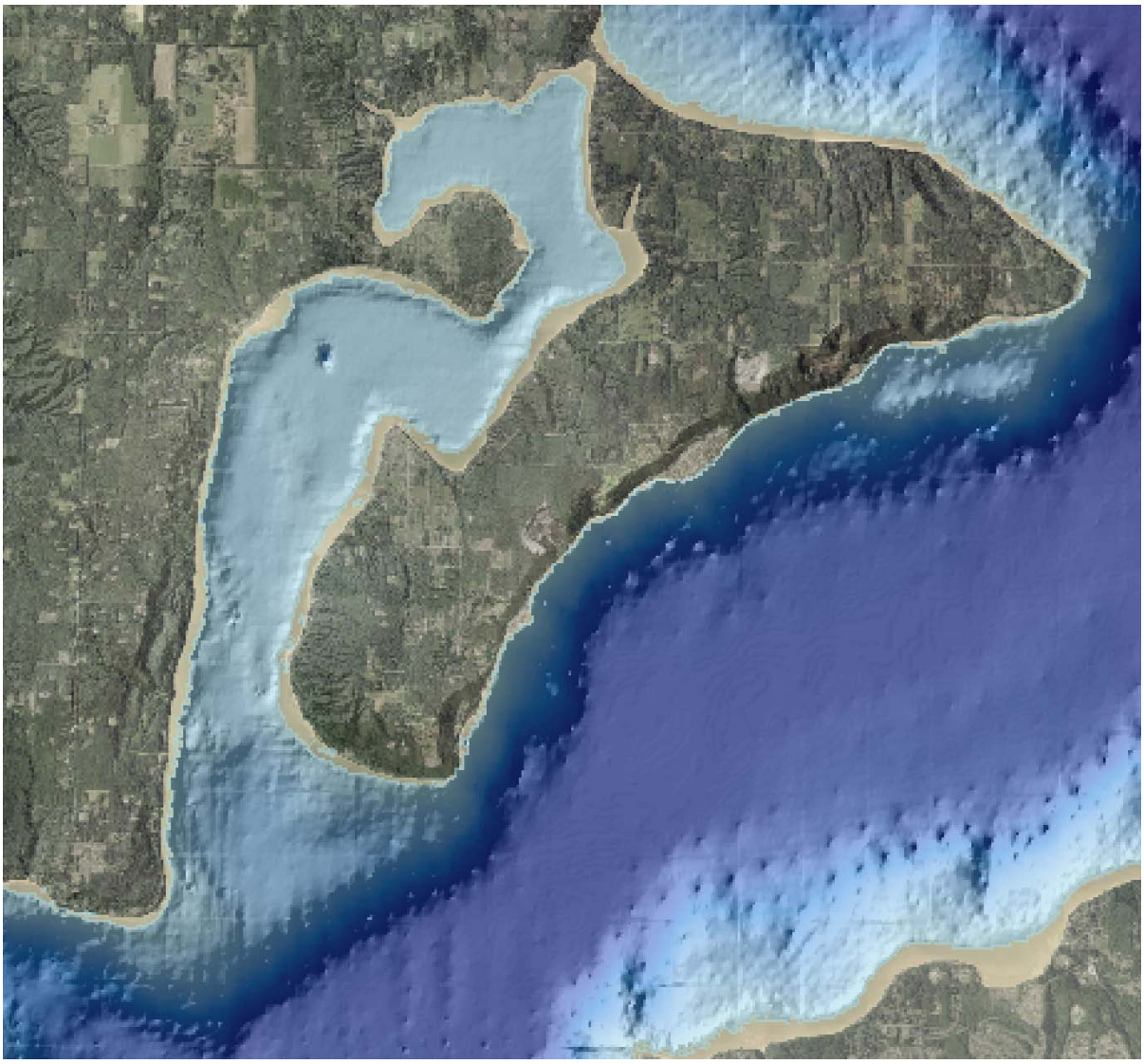
Washington Department of Natural Resources
Aquatic Resources Division - Aquatic Reserves Program



