological Benefits:	Fish access to spawning and rearing habitats, improved productivity of anadromous species. Golf Course culvert restricts fish access to approximately 2 miles of high quality coho spawning habitat.
Process Improvements:	Sediment transport and hydrology.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design, installation, and maintenance.
Maintenance Needed?	Likely.
References:	May et al. 2004. Haring 2000. URS Greiner, Inc. and SAIC 1999. Bates et al. 2003.

GOAL: Restore processes, structures, functions (continued)

34. Culvert Improvement, Heins Creek	Assess, repair/replace first culvert on Heins Creek. Existing 60" pipe has flow under and around the base of culvert.
Ecological Benefits:	Maintain/improve fish access to spawning and rearing habitats, improved productivity of anadromous species.
Process Improvements:	Sediment transport and hydrology.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design, installation, and maintenance.
Maintenance Needed?	Likely.
References:	URS Greiner, Inc. and SAIC 1999. Bates et al. 2003. T. Ostrom, 4 May 2010 e-mail message.

35. Diversion Dam, Gorst Creek	Purchase and remove or reconfigure diversion dam or assure long-term maintenance of fishways.
Ecological Benefits:	Increased spawning habitat productivity in lower creek.
Process Improvements:	Transport of gravel and larger sediments to the lower stream.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	• Land owner: City of Bremerton. • The diversion dam is used to provide flow to the Suquamish Tribe's Chinook rearing facility. Complete removal could only happen if the Tribe and State decided to cease operation of the Gorst facility.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design, implementation, monitoring and maintenance.
Maintenance Needed?	Likely
References:	URS Greiner, Inc. and SAIC 1999.

Figure 18 Gorst Mainstem, Upstream of Old Belfair Highway

GOAL: Restore processes, structures, functions (continued)

36. Estuary Enhancement, Viking Fence Pocket Estuary	Remove the existing culvert under the Navy railroad tracks and replace with a fish passable culvert. Remove fill at the west side and possibly portions of the west and south shore, plant salt marsh species, plant additional native shrubs and trees.
Ecological Benefits:	Fish access, enhanced lagoon shores, refuge habitat for migrating salmon.
Process Improvements:	Restore natural flushing of the intertidal pond.
Public Benefits:	• The area is within the Navy railway right of way and is not open to the public. The public could view the site from the highway. • Aesthetics may not be perceived as improved over existing conditions. The existing saltwater lagoon currently receives tidal influence and the project would only improve access to the lagoon by marine species.
Issues:	• See Johannessen 2009 for conceptual site plan. • This estuary was artificially created by the railway causeway. • Construction may be difficult since the site has limited access and closure of the railway may not be feasible. Alternative construction techniques such as soil freezing and horizontal directional drilling may be required (Navy 2008). • Permitting may be fairly easy if the replacement option can stay within the existing culvert and railroad grade. • Contamination not expected. • Navy-owned and controlled area, but the impacts to the adjacent privately-owned site may be difficult to mitigate.
Cost:	$2 million for 1.8 acres or 1.1 million dollars per acre (Navy 2008). $1.4 million (assumed railway remains operational during construction, Johannessen 2009).
Likelihood of Success?	Moderate to high, with appropriate design, implementation, monitoring and maintenance.
Maintenance Needed?	Normal culvert maintenance; monitor and maintain plantings until established.
References:	Navy 2008. Johannessen 2009. Bates et al. 2003.

Figure 19 Degraded Salt Marsh at Viking Fence Facility (Johannessen 2009)

GOAL: Restore processes, structures, functions (continued)

37.	**Large Woody Debris (LWD), Gorst Creek**	Develop and implement a short-term LWD strategy for Gorst Creek, from the mouth to RM 2.3 to provide LWD presence and habitat diversity until full riparian function is restored.
	Ecological Benefits:	Improved stream spawning habitat.
	Process Improvements:	Improved stream hydrology.
	Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
	Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	High, with appropriate design and implementation.
	Maintenance Needed?	Likely
	References:	Haring 2000.

38.	**Trash Removal, Parish Creek**	Remove large accumulation of tires from wetland complex in the headwaters of Parish Creek.
	Ecological Benefits:	Improved water quality, hydrology, and habitat quality.
	Process Improvements:	Hydrology.
	Public Benefits:	Improved water quality, improved aesthetics, improved public views.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	High
	Maintenance Needed?	Periodic trash removal likely.
	References:	Haring 2000.

Figure 20 Headwaters, Parish Creek

GOAL: Restore processes, structures, functions (continued)

39. Navy Railroad Crossings, Gorst Watershed

- Evaluate replacement of Heins Creek and other culverts with larger culverts or bridges.
- Continue to clean sediment and debris from fish ladder on routine basis.

Ecological Benefits:	Fish access to spawning and rearing habitats, improved productivity of anadromous species.
Process Improvements:	Sediment transport and hydrology. Larger culverts may better transport sediments, reducing maintenance and cleaning requirements.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	Navy-owned facility, culvert failure would affect Navy railroad use.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and implementation.
Maintenance Needed?	Likely
References:	Haring 2000.

GOAL: Reduce Pollution

40. Low Impact Development, Gorst Creek

Implement low impact development throughout the watershed, particularly on Parish Creek, including stormwater quantity control and water quality treatment for stormwater runoff. Retrofit existing development to state-of-the-art stormwater quality and quantity best management practices, particularly those areas located just upstream of SR 3 and the Sunny Slope development adjacent to Parish Creek.

Ecological Benefits:	Improved water quality.
Process Improvements:	Increased stormwater retention and infiltration.
Public Benefits:	Improved water quality.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • The City of Bremerton received an EPA grant to fund a Comprehensive Watershed Plan for Sustainable Development and Restoration of the Gorst Creek Watershed. As part of this study, the City will develop a Stormwater Plan to identify and prioritize existing surface water issues, corrections necessary for existing problems, and collection system improvements necessary for future development within the watershed. • Would require land ownership, easement or agreement prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and implementation.
Maintenance Needed?	Routine maintenance would be required.
References:	Haring 2000.

GOAL: Reduce Pollution (continued)

41. Fecal Coliform and Dissolved Oxygen, Gorst Creek	Identify and correct sources of fecal coliform contamination. Monitor dissolved oxygen levels downstream of Gold Mountain Golf Course, and on Jarstad Creek downstream of Bremerton Forest Road; correct problems as warranted.
Ecological Benefits:	Improved water quality.
Process Improvements:	N/A
Public Benefits:	Improved water quality.
Issues:	• Dept of Ecology has enforcement authority (RCW 90.48) for water quality in waters of the state. Kitsap County Health Department has local enforcement authority for water quality problems that put public health at risk and can also enforce local solid waste ordinances. • This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions.
Cost:	Unknown
Likelihood of Success?	Moderate to high, with appropriate design and implementation.
Maintenance Needed?	Routine maintenance likely.
References:	Haring 2000.

GOAL: Public Involvement

42. Jarstad Park Expansion	Jarstad Park is owned by the City of Bremerton. Lands to the west, north, and east of the park are also owned by the City of Bremerton, lands to the south are privately owned. The park could be expanded through designation of other City land as parkland, or purchase of private properties to the south.
Ecological Benefits:	Prevent future disturbance and changes.
Process Improvements:	N/A
Public Benefits:	Increased parkland.
Issues:	Would need to determine use of park expansion - active recreation area or conservation area.
Cost:	Unknown
Likelihood of Success?	High
Maintenance Needed?	Likely
References:	Stakeholder meeting 6 Oct 09.

GOAL: Public Involvement (continued)

43. Public Involvement and Education, Gorst Creek

Invest in public involvement, education, and watershed monitoring.

Ecological Benefits:	Understand health of system and assist future planning efforts.
Process Improvements:	N/A
Public Benefits:	Increased public interest and involvement. Public feedback and input considered before decisions made.
Issues:	• The City of Bremerton received an EPA grant to fund a Comprehensive Watershed Plan for Sustainable Development and Restoration of the Gorst Creek Watershed. As part of this study, the City's project team will engage the public through a series of meetings and develop informational handouts to convey the findings of the Comprehensive Plan and other project deliverables as they are prepared. • This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate outreach and participation.
Maintenance Needed?	On-going efforts necessary to maintain public interest.
References:	URS Greiner, Inc. and SAIC 1999.

GOAL: Assess

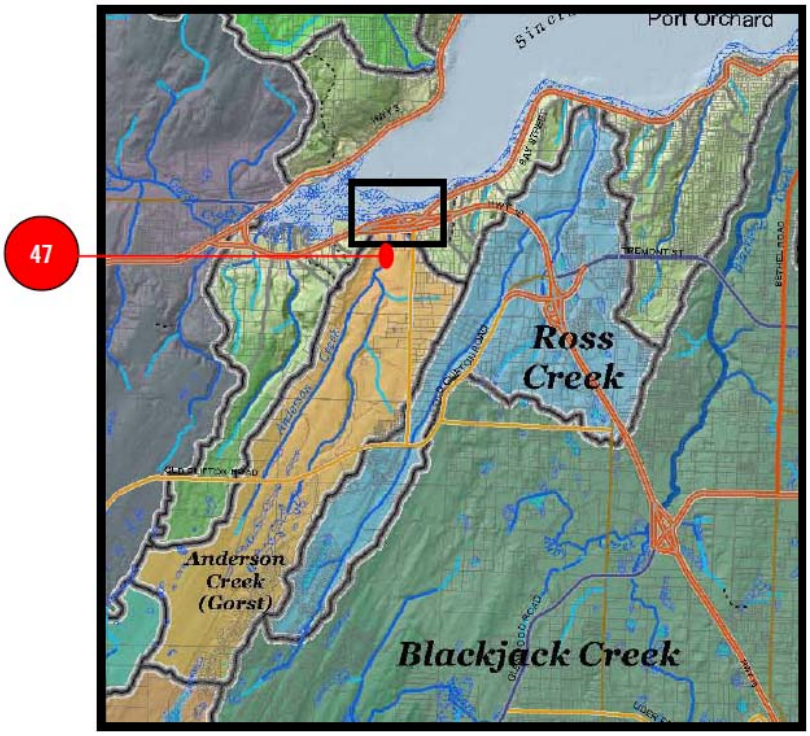
44. Baseline Stream Assessment, Gorst Creek

Assess existing stream channel conditions, historical changes, and processes that shape the channel over time. Assessment should include:

- Processes that influenced past and current channel morphology and habitats.
- Current channel conditions including morphology and stability.
- Probable future channel morphology.
- Potential constraints to recovery and restoration.

Ecological Benefits:	Understand driving forces of channel morphology to increase likelihood of success for habitat restoration, streambank protection, and other instream construction projects.
Process Improvements:	Understand causes of change prior to designing/implementing projects to mimic or alter natural channel processes.
Public Benefits:	Increase public education / awareness of stream processes and challenges.
Issues:	• The City of Bremerton received an EPA grant to fund a Comprehensive Watershed Plan for Sustainable Development and Restoration of the Gorst Creek Watershed. As part of this study, the City will conduct a Watershed Characterization Study which will set the ecological framework for sustainable (re)development within the watershed. • This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Site access may require land ownership, easement or agreement.
Cost:	Unknown
Likelihood of Success?	N/A
Maintenance Needed?	N/A
References:	Saldi-Caromile et al. 2004.

6.6 Details - Enhancement Opportunities, Anderson Creek

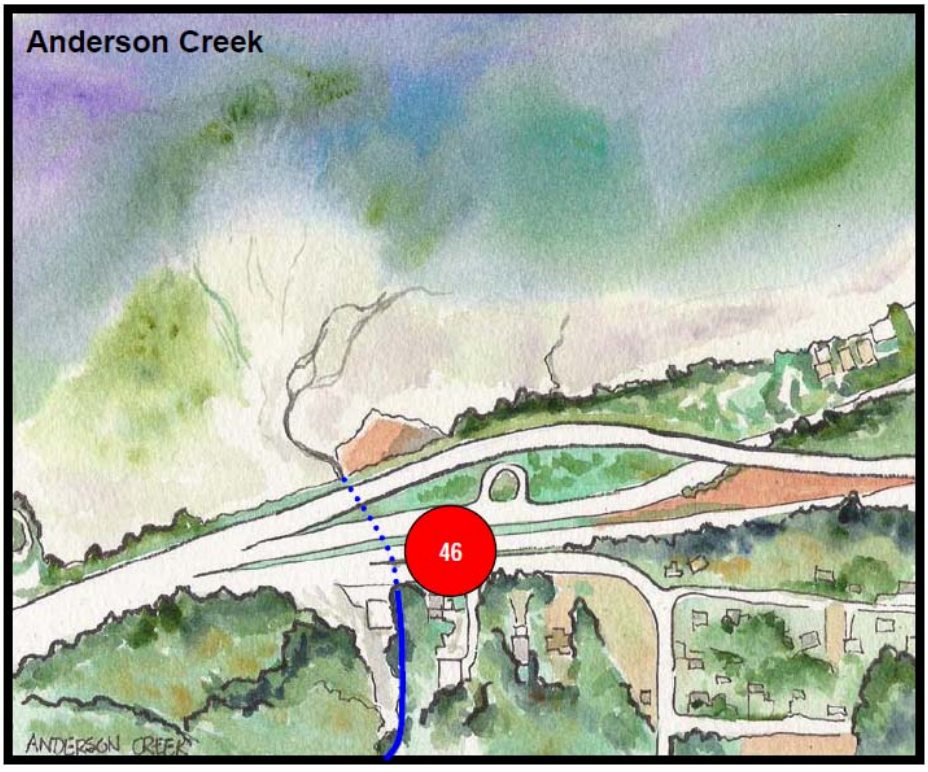


Values

- Forage fish spawning
- Coho, chum, steelhead, and cutthroat use

Challenges

- Channelized lower reach
- Concrete-lined channel sections
- Suburban development, septic systems



Watershed Actions

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Figure 21 Anderson Creek Actions

GOAL: Protect processes, structures, functions

45. Purchase and Preserve Property, Anderson Creek

Identify and purchase property for conservation.

Ecological Benefits:	Prevent future disturbance and changes.
Process Improvements:	N/A
Public Benefits:	Perpetual preservation, insurance against further development.
Issues:	Would require land purchase, easement or agreement with owner(s).
Cost:	Unknown
Likelihood of Success?	High
Maintenance Needed?	Unknown
References:	URS Greiner, Inc. and SAIC 1999.

GOAL: Restore processes, structures, functions

46. Daylight Lower Reach, Anderson Creek

Daylight stream in lower reach, install bridge under Highway 16 to restore natural channel configuration, estuarine function, and natural sediment transport through the SR 166/16 corridor.

Ecological Benefits:	Improved fish and wildlife habitat.
Process Improvements:	Hydrology.
Public Benefits:	Action would contribute to natural floodplain functions and healthy and sustainable salmonid populations.
Issues:	• There is no natural entrance to this creek. • Should conduct Baseline Stream Assessment prior to implementing action. • Would require land ownership, easement or agreement with owner(s) prior to actions.

Figure 22 Anderson Creek Flowing Beneath Highway 16 (Kitsap Health District 2009)

Cost:	Unknown
Likelihood of Success?	Moderate to high, with appropriate design and installation.
Maintenance Needed?	Likely
References:	Haring 2000.

GOAL: Restore processes, structures, functions (continued)

47. Remove Concrete, Anderson Creek	Remove concrete at RM 0.25 and restore natural channel configuration and floodplain function through the City of Bremerton water property.
Ecological Benefits:	Enhanced salmonid spawning opportunities. Improved fish and wildlife habitat. Improved riparian habitat diversity.
Process Improvements:	Restore hydrology, improved sediment transport processes.
Public Benefits:	Aesthetic improvement.
Issues:	• Current structure is inadequate for fish passage. Should re-meander stream through this section to correct for potential flooding and fish passage issues. • Up to 90% of the spawning is located within the lower section of the stream below this structure, which is most prone to scour and flooding. Flooding could impact entire spawning success in this reach. • Should conduct Baseline Stream Assessment prior to implementing action. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and implementation.
Maintenance Needed?	Maintenance likely, at least in short-term.
References:	Haring 2000.

GOAL: Reduce Pollution

48. Low Impact Development, Anderson Creek	Implement low impact development, including stormwater quantity control and water quality treatment for stormwater runoff. Retrofit existing development in watershed to state-of-the-art stormwater quality and quantity best management practices.
Ecological Benefits:	Improved water quality.
Process Improvements:	Increased stormwater retention and infiltration.
Public Benefits:	Improved water quality.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and implementation.
Maintenance Needed?	Routine maintenance would be required.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

GOAL: Public Involvement

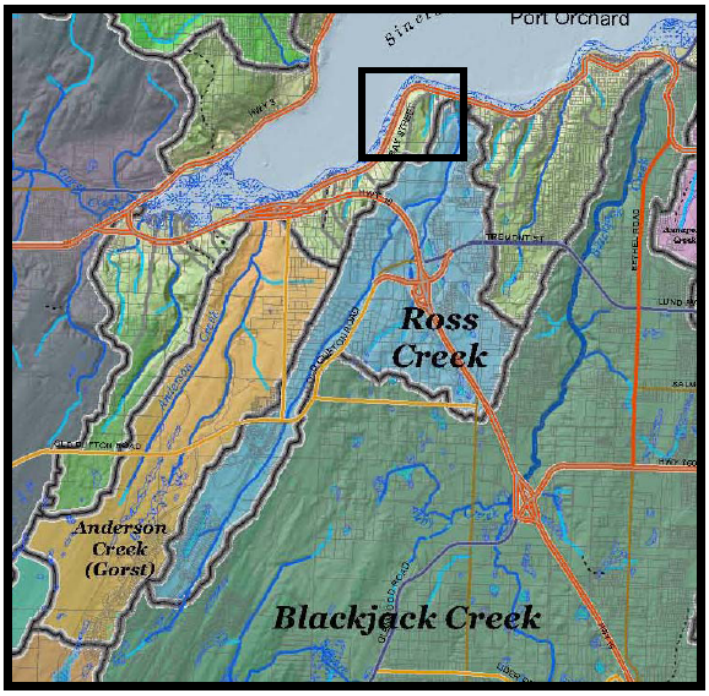
49. Citizen-Based Watershed Management, Anderson Creek	Fund citizen-based watershed management efforts.
Ecological Benefits:	Understand health of system and assist future planning efforts.
Process Improvements:	N/A
Public Benefits:	Increase public interest and involvement. Public feedback and input considered before decisions made.
Issues:	This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate outreach and participation.
Maintenance Needed?	On-going efforts necessary to maintain public interest.
References:	URS Greiner, Inc. and SAIC 1999.

GOAL: Assess

50. Baseline Stream Assessment, Anderson Creek	Assess existing stream channel conditions, historical changes, and processes that shape the channel over time. Assessment should include: • Processes that influenced past and current channel morphology and habitats. • Current channel conditions including morphology and stability. • Probable future channel morphology. • Potential constraints to recovery and restoration.
Ecological Benefits:	Understand driving forces of channel morphology to increase likelihood of success for habitat restoration, streambank protection, and other instream construction projects.
Process Improvements:	Understand causes of change prior to designing/implementing projects to mimic or alter natural channel processes.
Public Benefits:	Increase public education and awareness of stream processes and challenges.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Site access may require land ownership, easement or agreement with owner(s).
Cost:	Unknown
Likelihood of Success?	N/A
Maintenance Needed?	N/A
References:	Saldi-Caromile et al. 2004.

6.7 Details - Enhancement Opportunities, Ross Creek

Tributary: McCormick Creek



Values

- Forage fish spawning
- Coho, chum, steelhead, and cutthroat use

Challenges

- Fish passage barriers
- Suburban development, septic systems
- Sediment source removal

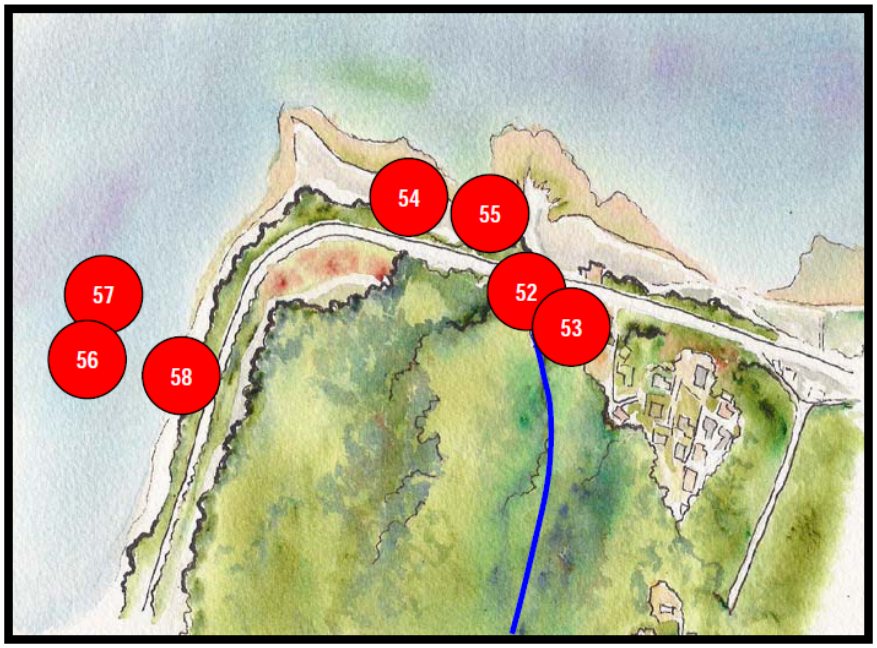


Figure 23 Ross Creek Actions

GOAL: Protect processes, structures, functions

51. Purchase and Preserve Property, Ross Creek	Identify and purchase property for conservation.
Ecological Benefits:	Prevent future disturbance and changes.
Process Improvements:	N/A
Public Benefits:	Perpetual preservation, insurance against further development.
Issues:	Would require land purchase, easement or agreement with owner(s).
Cost:	Unknown
Likelihood of Success?	High
Maintenance Needed?	Unknown
References:	URS Greiner, Inc. and SAIC 1999.

GOAL: Restore processes, structures, functions

52. Culvert Replacement and Restore Estuary Functions, Ross Creek at Hwy 166	Replace culvert at the SR 166 crossing with bridge or a much larger culvert that will restore saltwater tidal influence upstream and flush accumulated sediments into Sinclair Inlet, restore estuary functions.
Ecological Benefits:	Improved fish passage. Improved diversity of estuary habitat. Enhanced salmonid spawning opportunities.
Process Improvements:	Sediment transport and hydrology.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	• Should conduct Baseline Stream Assessment prior to implementing action. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design, installation, and maintenance.
Maintenance Needed?	Yes
References:	Borde et al. 2009. Applied Environmental Services, Inc. 2002. Haring 2000. URS Greiner, Inc. and SAIC 1999. Bates et al. 2003.

53. Purchase and Remove or Relocate Restaurant, Ross Creek	Purchase restaurant, remove or relocate buildings and pavement, remove invasive species.
Ecological Benefits:	Improved water quality, improved native vegetation diversity, reduction in invasive plants.
Process Improvements:	Restore natural hydrology, native vegetation succession.
Public Benefits:	Action would contribute to healthy and sustainable estuary. Estuary view from adjacent highway would be more natural.
Issues:	Would require land acquisition prior to actions.
Cost:	Unknown
Likelihood of Success?	Moderate to high, with monitoring, adaptive management, and maintenance.
Maintenance Needed?	Likely
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

Figure 24 Ross Creek Estuary

GOAL: Restore processes, structures, functions (continued)

54. Remove Bulkhead, Add Beach Nourishment, Ross Point	Remove bulkhead, add gravel nourishment along edges of surf smelt spawning zone and monitor for spawning expansion.
Ecological Benefits:	Expanded surf smelt spawning zone.
Process Improvements:	Augment sediment transport with addition of appropriate substrate.
Public Benefits:	Improved public views. Action would contribute to healthy and sustainable salmonid populations by supporting forage fish populations.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	Moderate, with periodic maintenance.
Maintenance Needed?	Yes, periodic replenishment required.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

GOAL: Restore processes, structures, functions (continued)

55.	**Remove Old Foundations and Piles, Ross Point**	Remove old homesite foundations and piles on intertidal area south of Ross Point.
	Ecological Benefits:	Expanded natural shoreline. Increased forage fish spawning area.
	Process Improvements:	Hydrology, sediment transport.
	Public Benefits:	Improved public views.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	High
	Maintenance Needed?	Unlikely
	References:	Applied Environmental Services, Inc. 2002. Haring 2000.
56.	**Remove Creosote Piling and Derelict Vessels, Ross Point**	Remove old creosote pilings just south of barge anchorage. Remove derelict vessels and unauthorized moorage.
	Ecological Benefits:	Improved water quality, reduced structural over-water coverage.
	Process Improvements:	Hydrology, sediment transport.
	Public Benefits:	Improved public views.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	High
	Maintenance Needed?	Unlikely
	References:	Applied Environmental Services, Inc. 2002. Haring 2000.
57.	**Remove Barge Anchorages, Ross Point**	Remove existing barge anchorages at Ross Point.
	Ecological Benefits:	Improved water quality, reduced structural over-water coverage.
	Process Improvements:	Reduced shading.
	Public Benefits:	Improved public views.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	High
	Maintenance Needed?	Unlikely
	References:	Stakeholder Meeting 13 Jan 10.

GOAL: Restore processes, structures, functions (continued)

58.	**Beach Nourishment, Barge Anchorage, Ross Point**	Beach nourishment on beach adjacent to barge anchorage. Maintain beach nourishment through adaptive management.
	Ecological Benefits:	Expanded surf smelt spawning zone.
	Process Improvements:	Augment sediment transport with addition of appropriate substrate.
	Public Benefits:	Action could contribute to healthy and sustainable salmonid populations by supporting forage fish populations.
	Issues:	Location is close to active forage fish spawning areas. Further investigation needed to determine potential benefits/impacts of nourishment at this location. Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	Low to moderate, would require long-term monitoring and maintenance.
	Maintenance Needed?	Yes, periodic replenishment required.
	References:	Applied Environmental Services, Inc. 2002. Haring 2000.