Maury Island Environmental Aquatic Reserve
Draft Management Plan

July 13, 2004

WASHINGTON STATE DEPARTMENT OF
Natural Resources
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1.0 Executive Summary

The Washington State Department of Natural Resources (DNR) manages 2.4 million acres of aquatic lands in Washington to provide a balance of public benefits for the people of the state. These lands include shorelands, tidelands, and bedlands in the Puget Sound, along the Pacific Coast, and many freshwater navigable rivers and lakes throughout the state. Washington Administrative Code 332-30-151 establishes the guidance for DNR to establish aquatic reserves to ensure environmental protection of state-owned aquatic lands.

> The Maury Island Aquatic Reserve was established as an environmental reserve to ensure environmental protection of the unique habitats and species identified in the area.

This plan identifies the habitats and species in the reserve and the actions that will be employed to protect these resources. The management emphasis will place protection of these resources above other management activities.

> In general, within its statutory authority, DNR will limit new and continued uses in the reserve that may adversely affect the habitats and species identified for conservation within the reserve. New and continued activities authorized within the reserve must also implement actions that primarily serve the objectives of the reserve designation in support of the desired future conditions described in section 4.5.

The following management goals are established for the reserve:

- Conserve, at a minimum, and enhance, where there are opportunities, native habitats and associated plant and wildlife species, with a special emphasis on forage fish, salmonids, and migratory birds.
- Protect and restore the functions and natural processes of nearshore ecosystems in support of the natural resources of the reserve.
- Promote stewardship of riparian and aquatic habitats and species by providing education and outreach opportunities and promoting coordination with other resource managers.
- Support traditional recreational, commercial, and cultural uses in and adjacent to the site and promote responsible management of these uses in a manner consistent with the reserve goals.

The management plan will be reviewed and updated as necessary every ten years throughout the 90-year term of the reserve designation. Changes in site conditions of habitats and species, and existing uses of state-owned aquatic lands will be included in the updates. Research and monitoring results will be used to guide DNR in determining if management actions are meeting the goals and objectives of the reserves. If management actions are not supporting the objectives for the reserve, then they will be modified, monitored, and evaluated during the following 10-year review process in accordance with adaptive management strategies.

for the reserve, then they will be modified, monitored, and evaluated during the following 10-year review process in accordance with adaptive management strategies.

This plan is based on a collection of available research on aquatic resources at the site and over 18 months of public outreach. The interests expressed by the citizens of Vashon and Maury Islands, county and state government, the Puyallup Tribe, non-government organizations, and other groups and individuals to promote the conservation of aquatic resources and maintain the quality of life at the site guided the development of the plan.

2.0 Introduction

The DNR is directed by the Revised Code of Washington (RCW) to manage state-owned aquatic lands to provide a balance of public benefits that include encouraging public access, fostering water-dependent use, ensuring environmental protection, and utilizing renewable resources. In addition, the DNR is directed to generate revenue from state-owned aquatic lands when it is consistent with the other public benefits. The DNR is further authorized in RCW 79.10.210 and RCW 79.90.460(3) to manage the state's sensitive aquatic lands and to remove them when necessary from conflicting uses. As part of this authority, under Washington Administrative Code (WAC) 332-30-151 DNR can establish environmental, scientific, and education aquatic reserves. The reserve along the shores of Vashon and Maury Islands, was established as an environmental aquatic reserve in 2000, and confirmed as a reserve candidate in 2003, to conserve and enhance important habitats and species.

2.1 Statewide Aquatic Reserve Program Goals

The Non-Project Final Environmental Impact Statement Aquatic Reserves Program Guidance (EIS) (DNR 2002) specified that the goal of the Aquatic Reserve Program is to serve as a tool to help DNR ensure environmental protection, preservation, and enhancement on state-owned aquatic lands. While DNR manages for a balance of public benefits on all state-owned aquatic lands, the emphasis within reserves is on ensuring environmental protection. The other public benefits may take place within reserves, but they will be a lesser priority and may occur only if they meet the criteria established in this plan under Section 5.2.