59.	**Large Woody Debris (LWD), Ross Creek**	Develop and implement a short-term LWD strategy to provide LWD presence and habitat diversity until full riparian function is restored.
	Ecological Benefits:	Improved stream spawning habitat.
	Process Improvements:	Improved stream hydrology.
	Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
	Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	High, with appropriate design and implementation.
	Maintenance Needed?	Likely
	References:	Applied Environmental Services, Inc. 2002. Haring 2000.

Figure 25 Woody Debris in Channel

GOAL: Restore processes, structures, functions (continued)

60.	**Riparian Buffers, Ross Creek**	Eliminate or reduce encroachment from existing development and establish functional riparian buffers.
	Ecological Benefits:	Improved water quality. Increased riparian diversity.
	Process Improvements:	Improved riparian system.
	Public Benefits:	Action would contribute to healthy and sustainable salmonid populations. Aesthetic improvement.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	Moderate to high, with monitoring, adaptive management, and maintenance.
	Maintenance Needed?	Likely
	References:	Applied Environmental Services, Inc. 2002. Haring 2000.
61.	**Remove Invasive Species, Ross Creek**	Remove invasive plant species in Ross Creek.
	Ecological Benefits:	Improved native vegetation diversity and habitat quality.
	Process Improvements:	Native vegetation succession.
	Public Benefits:	Improved public views.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	Moderate to high, with periodic maintenance.
	Maintenance Needed?	Likely
	References:	Stakeholder Meeting 13 Jan 10.
62.	**Trash Removal, Ross Creek**	Remove accumulated garbage and debris in Ross Creek.
	Ecological Benefits:	Improved water quality, hydrology, and habitat quality.
	Process Improvements:	Hydrology.
	Public Benefits:	Improved water quality, improved aesthetics, improved public views.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	High
	Maintenance Needed?	Periodic trash removal likely.
	References:	Applied Environmental Services, Inc. 2002. Haring 2000.

GOAL: Reduce Pollution

63. Low Impact Development, Ross Creek	Implement low impact development, including stormwater quantity control and water quality treatment for stormwater runoff. Retrofit existing development in watershed to state-of-the-art stormwater quality and quantity best management practices.
Ecological Benefits:	Improved water quality.
Process Improvements:	Increased stormwater retention and infiltration.
Public Benefits:	Improved water quality.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and implementation.
Maintenance Needed?	Routine maintenance would be required.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.
64. Fecal Coliform and Dissolved Oxygen, Ross Creek	Identify and correct sources of fecal coliform contamination. Monitor dissolved oxygen levels, correct problems as warranted.
Ecological Benefits:	Improved water quality.
Process Improvements:	N/A
Public Benefits:	Improved water quality.
Issues:	• Dept of Ecology has enforcement authority (RCW 90.48) for water quality in waters of the state. Kitsap County Health Department has local enforcement authority for water quality problems that put public health at risk and can also enforce local solid waste ordinances. • This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions.
Cost:	Unknown
Likelihood of Success?	Moderate to high, with appropriate design and implementation.
Maintenance Needed?	Routine maintenance likely.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

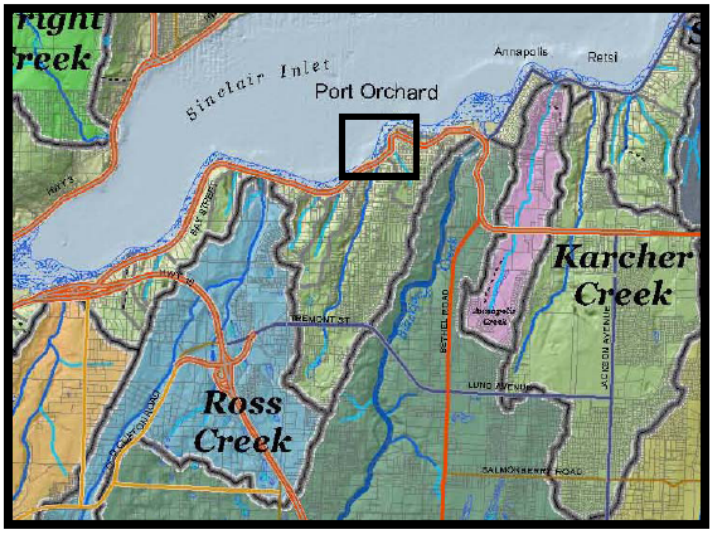
GOAL: Public Involvement

65. Citizen-Based Watershed Management, Ross Creek	Fund citizen-based watershed management efforts.
Ecological Benefits:	Understand health of system and assist future planning efforts.
Process Improvements:	N/A
Public Benefits:	Increased public interest and involvement. Public feedback and input considered before decisions made.
Issues:	This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate outreach and participation.
Maintenance Needed?	On-going efforts necessary to maintain public interest.
References:	URS Greiner, Inc. and SAIC 1999.

GOAL: Assess

66. Baseline Stream Assessment, Ross Creek	Assess existing stream channel conditions, historical changes, and processes that shape the channel over time. Assessment should include: • Processes that influenced past and current channel morphology and habitats. • Current channel conditions including morphology and stability. • Probable future channel morphology. • Potential constraints to recovery and restoration.
Ecological Benefits:	Understand driving forces of channel morphology to increase likelihood of success for habitat restoration, streambank protection, and other instream construction projects.
Process Improvements:	Understand causes of change prior to designing/implementing projects to mimic or alter natural channel processes.
Public Benefits:	Increase public education and awareness of stream processes and challenges.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Site access may require land ownership, easement or agreement with owner(s).
Cost:	Unknown
Likelihood of Success?	N/A
Maintenance Needed?	N/A
References:	Saldi-Caromile et al. 2004.

6.8 Details - Enhancement Opportunities, Port Orchard



Values

- Surf smelt spawning
- Public shoreline access
- Scenic views
- Marine bird and mammal observation points

Challenges

- Shorelines: steep, armored, filled, and dredged
- Commercial and residential development

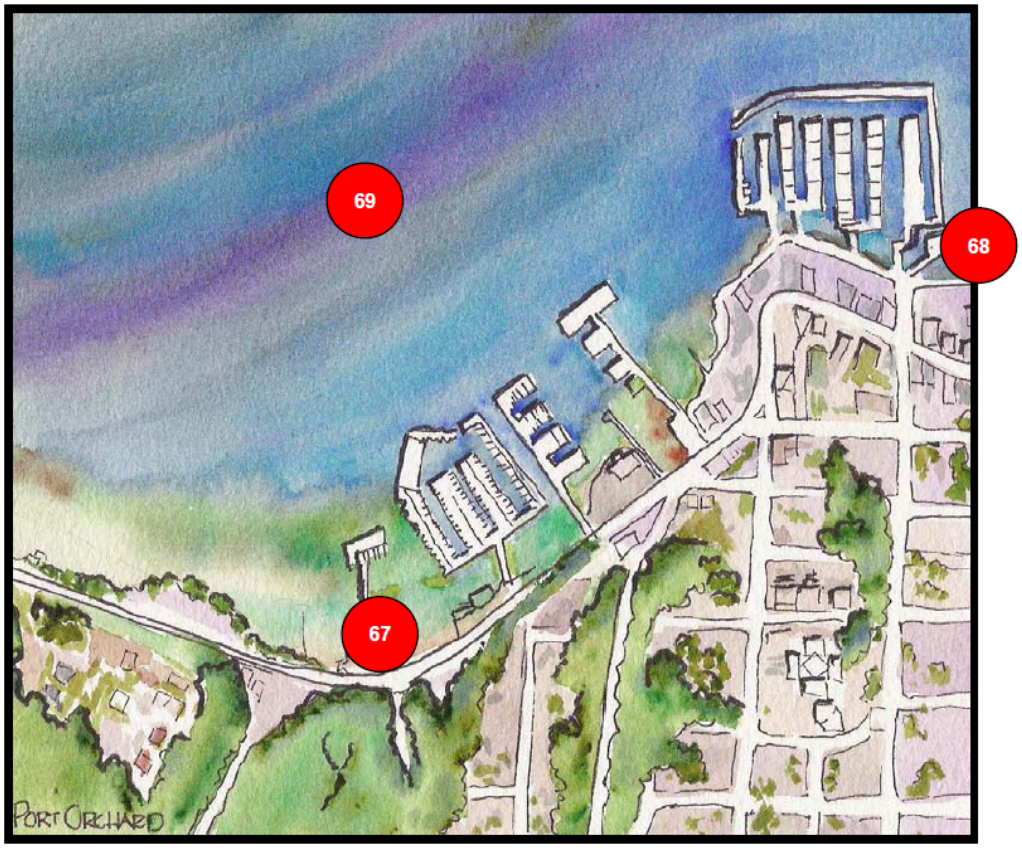


Figure 26 Port Orchard Actions

GOAL: Restore processes, structures, functions

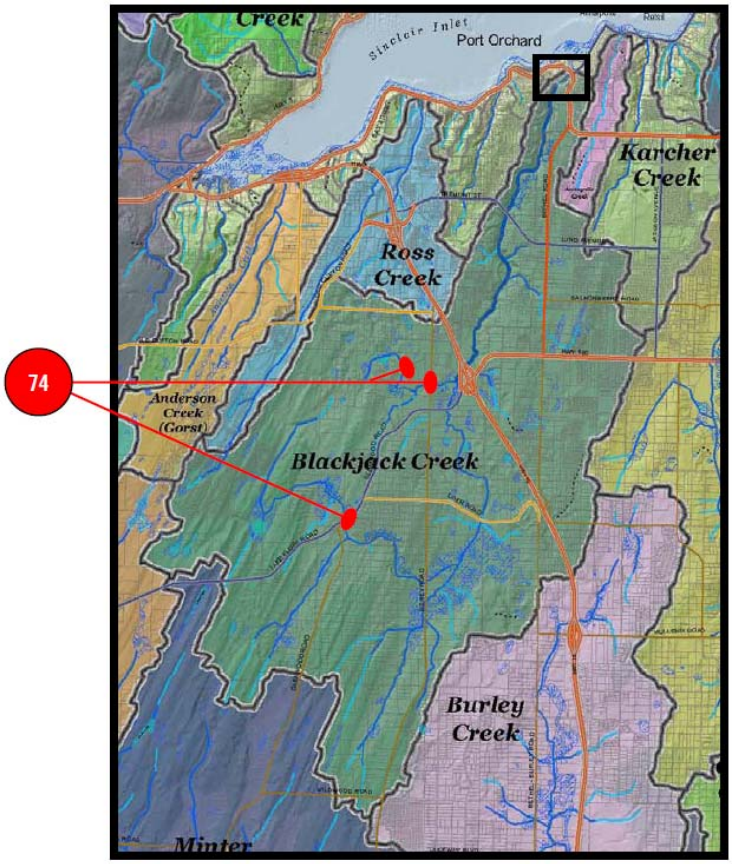
67. Intertidal Enhancement, Port Orchard Boat Launch	Add gravel/cobble to intertidal area around the boat launch where the slope of the bottom is ideal for surf smelt spawning.
Ecological Benefits:	Improved surf smelt spawning habitat.
Process Improvements:	Augment sediment transport with addition of appropriate substrate.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations by supporting forage fish populations.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	Moderate, would require long-term monitoring and maintenance.
Maintenance Needed?	Yes, periodic replenishment required.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

GOAL: Assess

68. Investigate Enhancement Opportunities at Port Orchard Marina and Sinclair Marina	Determine need and feasibility of enhancing existing pocket beach. Pocket beach is highly productive surf smelt spawning area.
Ecological Benefits:	Assess opportunities to improve surf smelt spawning habitat.
Process Improvements:	N/A
Public Benefits:	Public education and awareness of values and challenges.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to access.
Cost:	Unknown
Likelihood of Success?	N/A
Maintenance Needed?	N/A
References:	Stakeholder Meeting 13 Jan 10.
69. Investigate Transportation Alternatives and Improvements to Reduce Highway Use	Investigate transportation alternatives and improvements to reduce highway use. For example, water taxi service between Port Orchard and Bainbridge Island could reduce reliance on existing highways.
Ecological Benefits:	Reduced highway use, reduced need for enlarged/upgraded transportation infrastructure.
Process Improvements:	N/A
Public Benefits:	Public education and awareness of transportation impacts and challenges.
Issues:	
Cost:	Unknown
Likelihood of Success?	N/A
Maintenance Needed?	N/A
References:	Stakeholder Meeting 13 Jan 10.

6.9 Details - Enhancement Opportunities, Blackjack Creek

Tributaries: Square Creek, Ruby Creek



Values

- Regionally distinct stock of summer chum salmon
- Chinook, chum, coho, steelhead, and cutthroat use

Challenges

- Surface water runoff
- Commercial development, lower watershed
- Agricultural and residential development upper watershed

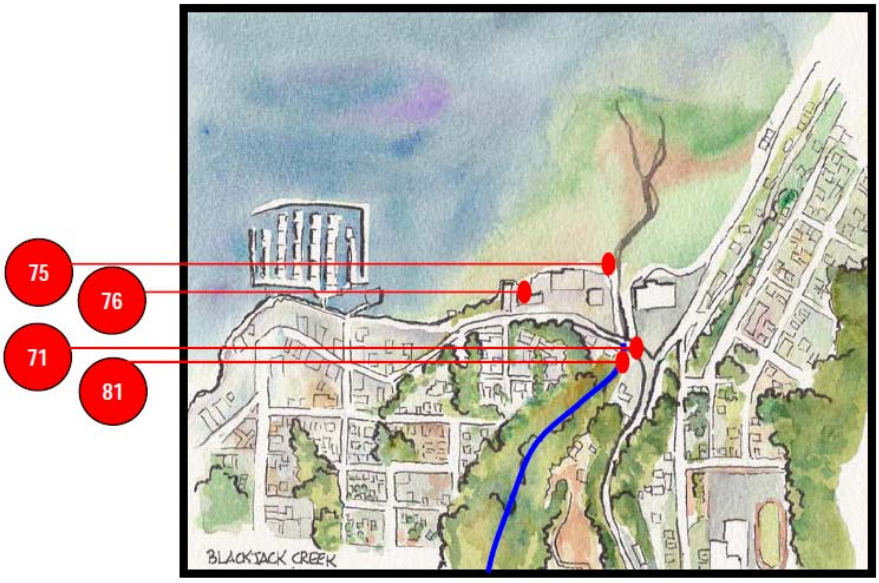


Figure 27 Blackjack Creek Actions

GOAL: Protect processes, structures, functions

70. Acquire and Protect High Quality Habitat along Blackjack Creek	Identify and protect high quality riparian habitat on Blackjack Creek through purchase and/or easements. Continue protection and development restrictions in lower Blackjack Creek canyon. Protect high quality riparian habitat on Blackjack Creek just upstream of Sidney Road. Protect/preserve/acquire as much of Square Creek upstream of Sidney Road as possible. Protect as much of Ruby Creek upstream of Sidney Road as possible.
Ecological Benefits:	Prevent future disturbance and changes.
Process Improvements:	N/A
Public Benefits:	Perpetual preservation, insurance against further development.
Issues:	Would require land purchase, easement or agreement with owner(s).
Cost:	Unknown
Likelihood of Success?	High
Maintenance Needed?	Unknown
References:	Applied Environmental Services, Inc. 2002. Haring 2000. URS Greiner, Inc. and SAIC 1999.

GOAL: Restore processes, structures, functions

71. Estuary Improvement, Blackjack Creek	Rebuild the Blackjack Creek outlet and sub-estuary. Remove or relocate commercial development within the former Blackjack Creek estuary. Remove channel and rip rap, add more riparian vegetation. Protect and restore estuarine habitat (particularly upstream of Bay Street), including restoration of riparian function and reduction of commercial encroachment, where feasible.
Ecological Benefits:	Increased natural shoreline habitat. Improved beach spawning habitat. Increased riparian diversity.
Process Improvements:	Hydrology, sediment transport processes, native vegetation succession.
Public Benefits:	Aesthetic improvement, increased wildlife observation opportunities.
Issues:	• Should conduct Baseline Stream Assessment prior to implementing action. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	Moderate to high, with appropriate design and implementation.
Maintenance Needed?	Maintenance likely, particularly if all actions not accomplished at one time.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

Figure 28 Lower Blackjack Creek

GOAL: Restore processes, structures, functions (continued)

72. Channel and Riparian Improvements, Blackjack Creek

Restore natural channel configuration and floodplain function on Blackjack Creek through the channelized agricultural area upstream of Sedgwick Road, and through the agricultural area of Ruby Creek downstream of Glenwood Road. Restore functional riparian zones throughout the watershed, with particular emphasis on Blackjack Creek upstream of Sedgwick Road, Unnamed 15.0206, and Square Creek.

Ecological Benefits: Improved fish access and spawning habitat.
Process Improvements: Hydrology.
Public Benefits: Action would contribute to healthy and sustainable salmonid populations.
Issues:
- Should conduct Baseline Stream Assessment prior to implementing action.
- Would require land ownership, easement or agreement with owner(s) prior to actions.

Cost: Unknown
Likelihood of Success? Moderate to high, with appropriate design and implementation.
Maintenance Needed? Likely
References: Haring 2000.

Figure 29 Ruby Creek Downstream of Glenwood Road

73. Agricultural Improvements, Blackjack Creek

Reduce habitat impacts on agricultural lands upstream of SR 16, including development and implementation of farm plans that restore stream functions. Identify and correct areas in the watershed that have unrestricted livestock access.

Ecological Benefits: Improved water quality.
Process Improvements: N/A
Public Benefits: Improved water quality.
Issues:
- In the upper watershed, especially Ruby Creek, there are hobby farms of various sizes, some with cattle in the channel, etc. Ruby Creek itself has been straightened and somewhat channelized in many reaches, with wetlands filled and other impacts. There is also a history of conversion from agricultural to commercial use. Stormwater impacts from past poor practices are apparent. Riparian areas are compromised by past agriculture and current uses. Many old fields are covered in reed canary grass with little or no successional processes at work.
- Would require land ownership, easement or agreement with owner(s) prior to actions.

Cost: Unknown
Likelihood of Success? High, with appropriate design and implementation.
Maintenance Needed? Routine maintenance likely.
References: Applied Environmental Services, Inc. 2002. Haring 2000.

GOAL: Restore processes, structures, functions (continued)

74. Upstream Fish Passage and Habitat Improvement, Blackjack Creek	Improve fish passage and upstream habitat at two culverts in the Ruby Creek drainage and at the Sidney Road crossing of Square Creek.
Ecological Benefits:	Improved fish access and spawning habitat.
Process Improvements:	Sediment transport and hydrology.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and installation.
Maintenance Needed?	Likely.
References:	Haring 2000. Bates et al. 2003.

Figure 30 Ruby Creek at Sydney Road, Square Creek at Glennwood Road

75. Pocket Beach Improvement, Blackjack Creek	Improve pocket beach for baitfish spawning at north edge of mall parking lot next to informal parking lot. Remove informal parking lot and replace with riparian vegetation. Meet with motel owners and operators to gain cooperation with shoreline vegetation restoration program in pocket beaches and specific locations.
Ecological Benefits:	Improved natural shoreline habitat. Improved beach spawning habitat. More riparian diversity.
Process Improvements:	Hydrology, sediment transport processes, native vegetation succession.
Public Benefits:	Aesthetic improvement, contribute to healthy and sustainable salmonid populations by supporting forage fish populations, increased wildlife observation opportunities.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	Moderate to high, with appropriate design, implementation, and maintenance.
Maintenance Needed?	Maintenance likely, particularly if all actions not accomplished at one time.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

GOAL: Restore processes, structures, functions (continued)

76. Remove Asphalt, Blackjack Creek Shoreline	Remove concrete and asphalt along road end near hotel and revegetate with native trees and shrubs.
Ecological Benefits:	More native vegetation.
Process Improvements:	Hydrology, sediment transport processes, native vegetation succession.
Public Benefits:	Aesthetic improvement, contribute to healthy and sustainable salmonid populations.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	Moderate to high, with appropriate design and implementation.
Maintenance Needed?	Likely. Expect to need maintenance until vegetation permanently established.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.
77. Large Woody Debris (LWD), Blackjack Creek	Develop and implement a short-term LWD strategy for lower two miles of Blackjack Creek and Square Creek, to provide LWD presence and habitat diversity until full riparian function is restored.
Ecological Benefits:	Improved stream spawning habitat.
Process Improvements:	Improve stream hydrology.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and implementation.
Maintenance Needed?	Likely
References:	Haring 2000.
78. Trash Removal, Blackjack Creek	Remove accumulated garbage and debris in Blackjack Creek.
Ecological Benefits:	Improved water quality, hydrology, and habitat quality.
Process Improvements:	Hydrology
Public Benefits:	Improved water quality, improved aesthetics, improved public views.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High
Maintenance Needed?	Periodic trash removal likely.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

GOAL: Reduce Pollution

79. Low Impact Development, Blackjack Creek	Implement low impact development, including stormwater quantity control and water quality treatment for stormwater runoff. Remediate existing stormwater impacts to the channel.
Ecological Benefits:	Improved water quality.
Process Improvements:	Increased stormwater retention and infiltration.
Public Benefits:	Improved water quality.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and implementation.
Maintenance Needed?	Routine maintenance would be required.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

80. Fecal Coliform and Dissolved Oxygen, Blackjack Creek	Identify and correct sources of fecal coliform contamination. Monitor dissolved oxygen levels downstream of Sedgwick Road and on Ruby Creek downstream of Sidney Avenue, correct problems.
Ecological Benefits:	Improved water quality.
Process Improvements:	N/A
Public Benefits:	Improved water quality.
Issues:	• Dept of Ecology has enforcement authority (RCW 90.48) for water quality in waters of the state. Kitsap County Health Department has local enforcement authority for water quality problems that put public health at risk and can also enforce local solid waste ordinances. • This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions.
Cost:	Unknown
Likelihood of Success?	Moderate to high, with appropriate design and implementation.
Maintenance Needed?	Routine maintenance likely.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

GOAL: Public Involvement

81. Viewing Platform, Blackjack Creek	Construct a viewing platform at the estuary to promote public awareness and education. Locate platform to avoid estuary impacts.
Ecological Benefits:	N/A
Process Improvements:	N/A
Public Benefits:	Viewing platform at the estuary would promote public awareness and education.
Issues:	May require land ownership, easement or agreement with owner(s)/user(s).
Cost:	Unknown
Likelihood of Success?	High, with appropriate outreach and participation.
Maintenance Needed?	Patrol and structural maintenance required.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

GOAL: Public Involvement (continued)

82.	**Public Involvement, Blackjack Creek**	Fund citizen-based watershed monitoring groups and landowner education programs. Fund public access and interpretive program.
	Ecological Benefits:	Understand health of system and assist future planning efforts.
	Process Improvements:	N/A
	Public Benefits:	Increased public interest and involvement. Public feedback and input considered before decisions made.
	Issues:	This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions.
	Cost:	Unknown
	Likelihood of Success?	High, with appropriate outreach and participation.
	Maintenance Needed?	On-going efforts necessary to maintain public interest.
	References:	URS Greiner, Inc. and SAIC 1999.

Figure 31 Plantings along Ruby Creek

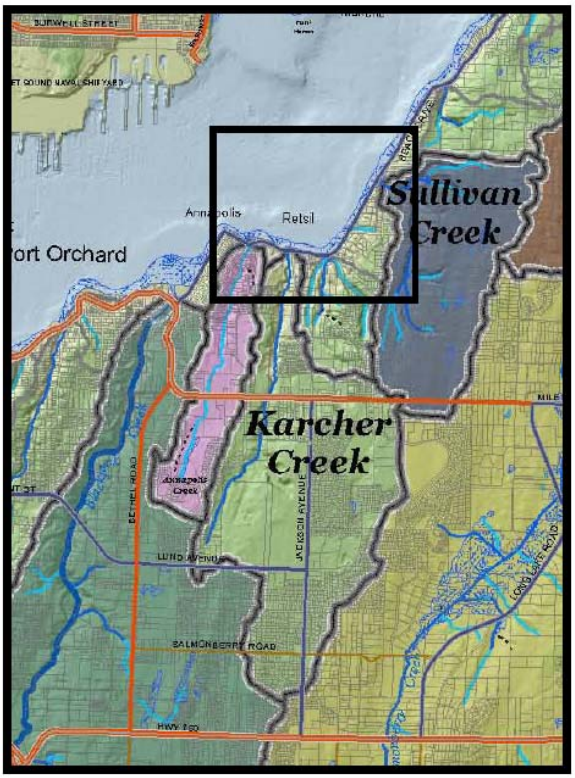
GOAL: Assess

83. Baseline Physical Stream Assessment, Blackjack Creek	Assess existing stream channel conditions, historical changes, and processes that shape the channel over time. Assessment should include: • Processes that influenced past and current channel morphology and habitats. • Current channel conditions including morphology and stability. • Probable future channel morphology. • Potential constraints to recovery and restoration.
Ecological Benefits:	Understand driving forces of channel morphology to increase likelihood of success for habitat restoration, streambank protection, and other instream construction projects.
Process Improvements:	Understand causes of change prior to designing/implementing projects to mimic or alter natural channel processes.
Public Benefits:	Increase public education and awareness of stream processes and challenges.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Site access may require land ownership, easement or agreement with owner(s).
Cost:	Unknown
Likelihood of Success?	N/A
Maintenance Needed?	N/A
References:	Saldi-Caromile et al. 2004.