2.2 Statewide Environmental Aquatic Reserve Objectives

The objectives specified in the programmatic EIS for environmental aquatic reserves include environmental protection, preservation, and enhancement of state-owned aquatic lands through: conservation of ecological functions; conservation of areas with cultural and historical significance; and enhancement with the goal of returning degraded systems to better functioning conditions. This plan outlines the site-specific goals and management strategies for the reserve.

2.3 Legal Authorities for Establishing Aquatic Reserves

The constitutional authority for the proprietary management on state-owned aquatic lands are derived from Articles XV and XVII of the Washington State Constitution. The Legislature delegated the responsibility for management of state-owned aquatic lands to DNR in RCW Chapter 79.90 through Chapter 79.96. The DNR's management of state - owned aquatic lands is governed by RCW Chapter 79.90 through Chapter 79.100 and certain provisions of RCW Chapter 79.01 through Chapter 79.80, RCW Chapter 43.12, RCW 43.30, and applicable WACs.

RCW 79.90.455 identifies environmental protection, the overarching goal of the Aquatic Reserve Program, as one of DNR's primary mandates for the management of state-owned aquatic lands. RCW 79.10.210 further authorizes DNR to identify and withdraw from all conflicting uses public lands that can be utilized for their natural ecological systems. WAC 332-30-151 directs DNR to consider lands with educational, scientific, and environmental values for aquatic reserve status, and identifies management guidelines for aquatic reserves. WAC 332-30-106(16) defines environmental reserves as sites of environmental importance, which are established for the continuance of environmental baseline monitoring and/or areas of historical, geological, or biological interest requiring special protective management.

2.4 Maury Island Environmental Aquatic Reserve Description and Location

The reserve is located in central Puget Sound and southwestern King County (see Appendix A for a legal description of the site). The reserve includes approximately 5,530 acres of state-owned aquatic bedlands and tidelands in Quartermaster Harbor and along the east and south shore of Maury Island, extending from Neill Point to the shores between Point Robinson and Luana Beach (Figure 1). The reserve consists mostly of subtidal areas, which are bedlands owned by the state. The state also owns approximately 12 percent of the intertidal areas (tidelands) of Quartermaster Harbor and the east side of Maury Island, which are also included within the reserve. The remainder of the tidelands adjacent to the reserve are not owned by the state and therefore are not included within the boundaries of the reserve (Figure 1). The reserve boundary extends waterward to a depth of 70 feet (21.4 meters) below mean lower low water, or one-half mile from the line of extreme low tide whichever is further waterward.

2.5 Purpose for Establishing the Maury Island Aquatic Reserve

Washington's marine ecosystems can be divided into three primary systems - the Columbia River Littoral Cell, the Olympic Coast, and the Georgia Basin, which includes Puget Sound (Ebbesmeyer et al. 1984). Nine sub-basins, based on oceanographic conditions, have been defined for the Georgia Basin, with the reserve located in the central Puget Sound sub-basin (Omernik and Gallant 1986). The reserve and its associated habitats and species are important components for conservation in the central Puget Sound sub-basin. The reserve was established for the conservation of several unique ecological features:

1. The boundaries of the reserve include nearly all of the known Quartermaster Harbor herring stock spawning grounds (Appendix G). These spawning grounds represent one of only 18 distinct Pacific herring spawning areas in Puget Sound. The reserve also includes a small portion of the herring stock's pre-spawning holding area.
2. The reserve contains Chinook salmon migratory corridors and rearing areas, bottom fish rearing habitat, and possibly bull trout migratory corridors.
3. Quartermaster Harbor was identified by the Audubon Society as an Important Bird Area and, in particular, an important area for wintering marine birds, especially western grebes.