84. Biological Stream Assessment, Blackjack Creek	Perform continued stream assessments on Blackjack Creek to closely monitor its health and viability as a salmon stream.
Ecological Benefits:	Understand health of system and assist future planning efforts.
Process Improvements:	N/A
Public Benefits:	Public education and awareness of values and challenges.
Issues:	Site access may require land ownership, easement or agreement with owner(s).
Cost:	Unknown
Likelihood of Success?	N/A
Maintenance Needed?	N/A
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

6.10 Details - Enhancement Opportunities, Annapolis Point and East

Annapolis Creek, Karcher (Olney, Retsil) Creek, Sacco (Sullivan) Creek



Values

- Coho, chum, and cutthroat use
- Public shoreline access

Challenges

- Shoreline armoring
- Fish passage barriers
- Residential development

Watershed Actions

Annapolis: 88, 93, 95, 90, 94

Karcher/Olney/Retsil: 89, 90, 95

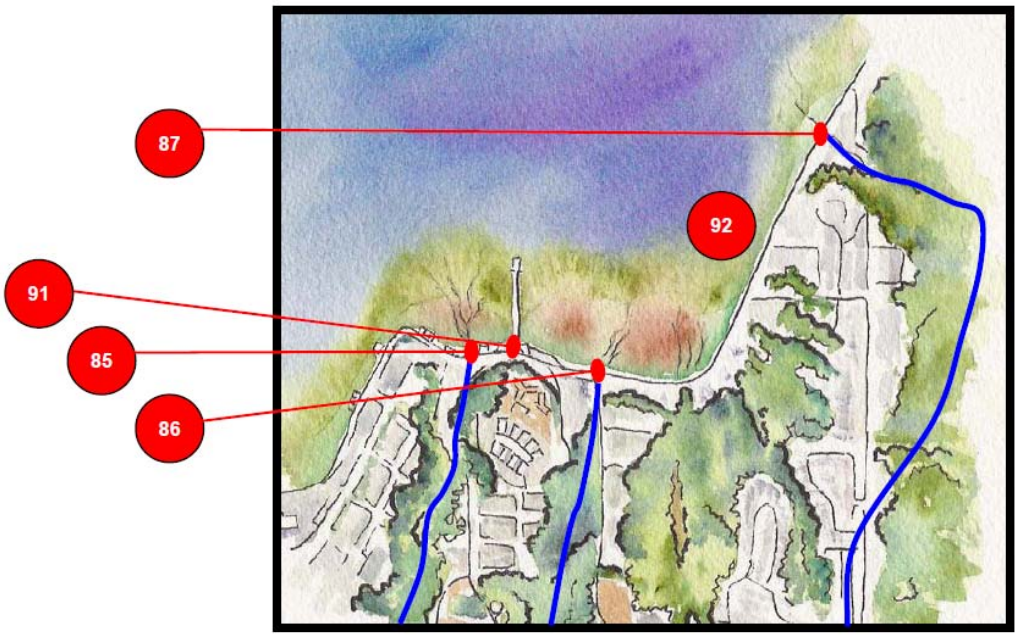


Figure 32 Annapolis Point and East Actions

GOAL: Restore processes, structures, functions

85.	**Culvert Replacement and Floodway Restoration, Annapolis Creek**	Replace undersized restrictive culvert, Annapolis Creek at Beach Drive and restore floodway.
	Ecological Benefits:	Improved fish access.
	Process Improvements:	Sediment transport and hydrology.
	Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	High, with appropriate design, installation, and maintenance.
	Maintenance Needed?	Yes
	References:	Borde et al. 2009. Haring 2000. Bates et al. 2003.
86.	**Culvert Replacement, Karcher (Olney, Retsil) Creek at Beach Drive**	Replace culvert, Karcher (Olney, Retsil) Creek at Beach Drive.
	Ecological Benefits:	Improved fish access.
	Process Improvements:	Sediment transport and hydrology.
	Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
	Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
	Cost:	Unknown
	Likelihood of Success?	High, with appropriate design, installation, and maintenance.
	Maintenance Needed?	Yes
	References:	Borde et al. 2009. Bates et al. 2003.

Figure 33 Karcher (Olney, Retsil) Creek Upstream of Beach Drive, Karcher (Olney, Retsil) Creek Outlet

GOAL: Restore processes, structures, functions (continued)

87. Estuary Restoration, Sacco (Sullivan) Creek	Relocate roads away from estuary edge and allow marsh re-establishment.
Ecological Benefits:	Improved fish access. Enhanced estuary. Diversified habitat.
Process Improvements:	Sediment transport and hydrology.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	• Should conduct Baseline Stream Assessment prior to implementing action. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design, installation, and maintenance.
Maintenance Needed?	Yes
References:	Borde et al. 2009. Bates et al. 2003.

Figure 34 Sacco (Sullivan) Creek Estuary Looking North and South

88. Riparian Improvements, Annapolis Creek	Restore functional riparian zones throughout the watershed, particularly through the high school property and along Arnold Avenue. Remove small-hydro dam at the high school, and restore natural channel configuration and functional habitat conditions. Assess, prioritize, and correct fish passage barriers upstream of the high school, as warranted.
Ecological Benefits:	Improved fish and wildlife habitat. Increased fish access.
Process Improvements:	Hydrology, native vegetation succession.
Public Benefits:	Improved public views.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	Moderate due to existing development. Would require monitoring, adaptive management, and maintenance.
Maintenance Needed?	Likely
References:	Haring 2000.

GOAL: Restore processes, structures, functions (continued)

89. Remove Invasive Vegetation, Karcher (Olney, Retsil) Creek

Remove invasive vegetation.

Ecological Benefits:	Improved native vegetation diversity and habitat quality.
Process Improvements:	Native vegetation succession.
Public Benefits:	Improved public views.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	Moderate to high, with periodic maintenance.
Maintenance Needed?	Likely
References:	Borde et al. 2009.

90. Large Woody Debris (LWD), East Port Orchard

Develop and implement a short-term LWD strategy to provide LWD presence and habitat diversity until full riparian function is restored.

Ecological Benefits:	Improved stream spawning habitat.
Process Improvements:	Improved stream hydrology.
Public Benefits:	Action would contribute to healthy and sustainable salmonid populations.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and implementation.
Maintenance Needed?	Likely
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

Figure 35 Woody Debris in Channel

GOAL: Restore processes, structures, functions (continued)

91. Remove Riprap and Restore Natural Shoreline	Remove riprap at the site of the former Annapolis boat ramp and restore natural shoreline.
Ecological Benefits:	Improved beach and shoreline.
Process Improvements:	Sediment transport.
Public Benefits:	Improved public views.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High
Maintenance Needed?	Likely to require maintenance until shoreline stabilized.
References:	Borde et al. 2009. Applied Environmental Services, Inc. 2002. Haring 2000.

92. Beach Nourishment, East Port Orchard	Beach nourishment at appropriate locations.
Ecological Benefits:	Improved beach habitat.
Process Improvements:	Augment sediment transport with addition of appropriate substrate and vegetation.
Public Benefits:	Improved public views. Action would contribute to healthy and sustainable salmonid populations by supporting forage fish populations.
Issues:	Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	Depends on location.
Maintenance Needed?	Yes, periodic replenishment required.
References:	Applied Environmental Services, Inc. 2002. Haring 2000.

GOAL: Reduce Pollution

93. Low Impact Development, Annapolis Creek	Implement low impact development throughout the watershed, including stormwater quantity control and water quality treatment for stormwater runoff. Retrofit existing development to state-of-the-art stormwater quality and quantity best management practices.
Ecological Benefits:	Improved water quality.
Process Improvements:	Increased stormwater retention and infiltration.
Public Benefits:	Action would contribute to water quality improvement.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Would require land ownership, easement or agreement with owner(s) prior to actions.
Cost:	Unknown
Likelihood of Success?	High, with appropriate design and implementation.
Maintenance Needed?	Routine maintenance would be required.
References:	Haring 2000.

GOAL: Reduce Pollution (continued)

94. Fecal Coliform and Dissolved Oxygen, Annapolis Creek	Identify and correct sources of fecal coliform contamination. Monitor dissolved oxygen levels, correct as warranted.
Ecological Benefits:	Improved water quality.
Process Improvements:	N/A
Public Benefits:	Improved water quality.
Issues:	• Dept of Ecology has enforcement authority (RCW 90.48) for water quality in waters of the state. Kitsap County Health Department has local enforcement authority for water quality problems that put public health at risk and can also enforce local solid waste ordinances. • This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions.
Cost:	Unknown
Likelihood of Success?	Moderate to high, with appropriate design and implementation.
Maintenance Needed?	Routine maintenance likely.
References:	Haring 2000.

GOAL: Assess

95. Baseline Stream Assessment, Annapolis/Karcher (Olney, Retsil)/Sacco (Sullivan) Creeks	Assess existing stream channel conditions, historical changes, and processes that shape the channel over time. Assessment should include: • Processes that influenced past and current channel morphology and habitats. • Current channel conditions including morphology and stability. • Probable future channel morphology. • Potential constraints to recovery and restoration.
Ecological Benefits:	Understand driving forces of channel morphology to increase likelihood of success for habitat restoration, streambank protection, and other instream construction projects.
Process Improvements:	Understand causes of change prior to designing/implementing projects to mimic or alter natural channel processes.
Public Benefits:	Increase public education and awareness of stream processes and challenges.
Issues:	• This action is recommended in multiple watersheds. Implementing this action basin-wide would result in consistency, efficiency, and cost savings over individual actions. • Site access may require land ownership, easement or agreement with owner(s).
Cost:	Unknown
Likelihood of Success?	N/A
Maintenance Needed?	N/A
References:	Saldi-Caromile et al. 2004.

7.0 References

Applied Environmental Services, Inc. 2002. City of Port Orchard Shoreline Resource Analysis and Inventory.

Bates, K. M., R. J. Barnard, B. Heiner, J. P. Klavas, and P. D. Powers. 2003. Design of Road Culverts for Fish Passage. Washington Department of Fish and Wildlife, Olympia, Washington. 110 pp.

Borde, A. B., C. Judd, N. K. Sather, and R. M. Thom. 2009. East Kitsap County Nearshore Habitat Assessment and Restoration Prioritization Framework. Prepared for Kitsap County, Department of Community Development.

City of Bremerton, Department of Public Works and Utilities. 2009. Combined Sewer Overflow Annual Report for 2008. NPDES Permit #WA-002928-9. Submitted to Washington Department of Ecology January 31, 2009.

Collins, B. D. and A. J. Sheikh. 2005. Historical Reconstruction, Classification, and Change Analysis of Puget Sound Tidal Marshes. Project Completion Report to: Washington Department of Natural Resources Aquatic Resources Division, Olympia, WA Olympia, WA 98504-7027. University of Washington, Puget Sound River History Project, Department of Earth and Space Sciences, Seattle, WA 98195. June 30, 2005.

ENVVEST 2006. 2006. Puget Sound Naval Shipyard and Intermediate Maintenance Facility Project ENVVEST Community Update June 2006. Brochure and CD. Marine Environmental Support Office-NW, Space and Naval Warfare Systems Center, Bremerton, WA. August 2006. Ecology Publication Number 06-10-54.

Fresh, K., C. Simenstad, J. Brennan, M. Dethier, G. Gelfenbaum, F. Goetz, M. Logsdon, D. Myers, T. Mumford, J. Newton, H. Shipman, and C. Tanner. 2004. Guidance for Protection and Restoration of the Nearshore Ecosystems of Puget Sound. Puget Sound Nearshore Partnership Report No. 2004-02. Published by Washington Sea Grant Program, University of Washington, Seattle, Washington. Available at http://pugetsoundnearshore.org.

Haring, D. 2000. Salmonid Habitat Limiting Factors. Water Resource Inventory Area 15 (East) Final Report. Washington State Conservation Commission. November 2000.

Hatchery Scientific Review Group - Lars Mobrand (chair), John Barr, Lee Blankenship, Don Campton, Trevor Evelyn, Conrad Mahnken, Paul Seidel, Lisa Seeb, and Bill Smoker. 2003. Hatchery Reform Recommendations. Seattle, WA.

Johannessen, J. 2009. Sinclair Inlet Shoreline Charrette, Beach Enhancement Summary, Prepared by Jim Johannessen, Licensed Engineering Geologist, MS, Coastal Geologic Services Inc. Prepared for Puget Sound Restoration Fund, Bainbridge Island, April 30, 2009.

Johnston R. K., G. H. Rosen, J. M. Brandenberger, V. S. Whitney, and J. M. Wright, 2009. Sampling and Analysis Plan for Ambient Monitoring and Toxicity Testing for Sinclair and Dyes Inlets, Puget Sound, Washington. Quality Assurance Project Plan, prepared in support of the Puget Sound Naval Shipyard and Intermediate Maintenance Facility Project ENVVEST, August 18, 2009, 70pp.

Kitsap County Health District. 2009. Water Quality Monitoring Report. Kitsap County Health District Water Quality Program.

May, C. W., M. C. Miller, and J. A. Southard. 2004. An Analysis of Stream Culvert Fish Passage on the Navy Railroad Line between Bremerton and Shelton, Washington. Prepared for Puget Sound Naval Shipyard and Intermediate Maintenance Facility under a Related Services Agreement with the U.S. Department of Energy under Contract DE-AC06-76RLO 1830.

May, C. W. and G. Peterson. 2003. Kitsap Salmonid Refugia Report.

Olyer, J. 2010. Fin Fish Biologist, Suquamish Tribe, Suquamish, WA. May 4, 2010. Personal communication, email exchange with Chris Stevenson, NAVFAC NW, re: Aquascape Comments.

Saldi-Caromile, K., K. Bates, P. Skidmore, J. Barenti, and D. Pineo. 2004. Stream Habitat Restoration Guidelines: Final Draft. Co-published by the Washington Departments of Fish and Wildlife and Ecology and the U.S. Fish and Wildlife Service. Olympia, Washington.

Tetratech 1988. Sinclair and Dyes Inlets Urban Bay Action Program: Initial Data Summaries and Problem Identification. Prepared by Tetratech for EPA R10-Puget Sound Estuary Program, EPA Doc #TC-3338-13, Final Report.

U. S. Navy. 2008. CVN Maintenance Wharf Mitigation Plan, Naval Base Kitsap Bremerton. NAVFAC Northwest.

U.S. Navy, U.S. EPA, and Washington State Department of Ecology 2000. Project ENVVEST: Phase I Final Project Agreement for the Puget Sound Naval Shipyard, September 25, 2000 [Federal Register: October 23, 2000 (Volume 65, Number 205)]. http://www.epa.gov/ProjectXL/puget2/fpasigned.pdf.

URS Greiner, Inc., Science Applications International Corporation. 1999. Sinclair Inlet Existing Conditions Data Compilation.

8.0 Reports and Studies (Post-1999)

Report	Notes
Applied Environmental Services, Inc. 2002. City of Port Orchard Shoreline Resource Analysis and Inventory.	This report contains an inventory and analysis of shoreline conditions within the City of Port Orchard. Land use, public access, environmentally sensitive areas and fish habitat are addressed. The report divides the 3.5-mile shoreline and the first 0.1 river miles of both Ross and Blackjack Creeks into seven segments, based on ecological functions and existing/projected land uses. The report includes findings and recommendations for each segment.
Bates, K. M., R. J. Barnard, B. Heiner, J. P. Klavas, and P. D. Powers. 2003. Design of Road Culverts for Fish Passage. Washington Department of Fish and Wildlife, Olympia, Washington. 110 pp.	This is a guide for property owners and engineers who are designing permanent road-crossing culverts to facilitate upstream fish migration. It provides guidance for projects involving new culvert construction as well as retrofitting or replacing existing culverts. The designer will need to have a working knowledge of hydraulic engineering, hydrology and soils/structural engineering to accomplish an appropriate design. http://wdfw.wa.gov/hab/ahg/culverts.htm
Borde, A. B., C. Judd, N. K. Sather, and R. M. Thom. 2009. East Kitsap County Nearshore Habitat Assessment and Restoration Prioritization Framework. Prepared for Kitsap County, Department of Community Development.	The authors used a GIS-based model to assess the condition of marine shorelines in East Kitsap County. The report summarizes the state of the nearshore and identifies priority areas for habitat protection, restoration, enhancement, and creation. The report identifies drift cells and Nearshore Assessment Units (NAUs) throughout East Kitsap County. The assessment delineates 35 NAUs in the Sinclair Inlet Study Area; each unit was scored for controlling factors and dominant physical processes. Controlling factors include substrate, wave energy, depth/slope, light, disturbance frequency, and water quality. Dominant physical processes include sediment transport, wave erosion, fluvial deposition, tidal erosion, and wave deposition. The report recommends general management options for each Nearshore Assessment Unit. http://www.kitsapgov.com/dcd/nr/nearshore/
Brennan, J. S. and H. Culverwell. 2004. Marine Riparian: An Assessment of Riparian Functions in Marine Ecosystems. Published by Washington Sea Grant Program. Copyright 2005, UW Board of Regents, Seattle, WA. 34 pp.	This study focuses on riparian functions and marine ecosystem issues in the Puget Sound region. While research and empirical data to quantify functional characteristics of marine riparian systems in Puget Sound are substantially lacking, this review and assessment indicates that marine riparian functions play an important role in marine nearshore ecosystems. The assessment also indicates that the lack of attention to marine riparian areas and poor protective standards have resulted in substantial loss and degradation of marine riparian and nearshore ecosystem components, which are of value to fishes, wildlife, and human health and safety. There is a critical need to develop and implement a research program and protective standards to learn more about marine riparian systems and prevent further degradation and loss of riparian functions and benefits. The assessment contains recommendations to be considered as part of any coastal management strategy and development of shoreline regulations.

Report	Notes
Brennan, J. S., K. F. Higgins, J. R. Cordell, and V. A. Stamatiou. 2004. Juvenile Salmon Composition, Timing, Distribution, and Diet in Marine Nearshore Waters of Central Puget Sound in 2001-2002. King County Department of Natural Resources and Parks, Seattle, WA. 164 pp.	Investigated use of marine nearshore waters by juvenile salmonids within WRIAs 8 and 9, including Vashon/Maury Islands within the boundaries of King and south Snohomish Counties. Fish were collected, measured, weighed and checked for coded wire tags and adipose fin clips. Gut contents were collected to determine diet composition. Sampling conducted May-Oct 2001 and Apr-Dec 2002. Broad geographical distribution of salmonids found, originating from 13 watersheds and 23 hatcheries. High component of terrestrial insects found in diet of juvenile Chinook. Similar timing, similar distribution and similarities in diet between hatchery-raised and wild fish suggest they are likely competing for the same resources.
City of Bremerton. 2003. Centennial Clean Water Fund Grant #G0000172 "Cooperative Approach to CSO Reduction" Final Report. Submitted to Washington Department of Ecology July 2003.	The City of Bremerton requested a Centennial Clean Water Fund Grant to assist with separation of private property stormwater systems from the sanitary sewer system. The program accomplished two tasks: 1) educated citizens, elected officials, and business and property owners about CSOs and point source pollution; is the final report and summary for the program; and 2) facilitated separation of private property stormwater from the sanitary sewer system. As of 2003, the program removed approximately 260,000 gallons of stormwater per inch of rain, from the sanitary sewer system.
City of Bremerton, Department of Public Works and Utilities. 2009. Combined Sewer Overflow Annual Report for 2008. NPDES Permit #WA-002928-9. Submitted to Washington Department of Ecology January 31, 2009.	This Combined Sewer Overflow (CSO) Annual Report describes improvements made in 2008, provides summaries of past CSO reduction efforts, and describes future projects. In 2008, the City of Bremerton's wastewater collection system contained 15 CSO sites. These structures are in the older portion of the City's wastewater collection system and some pre-date the first wastewater treatment plant built in 1946. http://www.ci.bremerton.wa.us/forms/publicworks/2008AnnualCSOReport.pdf
Collins, B. D. and A. J. Sheikh. 2005. Historical Reconstruction, Classification, and Change Analysis of Puget Sound Tidal Marshes. Project Completion Report to: Washington Department of Natural Resources Aquatic Resources Division, Olympia, WA Olympia, WA 98504-7027. University of Washington, Puget Sound River History Project, Department of Earth and Space Sciences, Seattle, WA 98195. June 30, 2005.	This report presents the results of an investigation into the historical nearshore environment of the Puget Sound region. Original U.S. Coast and Geodetic Survey (USC&GS) topographic sheets (T-sheets) mostly from the period between 1850 and 1890 were used to create a Geographic Information Systems (GIS) geodatabase with continuous coverage of the entire Puget Sound shoreline. The authors used this data along with other data sources to reconstruct the historical nearshore environment. This study concentrated on one facet of the nearshore environment, tidal wetlands. Sinclair Inlet is one of several shallow inlets west of Bainbridge Island, created by shallow flooding of a series of glacial drainage ways. The report concludes with a brief comparison of historical to current conditions. Sinclair Inlet is one of the Western Inlets discussed in the report. http://riverhistory.ess.washington.edu/research/tidal_marshes.php
Cramer, M. C., K. Bates, D. Miller, K. Boyd, L. Fotherby, P. Skidmore, and T. Hoitsma. 2003. Integrated Streambank Protection Guidelines. Published by Washington State Aquatic Habitat Guidelines Program.	These guidelines assist individuals, organizations, and state and local governments with addressing streambank erosion concerns through an informed decision-making process, and protecting the public and property while avoiding or minimizing damage to fish and wildlife habitat. http://wdfw.wa.gov/hab/ahg/ispgdoc.htm

Report	Notes
ENVVEST. 2006. Puget Sound Naval Shipyard and Intermediate Maintenance Facility Project ENVVEST Community Update June 2006. Brochure and CD. Marine Environmental Support Office-NW, Space and Naval Warfare Systems Center, Bremerton, WA. August 2006. Ecology Publication Number 06-10-54.	The brochure contains a summary of recent progress and provides links to obtain more detailed information about Project ENVVEST. The compact disk provides an update of activities being conducted by the project. http://www.ecy.wa.gov/biblio/0610054.html
Fresh, K., C. Simenstad, J. Brennan, M. Dethier, G. Gelfenbaum, F. Goetz, M. Logsdon, D. Myers, T. Mumford, J. Newton, H. Shipman, and C. Tanner. 2004. Guidance for Protection and Restoration of the Nearshore Ecosystems of Puget Sound. Puget Sound Nearshore Partnership Report No. 2004-02. Published by Washington Sea Grant Program, University of Washington, Seattle, Washington.	This guidance document presents a framework for a future strategic plan that will guide development and selection of nearshore ecosystem recovery projects. The document also contains criteria for developing and selecting recovery projects until the strategic plan is adopted. http://pugetsoundnearshore.org
Fresh, K. L., D. J. Small, H. Kim, C. Waldbilling, M. Mizell, M. I. Carr, and L. Stamatiou. 2006. Juvenile Salmon Use of Sinclair Inlet, Washington in 2001 and 2002. Washington Department of Fish and Wildlife Report No. FPT 05-08.	This study indicates that Sinclair Inlet is used by three major groups of juvenile Chinook salmon. The first group is hatchery origin fish released into Gorst Creek, typically in late May through the end of June. The second group is hatchery fish from sources outside the Inlet migrating into Sinclair Inlet. This group is present from July to September. The third group is wild juvenile Chinook salmon which could be naturally spawning fish from Gorst Creek or nearby local systems, or from other river systems similar to hatchery fish. Study estimates that 91% of the entire 26 km of surveyed shoreline had armoring or was modified from natural conditions. There was not evidence of consistent differences in diet of hatchery origin and wild juvenile Chinook salmon. Juvenile Chinook salmon appear to be primarily surface and mid-water feeders while juvenile chum salmon were foraging primarily in mid-waters to the bottom. http://wdfw.wa.gov/fish/papers/ps_salmon/index.htm
Gerstel, W. J. and J. F. Brown 2006. Alternative Shoreline Stabilization Evaluation Project Final Report. Prepared for Puget Sound Action Team.	This study evaluated alternatives to traditional shoreline armoring practices and applications at 17 sites in Puget Sound. Findings: Need better agency guidelines/specifications; need better site characterization to reduce project costs and environmental impacts; some sites over-designed due to perceived property owner issues/concerns; need to provide more information to shoreline property owners; contractors had difficulty obtaining specified/appropriate materials for projects.