4. Harbors and bays, the size of Quartermaster Harbor, are relatively uncommon in Puget Sound, and most have been heavily influenced by human development.
5. The reserve also includes the eastern shore of Maury Island. This area supports a unique, uninterrupted drift cell (area of mud, sand, or gravel material moved in the nearshore zone by waves and currents) that converges at Point Robinson with another drift cell along the northern shore of Maury Island (Appendix D). This convergence zone provides sediment to a sand spit located at Point Robinson. Drift along the south and east shore of Maury Island is northeast from Piner Point to the convergence zone at Point Robinson, with no reversals in direction. Such long, relatively uninterrupted drift cells are becoming a rare occurrence in the central Puget Sound region. These physical features are critical for the maintenance and development of accretional shore features. This drift cell feeds a minimally armored sand spit found at Point Robinson, which is also an increasingly uncommon occurrence within Puget Sound.
6. The reserve is unique within the central Puget Sound sub-basin because it has a diverse set of habitats and species that include extensive eelgrass beds, kelp beds, sand and mudflats, and herring, surf smelt, and sand lance spawning grounds.

2.6 Relationship to other Federal, State, Local, and Tribal Management

The reserve is located within the Puyallup Tribe's exclusive usual and accustomed fishing area. As such, it is essential that conservation goals and management activities be established to not conflict with the Puyallup Tribe's management and interests. The DNR will engage in a government-to-government dialog with the Puyallup Tribe to ensure that their treaty rights and trust responsibilities are upheld throughout the 90-year term of the reserve.

The successful management of the reserve will require coordination and collaboration with public and private entities at the local, state, federal, and tribal levels. The DNR will serve as the administrative lead for reserve management, but will seek active participation from other government and non-government entities listed in Appendix B. In the long-term, the DNR may seek to establish a management advisory group (which may consist of representatives from the groups identified in Appendix B) that focuses on local issues and management coordination for the reserve. In the short-term, management of the reserve will include attempts to coordinate and collaborate with the entities listed in Appendix B.

2.7 Planning Process

This management plan was developed in accordance with the State Environmental Policy Act (SEPA). The environmental impacts associated with the plan were evaluated in a Supplemental Environmental Impact Statement. The management plan shall serve as DNR's primary management guidance for the 90-year term of the reserve. Every ten years after the adoption of the plan, it shall be reviewed and updated with current scientific, management, and site-specific information. During the development of the original plan and each subsequent update, the DNR shall work with other jurisdictions, Tribes, interest groups, and local citizens to establish cooperative management actions for activities within and adjacent

to the reserve to conserve habitats and species within the reserve.

2.8 Management Actions Overview

The management plan addresses the following primary management actions:

- Research and Monitoring: DNR will emphasize the establishment of the baseline ecological conditions within the reserve, development of a monitoring database, and identification of the appropriate timing and methods for effectiveness monitoring. Effectiveness monitoring defined in Section 5.1.2 will help to evaluate the success of management actions in meeting the goals and objectives described in Section 3.0 for the reserve.
- DNR Management Guidance for Activities on State-Owned Aquatic Lands: The aquatic reserve is located on state-owned aquatic lands managed by DNR and does not include private or other public tidelands or uplands adjacent to the reserve. Sections 5.2 and 5.3 define DNR's management strategies for activities that occur within the reserve. Management of the reserve will focus on activities that DNR has direct proprietary authority over, such as existing, pending, and proposed uses of state-owned aquatic lands.
- Activities on Private and Public Land Adjacent to the Reserve: The DNR does not have regulatory or proprietary authority over private and public aquatic lands and uplands that are not owned by the State of Washington. Section 5.4 describes activities that adjacent landowners and managers may voluntarily consider to contribute to the success of the reserve.

Figure 1: Maury Island Aquatic Reserve
For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm

3.0 Maury Island Environmental Aquatic Reserve Goals and Objectives

The reserve was designated to conserve (preserve, restore, and/or enhance) the habitats and species that make the site unique. The proposed Maury Island Aquatic Reserve goals are broad statements of desired future condition. The DNR has formulated the following goals to conserve the critical habitats and associated species identified in Section 4.0 and Appendix C, including:

I. Preserve, or restore and enhance where there are opportunities, native habitats and associated plant and wildlife species, with a special emphasis on forage fish, salmonids, and migratory birds.