Report	Notes
Haring, D. 2000. Salmonid Habitat Limiting Factors. Water Resource Inventory Area 15 (East) Final Report. Washington State Conservation Commission. November 2000.	This report addresses habitat conditions that support anadromous salmon and steelhead, based on the stock status designations identified in the Salmon and Steelhead Stock Inventory (SASSI (WDF et al. 1993)). Data included in this report include formal habitat inventories or studies specifically directed at evaluating fish habitat, other watershed data not specifically associated with fish habitat evaluation, and personal experience and observations of the watershed experts involved in the Technical Advisory Group. Prioritized habitat action recommendations are provided for each stream in which salmonid presence has been identified, and for each marine area, following the discussion of identified salmonid habitat concerns.
Hatchery Scientific Review Group - Lars Mobrand (chair), John Barr, Lee Blankenship, Don Campton, Trevor Evelyn, Conrad Mahnken, Paul Seidel, Lisa Seeb, and Bill Smoker. 2003. Hatchery Reform Recommendations, Central Sound. Seattle, WA.	The Hatchery Scientific Review Group (HSRG) reviewed the hatchery programs in the Puyallup River, Green River, Lake Washington, and East Kitsap Peninsula sub-regions. The review involved each identified sub-regional salmonid stock. The review included a consideration of the program's effects on all other hatchery and naturally spawning regional salmonid stocks. This chapter provides an overview of the Central Sound region and each sub-region, followed by reviews and recommendations for each salmonid stock that has an associated hatchery program. http://www.hatcheryreform.us/hrp_downloads/reports/puget_sound/reviews/HSRG_Recommendations_Central_Sound.pdf
Johannessen, J. 2009. Sinclair Inlet Shoreline Charrette, Beach Enhancement Summary, Prepared by Jim Johannessen, Licensed Engineering Geologist, MS, Coastal Geologic Services Inc. Prepared for Puget Sound Restoration Fund, Bainbridge Island, April 30, 2009.	This summary presents the following three enhancement projects for the northwest shoreline of Sinclair Inlet, as discussed during a 2-day design charrette in April 2009: Windy Point—Wright Creek Beach Nourishment, "Viking Fence" Pocket Estuary Enhancement, and Charleston Beach Habitat Diversification and Contaminant Isolation.
Johnston, R. K. J. M Bandenberger, V. Cullinan, C. W. May, B. Beckwith, V. S. Whitney, B. E. Skahill, and D. Metallo. 2008. An Empirical Water Quality Model for Stream and Storm Water Runoff Based on Watershed Land Use and Cover In Puget Sound, WA. Poster presented at South Sound Science Symposium, March 26, 2008, Tacoma, WA.	A watershed-based assessment of stream and storm water pollution runoff in the Sinclair-Dyes Inlet watershed was conducted as part of Project ENVVEST. Contaminant concentrations in representative streams and outfalls discharging into Sinclair and Dyes Inlets were evaluated during 18 storm events and wet/dry baseflow conditions between Nov. 2002 and May 2005. Data from this effort were used to develop empirical models relating stream and storm water quality to upstream land use and cover so that water-quality parameters could be estimated for the entire watershed without having to monitor all sources. http://www.ecy.wa.gov/puget_sound/symposium.html

Report	Notes
Johnston, R. K., D. E. Leisle, J. M. Brandenberger, S. A. Steinert, M. Salazar, and S. Salazar. 2007. Contaminant Residues in Demersal Fish, Invertebrates, and Deployed Mussels in Selected Areas of the Puget Sound, WA. Proceedings of the 2007 Georgia Basin Puget Sound Research Conference, Puget Sound Action Team and Environment Canada.	Contaminant levels in fish and invertebrates from various regions of the Puget Sound were evaluated to characterize tissue residue levels, assess potential ecological and human health impacts, and determine whether chemicals are being biomagnified in the food web. Specimens from Sinclair and Dyes Inlets were collected from PSAMP trawls and a caged mussel study. English sole and ratfish from Sinclair Inlet exceeded the tissue screening values (TSV) benchmark. One ratfish sample from Sinclair Inlet exceeded the no observed effect dose (NOED). The PCBs levels in English sole from Sinclair Inlet, Elliot Bay, and Commencement Bay were similar, but there were large differences in PCB concentrations measured in sea cucumber, crabs, ratfish, rock sole, surf perch, and sculpin collected from Sinclair Inlet compared to the reference locations. The PCBs in edible tissues of English sole, ratfish and crabs from Sinclair Inlet exceeded seafood benchmarks for non-cancer exposure to recreational and tribal fishers. The whole body concentrations of Hg were the highest in ratfish, with maximum concentrations observed in specimens from the Strait of Georgia and Sinclair Inlet. Elevated mercury (Hg) levels above the TSV were measured in samples of ratfish, rock sole, sand sole, sculpin, and mussels from Sinclair Inlet. http://www.engr.washington.edu/epp/psgb/2007psgb/2007proceedings/papers/13e_johns.pdf
Johnston R. K., G. H. Rosen, J. M. Brandenberger, V. S. Whitney, and J. M. Wright, 2009. Sampling and Analysis Plan for Ambient Monitoring and Toxicity Testing for Sinclair and Dyes Inlets, Puget Sound, Washington. Quality Assurance Project Plan, prepared in support of the Puget Sound Naval Shipyard and Intermediate Maintenance Facility Project ENVVEST, August 18, 2009, 70pp.	This document presents the ambient monitoring and toxicity testing sampling and analysis plan for the receiving waters of Sinclair and Dyes Inlets. The sampling plan describes specific sampling activities to assess the impact of contaminants discharged into Sinclair and Dyes Inlets, characterize the status and trend of ecological resources, assess the effectiveness of cleanup and pollution control measures, and determine if discharges from all sources are protective of beneficial uses including aquatic life in the receiving waters of Sinclair and Dyes Inlets. This document identifies the objectives, procedures, and quality assurance/quality control (QA/QC) requirements for sampling to be completed during 2009-2010.
Johnston, R. K, P. F. Wang, E. M. Carlson, A. C. Blake, K. E. Richter, M. C. Brand, C. E. Kyburg, B. E. Skahill, C. D. May, V. Cullinan, W. Choi, V. S. Whitney, D. E. Leisle, and B. Beckwith. 2008. An Integrated Watershed and Receiving Water Model for Fecal Coliform Fate and Transport in Sinclair and Dyes Inlets, Puget Sound, WA. Space and Naval Warfare Systems Center, Draft Final Technical Report, San Diego, CA. 160pp + appendices.	This report documents development, calibration, verification, and evaluation of an integrated model to simulate runoff and transport of fecal coliform (FC) bacteria from the watershed surrounding Sinclair and Dyes Inlets. The model recreated a wide range of dynamic loading from large-scale storm events with high flow conditions, to dry, low-flow conditions during the summer. Although data were limited for many of the stations in Sinclair Inlet, especially near the Shipyard and the Cities of Bremerton and Port Orchard, the model reproduced FC-loading episodes with a high degree of accuracy.

Report	Notes
Johnston, R. K., P. F. Wang, D. J. Small, and K. L. Fresh. 2007. A Hydrodynamic Simulation of a Conservative Tracer to Evaluate Dispersion of Out-Migrating Salmon in Sinclair Inlet, WA. Poster, Georgia Basin - Puget Sound Research Conference, March 26 - 30, 2007, Vancouver, Canada.	A high resolution curvilinear 3-dimensional hydrodynamic model (CH3D) for Sinclair and Dyes Inlets was set up to simulate the hydrological and tidal conditions present during the release of hatchery-reared, juvenile Chinook salmon from the Gorst Creek Hatchery (May 19 - Jun 30, 2002). The comparison indicated that the out-migrating juvenile salmon remained in the Inlet about 3 to 7 days longer than expected from dispersion due to mixing alone. http://www.engr.washington.edu/epp/psgb/2007psgb/2007proceedings/abstracts_html/poster%20sessions/P3.htm#johnston
Katz, C. N., P. L. Noble, D. B. Chadwick, B. Davidson, and R. D. Gauthier. 2004. Sinclair Inlet Water Quality Assessment. Puget Sound Wastewater Technology and Evaluation Research Project, Space and Naval Warfare Systems Center, San Diego, CA.	This report describes water quality data collected in Sinclair Inlet and the adjacent waters of Puget Sound in September 1997, and March and July 1998. Based on circulation patterns, the researches calculated a 57-day residence time for Sinclair Inlet. Conventional water quality measures are conditionally good. Eutrophication appears to be driven by nutrient influx from the Bremerton Publicly-Owned Treatment Works (POTW). Nutrient levels were highest in the inner inlet, where the POTW discharges. Measured metal and Polynuclear Aromatic Hydrocarbons (PAH) concentrations were well below water quality standards. http://www.ecy.wa.gov/programs/wq/tmdl/sinclair-dyes_inlets/sinclair_cd/Reports/ECOS_Survey_Rpt.htm
Kitsap County Health District. 2009. Water Quality Monitoring Report. Kitsap County Health District Water Quality Program.	This report summarizes the Health District's annual monitoring data for streams, lakes, and marine water collected during the 2009 water year (October 2008 – September 2009). During the 2009 water year, stream stations were scheduled to be monitored twelve (12) times and marine water stations six (6) times to characterize seasonal changes in water quality. Anderson Creek - water quality remains very good, stationary trend. Annapolis Creek - water quality improved in last few years, but still with periods of high bacteria concentrations, improving trend. Blackjack Creek - water quality poor, with periods of higher bacteria levels, stationary trend. Gorst Creek - water quality moderate, with periods of elevated bacteria, improving trend. Karcher Creek - water quality very poor, stationary trend. Ross Creek - water quality good, stationary trend. Sacco Creek - water quality very poor since 2004, frequently high levels of FC bacteria, stationary trend. Marine water – 13 out of 14 stations met fecal coliform bacteria standard, some stations exceeded temperature standards, generally during late summer. Overall improving marine water trend, with six of 13 stations showing significant improvement.
Kitsap County Health District Environmental Health Division. 2009. Pollution Identification and Correction Program 2009, Priority Area Work List for the Pollution Identification and Correction Program. Funded through Kitsap County Surface and Storm Water Management. January 2009.	This document ranks water quality problem areas and lists the 2009 Project Area Work List. The Sinclair Inlet Restoration Project is listed as an ongoing project that includes "the shoreline, Gorst SW outfalls, Annapolis, Beaver, Gorst, Ross, Blackjack, Sacco, Anderson, Parish Creeks, etc."

Report	Notes
Kohn N. P., J. M. Brandenberger, L. A. Niewolny, and R. K. Johnston. 2006. Organics Verification Study for Sinclair and Dyes Inlets, Washington. PNNL-16070, Pacific Northwest National Laboratory, Richland, WA.	Report describes Organics Verification Study conducted in 2005. In Sinclair Inlet, the distribution of residual organic contaminants is generally limited to areas immediately adjacent to the actively managed Puget Sound Naval Shipyard and Intermediate Maintenance Facility Superfund Site, where further source-control actions and monitoring are ongoing. http://www.pnl.gov/main/publications/external/technical_reports/PNNL-16070.pdf
Kohn, N. P, M. C. Miller. J. M. Brandenberger, and R. K. Johnston. 2005. Metals Verification Study for Sinclair and Dyes Inlets, Washington prepared by BSML and SSC-SD in support of Puget Sound Naval Shipyard and Intermediate Maintenance Facility Project Project ENVVEST.	The results show that sediment quality in Sinclair Inlet has improved markedly since implementation of cleanup and source control actions, and that distribution of residual contaminants is limited to nearshore areas already within the actively managed Puget Sound Naval Shipyard Superfund Site where further source control actions and monitoring are underway. Outside of the immediate vicinity of the PSNS Superfund site in Sinclair Inlet, the target metals concentrations met state sediment quality standards. http://www.ecy.wa.gov/programs/wq/tmdl/sinclair-dyes_inlets/bacteria_rpt/pnnl-14872.pdf
May, C. W., V. I. Cullinan, et al. 2005. An Analysis of Microbial Pollution in the Sinclair-Dyes Inlet Watershed.	This study relies on historical data collected by several cooperating agencies, in addition to data collected during the study period from spring 2001 through summer 2005. The findings indicate the presence of numerous sources of bacterial pollution in the Sinclair-Dyes Inlet watershed and multiple modes of transport of fecal coliform (FC) bacteria from sources to receiving waters and shellfish growing areas. Underlying sources of bacterial pollution include: 1) failing OWTS, 2) sewage spills, combined sewer overflow events, and failing sewer infrastructure; 3) NPS pollution in stormwater runoff from urbanizing areas; 4) improper or ineffective livestock and pet waste-management practices; and 5) illegal discharges from boats or marinas. Pollution mitigation should include: 1) proper operation and maintenance of onsite septic systems and municipal sewage treatment systems; 2) elimination of all illicit discharges, including land-based sources, boats, marinas; 3) control and treatment of stormwater runoff; 4) implementation of farm and livestock source-control and best management practices; and 5) public education to encourage bacterial pollution source control, such as pet waste-management programs. Also, enhancing natural systems, such as wetlands and riparian buffers, and the use of new technologies, such as innovative disinfection treatments can improve water quality. http://www.ecy.wa.gov/programs/wq/tmdl/sinclair-dyes_inlets/reports-documents.html

Report	Notes
May, C. W. and G. Peterson. 2003. Kitsap Salmonid Refugia Report.	This report identifies, describes and characterizes salmonid refugia areas within Kitsap County. Refugia are categorized A (highest) through D (lowest). Refugia areas are delineated as Focal Sub-Watersheds (FSW), Nodal-Riparian Corridors (NRC), Nearshore and Estuarine Refugia (NSE), and Critical-Contributing Areas (CCA). Sinclair Inlet is the shoreline with the lowest Nearshore-Estuarine score (19%), and is designated as a Category D Nearshore-Estuarine Refugia. • Category A refugia – None in Sinclair Inlet. • Category B refugia - Blackjack Creek headwaters (FSW), Square Creek (FSW), Anderson Creek (NRC), and Blackjack Creek mainstem. (NRC). • Category C refugia - Gorst Creek mainstem (NRC) and the following FSW: Gorst headwaters, Jarstad Creek, Heins Creek, and Ruby Creek. Note that Gorst was designated as Category C due to the influence of the hatchery. Without the hatchery influence, portions of this watershed would likely qualify as a Category B refugia. • Category D refugia - Blackjack Creek middle reaches (NRC) and Wright Creek (NRC). http://www.kitsapgov.com/dcd/nr/refugia/kitsap_refugia_report_2003.pdf.
Penttila, D. E. 2001. Effects of Shading Upland Vegetation on Egg Survival for Summer-Spawning Surf Smelt, Hypomesus, on Upper Intertidal Beaches in Northern Puget Sound. In: Proceedings of Puget Sound Research, 2001 Conference. Puget Sound Action Team, Olympia, WA.	Study results strongly suggest shading terrestrial vegetation of the "marine riparian corridor" has a positive effect on the survival of surf smelt spawn incubating in sand-gravel beaches in the upper intertidal zone during the summer months in the Puget Sound basin.
Puget Sound Partnership. 2009. Puget Sound Action Agenda. Protecting and Restoring the Puget Sound Ecosystem by 2020. December 1, 2008, updated May 27, 2009.	The Action Agenda establishes a unified set of actions that are needed to protect and restore Puget Sound. The Partnership lists five strategic priorities to achieve progress: protect intact processes, structures and functions; restore damaged processes, structures and functions; prevent water pollution; work together; and build an implementation, monitoring, and accountability management system. Sinclair Inlet is within the North Central Puget Sound Action Area.
Rice, C. A. 2006. Effects of Shoreline Modification on a Northern Puget Sound Beach: Microclimate and Embryo Mortality in Surf Smelt (*Hypomesus pretiosus*). Estuaries and Coasts 29 (1):63-71.	Study evaluates differences between natural and heavily modified beaches in terms of microclimate and one aspect of biological condition. Microclimate conditions on the modified beach were more variable, indicative of a less buffered environment. The proportion of smelt eggs containing live embryos on the altered beach was approximately half that of the natural beach.