II. Preserve, or restore and enhance the functions and natural processes of nearshore ecosystems with a special emphasis in support of the natural resources of the reserve.

III. Promote stewardship of riparian and aquatic habitats and species by providing education and outreach opportunities and promoting coordination with other resource managers.

IV. Support traditional recreational (i.e., boating, water skiing, fishing), commercial (i.e., marinas), and cultural uses in and adjacent to the site and promote responsible management of these uses in a manner consistent with the other goals for the reserve.

In contrast, Aquatic Reserve objectives reflect what will be achieved to meet a particular goal. When possible, reserve objectives are intended to be specific, measurable, achievable, and results oriented. The proposed objectives are listed below as they apply to each of the reserve goals.

I. Preserve, or enhance where there are opportunities, native habitats and associated plant and wildlife species, with a special emphasis on forage fish, salmonids, and migratory birds.

This goal will be achieved by:

- *Protecting fish spawning and rearing habitat and movement corridors.* Protect documented spawning and rearing areas from impacts associated with new developments on state-owned aquatic lands. Over time, eliminate the impacts associated with existing developments on state owned aquatic lands that affect ecological functions that support spawning and rearing habitat. Desired future conditions for forage fish habitat and salmon spawning, rearing, and migratory habitats are described in sections 4.5.8 and 4.5.9.
- *Identifying and minimizing sources of fish mortality resulting from human activities.* Continue monitoring efforts to identify interactions between fish and toxic materials, low dissolved oxygen conditions, and nutrients within the reserve. Wherever possible, eliminate sources of mortality resulting from human activities as they are identified.
- *Maintaining Clean Water Act standards for water and sediment quality.* Maintain water and sediment quality such that listing of waterbodies or segments within the

reserve as impaired under the Clean Water Act is unnecessary. Desired future conditions for water and sediment quality are described in section 4.5.2.

- *Sustaining or increasing the documented extent and species composition of native aquatic vegetation.* A biomass index comprised of bed area and bed density will be established to reflect native kelp and eelgrass bed conditions at reserve establishment. The biomass index of eelgrass and kelp beds should not decrease due to anthropogenic impacts from the baseline level that reflect the area and density at reserve establishment. Desired future conditions for kelp and eelgrass beds are described in sections 4.5.6 and 4.5.7.
- *Protecting and restoring intertidal sand and mudflats.* Maintain the total area of sand and mudflats documented to exist at the time the reserve is established. Desired future conditions for intertidal sand and mudflats are described in section 4.5.5.
- *Preventing non-indigenous organisms from invading or disrupting the ecosystem.* Prevent non-indigenous species not already found within the reserve from establishing populations within the reserve. For those established non-indigenous species that have the capacity to disrupt the ecosystem, undertake appropriate management actions to reduce the abundance and threat to the ecosystem posed by the non-indigenous organisms.
- *Protecting nearshore migratory bird habitat.* Maintain undisturbed shoreline habitats where birds can rest and feed during their annual winter migration. Desired future conditions for marine bird habitat are described in section 4.5.10.
- *Support the recovery and protection efforts for Federal and State threatened and endangered species, species of special concern and their habitats.* Identify, monitor and protect all special-status plant and animal species found in the reserve, focusing on species that are state or federally listed, proposed for listing, or candidates for listing. DNR will work with WDFW, NOAA and USFWS to support recovery of Chinook salmon and bull trout, if present, by protecting and restoring suitable habitats within the reserve.

II. Protect and restore the functions and natural processes of nearshore ecosystems in support of the natural resources of the reserve.