Report	Notes
Saldi-Caromile, K., K. Bates, P. Skidmore, J. Barenti, and D. Pineo. 2004. Stream Habitat Restoration Guidelines: Final Draft. Co-published by the Washington Departments of Fish and Wildlife and Ecology and the U.S. Fish and Wildlife Service. Olympia, Washington.	The first step in stream habitat restoration is to conduct an adequate watershed analysis and assessment, which characterizes watershed processes. Watershed-scale assessment should include adequate evaluation of hydrology and geomorphology of the stream system, to characterize flows and extent of channel degradation or integrity. Preferred approach should be stream restoration accompanying watershed restoration. Prefer less invasive design approaches (e.g., riparian livestock exclusion, appropriate revegetation) over more invasive and aggressive channel modifications or structures, (e.g., log or root wad placement). Streams have a remarkable ability to heal over time once the cause of their degradation is removed. Approaches that address degrading and destabilizing changes in the watershed are often sufficient and more appropriate than aggressive instream activities. http://wdfw.wa.gov/hab/ahg/shrg/index.htm
Simenstad, C, M. Logsdon, K. Fresh, H. Shipman, M. Dethier, and J. Newton. 2006. Conceptual Model for Assessing Restoration of Puget Sound Nearshore Ecosystems. Puget Sound Nearshore Partnership Report No. 2006-03. Published by Washington Sea Grant Program, University of Washington, Seattle, Washington.	The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) Nearshore Science Team (NST) has developed a Conceptual Model framework to aid in assessing restoration and preservation measures for nearshore ecosystems in Puget Sound, Washington. This framework was designed primarily as a synthesis tool to better understand nearshore ecosystem processes and the response of nearshore ecosystems to different stressors or, alternatively, restoration actions. It may also serve as a tool to plan and guide the scientific elements of the restoration project. http://pugetsoundnearshore.org.
Small, D. J., R. Bazzell, T. Livesey, J. Pavy, T. Snyder and C. Waldbillig, 2007. Monitoring Shoreline Habitat Restoration Sites for Forage Fish Use in Sinclair and Dyes Inlet, Washington. Poster, Georgia Basin - Puget Sound Research Conference, March 26 - 30, 2007, Vancouver, Canada.	Many of the former high intertidal areas of Sinclair and Dyes Inlets have been lost due to filling and armoring. Yet, forage fish spawning sites persist in nearly all pockets of beach with intact upper beach profiles. Monitoring and documentation of existing sites is useful to promote successful strategies and avoid potential problems in habitat restoration design. Authors monitored forage fish use and physical parameters associated with two beach restoration sites built in 2000 and 2002 (Jackson Park, Charleston Beach) and a nearby natural site (Ross Point). Beach profiles steepened in the upper beach, most noticeably at one section of Charleston Beach which lost nearly all of the supplemental beach material. Forage fish spawning density, mortality and frequency varied by location, with greatest mortality at the restoration sites even when densities were similar. Lessons learned through monitoring existing restoration sites will help guide future restoration project design. http://www.engr.washington.edu/epp/psgb/2007psgb/2007proceedings/abstracts_html/poster%20sessions/P6.htm

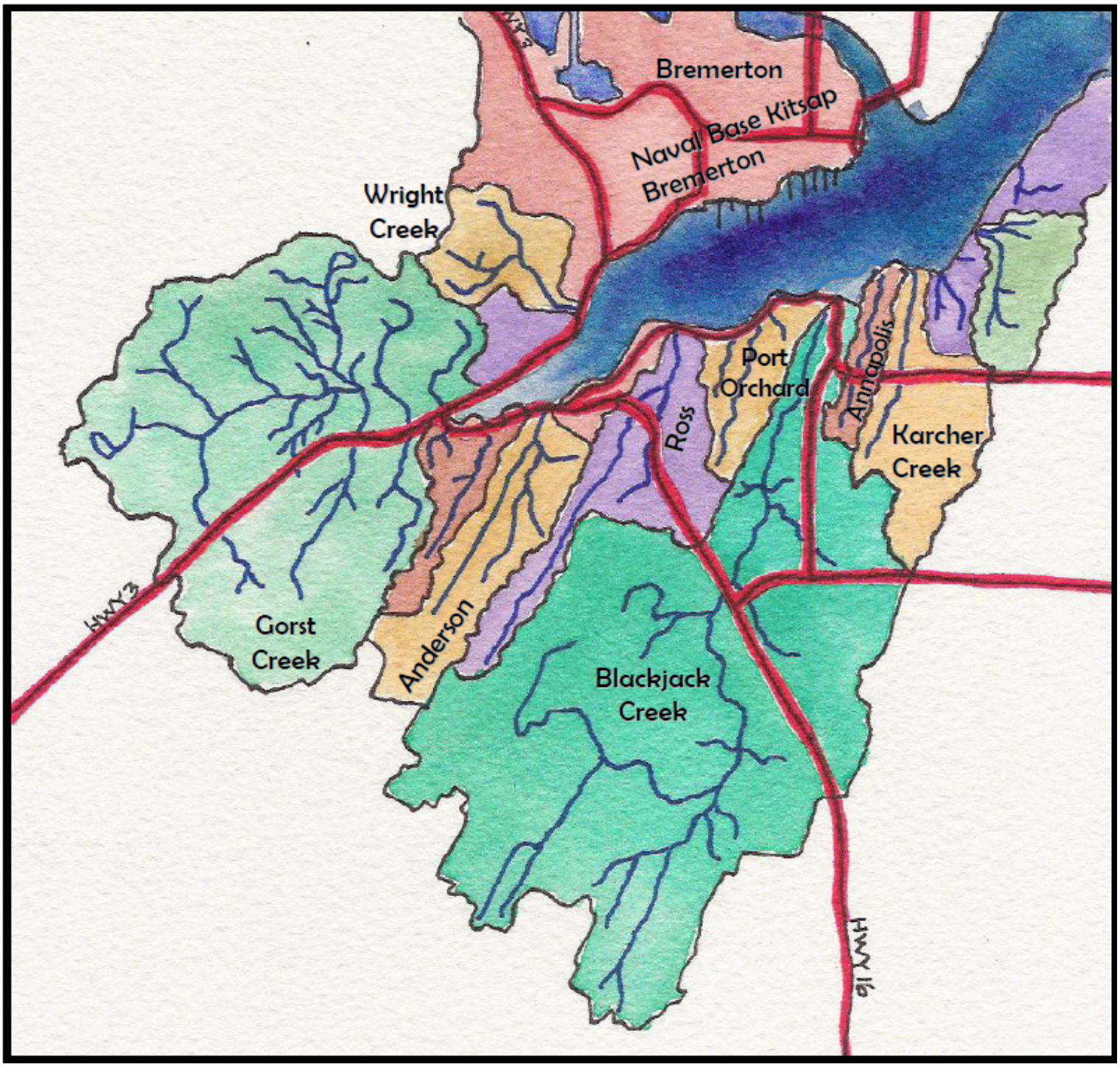
Report	Notes
Toft, J. D., C. Simenstad, J. Cordell, and L. Stamatiou. 2004. Fish Distribution, Abundance, and Behavior at Nearshore Habitats Along City of Seattle Marine Shorelines, with an Emphasis on Juvenile Salmonids. Technical Report SAFSUW-0401, School of Aquatic and Fishery Sciences, University of Washington. Prepared for Seattle Public Utilities, City of Seattle. 51 pp.	Overall, report results indicate that shoreline modifications have the most dramatic effect on nearshore fish densities and behaviors when the alterations extend from the supratidal through the subtidal zone.
URS 2002. Final RI Report, Bremerton Naval Complex OU B Section 3.0, U.S. Navy CLEAN Contract Revision No. CTO 0131, Engineering Field Activity, Northwest, 03/12/02 Contract No. N62474-89-D-9295.	Report presents the findings and conclusions drawn from the physical investigations performed throughout the Operable Unit (OU) B Remedial Investigation. The cultural geography and socioeconomics, ecology, meteorology/climate, surface water hydrology, geology, and hydrogeology of OU B are also discussed.
U.S. Coast and Geodetic Survey	U.S. Coast and Geodetic Survey T-sheets in NAD27 and NAD83/HARN datums, UTM Zone 10N, along with the original unreferenced images. Descriptive reports for the individual T-sheets are provided where digital copies were available. The Puget Sound Nearshore Project and the Washington DNR Aquatic Resources Division funded preparation of this data. http://riverhistory.ess.washington.edu/tsheets/framedex.htm
U. S. Navy. 2008. CVN Maintenance Wharf Mitigation Plan, Naval Base Kitsap Bremerton. NAVFAC Northwest.	This plan describes mitigation for impacts to species and habitat associated with the construction of a new carrier wharf at NAVBASE Kitsap Bremerton. The report documents the Navy's mitigation site selection, including consideration of the following potential mitigation projects: Pier 8 shore rehabilitation, Beaver Creek estuary restoration, Keyport shallow lagoon tidal enhancement, Beaver Creek culvert replacement, Jarstad Creek culvert replacement, Charleston Beach restoration, and railroad armoring removal near Gorst.
U.S. Navy, U.S. EPA, and Washington State Department of Ecology 2000. Project ENVVEST: Phase I Final Project Agreement for the Puget Sound Naval Shipyard, September 25, 2000 [Federal Register: October 23, 2000 (Volume 65, Number 205)].	This agreement is the first phase of the Navy's effort to develop and demonstrate an alternative strategy for managing pollutant sources, and to protect and improve the health of surface waters in Sinclair Inlet and Dyes Inlet. Phase I will be a study/research project. In Phase II, the Navy and stakeholders will use data gathered in Phase I to develop and propose alternative regulatory approaches. http://www.epa.gov/ProjectXL/puget2/fpasigned.pdf
Wang, P. F., R. K. Johnston, H. Halkola, R. E. Richter, and B. Davidson. 2004. A Modeling Study of Combined Sewer Overflows in the Port Washington Narrows and Fecal Coliform Transport in Sinclair and Dyes Inlets, Washington. Prepared by SSC San Diego for Puget Sound Naval Shipyard and Intermediate Maintenance Facility Project ENVVEST, Final Report, June 18, 2004, 26 pp.	This document presents the results of the study to model discharges from Combined Sewer Overflows (CSOs) in the Port Washington Narrows in Sinclair and Dyes Inlets, WA. The ability to simulate fecal coliform (FC) fate and transport in the Inlets assisted in reopening 1500 acres of shellfish beds in Dyes Inlet. The model is currently being used to support the development of a water clean-up plan for the Sinclair/Dyes Inlet watershed to improve the environmental quality of the watersheds. http://www.ecy.wa.gov/pubs/0503042appf.pdf
Washington Department of Ecology 2001, Shoreline Aerial Photographs.	http://apps.ecy.wa.gov/shorephotos

Report	Notes
Washington Department of Fish and Wildlife. 2009. Landscape Planning for Washington's Wildlife: Managing for Biodiversity in Developing Areas. 88 pp + App. Olympia, WA.	This guidance document helps local land use and conservation planners consider biodiversity in the planning process. The document goal is to provide information for planners and others to use in minimizing the impacts of development to terrestrial wildlife, and to conserve biodiversity that supports healthy, native wildlife populations. The document provides science-based recommendations. Wildlife is best served by: • Keeping large connected patches of undeveloped native vegetation intact. • Encouraging and maintaining low zoning densities within and immediately surrounding high value habitat areas and encouraging maintenance of native vegetation. • Managing road systems to minimize the number of new roads and new barriers to important animal movement corridors. • Planning open space to incorporate high-value habitat and corridors for animal movement. • Zoning for higher densities within urban and developed landscapes to avoid sprawl. http://wdfw.wa.gov/hab/phs/landscaping/landscape_planning_wildlife.pdf

APPENDIX A

Sinclair Inlet Existing Conditions Data Compilation (URS Greiner, Inc. and SAIC 1999)

Provided on Reference CD



SINCLAIR INLET

ENHANCEMENT OPPORTUNITIES
(AQUASCAPE II)