This goal will be achieved by:

Maintaining the integrity and function of nearshore drift cell processes. Support voluntary efforts to reduce impacts of shoreline modification on nearshore drift cell processes. Target a reduction of shoreline hardening to less than 30 percent of the shorelines throughout the reserve. Support restoration projects that demonstrate ecological benefits and feasibility of shoreline softening to shoreline landowners. Desired future conditions for nearshore drift cells are described in section 4.5.3.

- *Protecting and restoring hydrologic functions and water quality of stream mouth estuaries.* Support efforts to maintain natural flow regimes in streams and seeps

entering the reserve. Desired future conditions for stream mouth estuaries are described in section 4.5.4.

- *Working cooperatively to identify and minimize existing and potential future impacts on the nearshore environment resulting from outfalls and runoff discharging to the reserve.* Monitor nearshore water quality for signs of impairment resulting from outfalls or runoff discharging to the reserve. Support local efforts to manage and treat stormwater, sewage, and gray water discharging to the reserve.

III. Promote stewardship of riparian and aquatic habitats and species by providing education and outreach opportunities and promoting coordination with other resource managers.

This goal will be achieved by:

- *Promoting voluntary habitat conservation efforts within and adjacent to the reserve.* Provide trainings and educational materials to shoreline owners describing conservation benefits, best practices, and conservation incentive programs. Establish relationships with local stakeholders to support the reserve's function in providing ecosystem services to the local community.
- *Creating opportunities for public involvement in the management of the reserve.* Create and distribute annual summaries of reserve related activities, achievements and programs. Form and support diverse, stakeholder-based groups to give meaningful, timely input to the DNR regarding the Maury Island Aquatic Reserve.
- *Supporting scientific research and education related to management of the reserve through identifying and prioritizing research needs in relation to the goals identified in this section.* The reserve will work with other agencies and organizations to provide assistance to other programs by designing, conducting, or hosting at least one regionally based environmental education field trip, workshop, seminar, or study course each year. Partner with educational groups to develop and post interpretative materials describing natural resources found within the reserve.

IV. Support traditional recreational (i.e., boating, water skiing, fishing), commercial (i.e., marinas), and cultural uses in and adjacent to the site and promote responsible management of these uses in a manner consistent with the other goals for the reserve.

This goal will be achieved by:

- *Working in cooperation with lessees and recreational user groups to minimize and reduce identified impacts of human activities on the species and habitats within the reserve.* The DNR will take a leadership role in developing and strengthening partnerships, including working with volunteers, and will conduct a variety of outreach efforts to more effectively achieve reserve goals and contribution to the protection and enhancement of the aquatic ecosystems of Vashon and Maury islands.

- *Fostering public access to state-owned aquatic lands within the reserve in a manner consistent with the other management goals for the site.* Work with partners to provide safe and attractive opportunities to access public lands within and adjacent to the reserve. The reserve will provide a variety of quality boat and bank interactions with aquatic resources that are safe, consistent with state regulations, and compatible with reserve resources and purposes.

- *Supporting the integrity of adjacent archaeological, cultural, or historical sites.* The reserve will promote a deeper appreciation and understanding of the archaeological, cultural, and historical sites adjacent to the reserve. Desired future conditions for archaeological, cultural, and historical resources are described in section 4.5.11.

4.0 Reserve Resource Descriptions

A detailed description of natural resources found within and adjacent to the reserve is provided in Appendix C. This section includes a brief overview of the distinctive ecological zones, habitats, species, and archaeological, cultural, and historical resources found within or adjacent to the reserve and their desired future conditions. The desired future conditions represent the goal for the resource and the proposed activities for achieving these conditions.

Natural resource descriptions summarized here and provided in Appendix C benefit from research associated with a Quartermaster Harbor Marine Park Study completed in 1975, research associated with development proposals for the Piner Point – Point Robinson nearshore, and other available sources. However, there are gaps in the scientific understanding of the distribution and abundance of many natural resources in this reserve. Research and monitoring described in Section 5.1 of this document will allow DNR to minimize these gaps and adopt more specific management actions for the reserve.

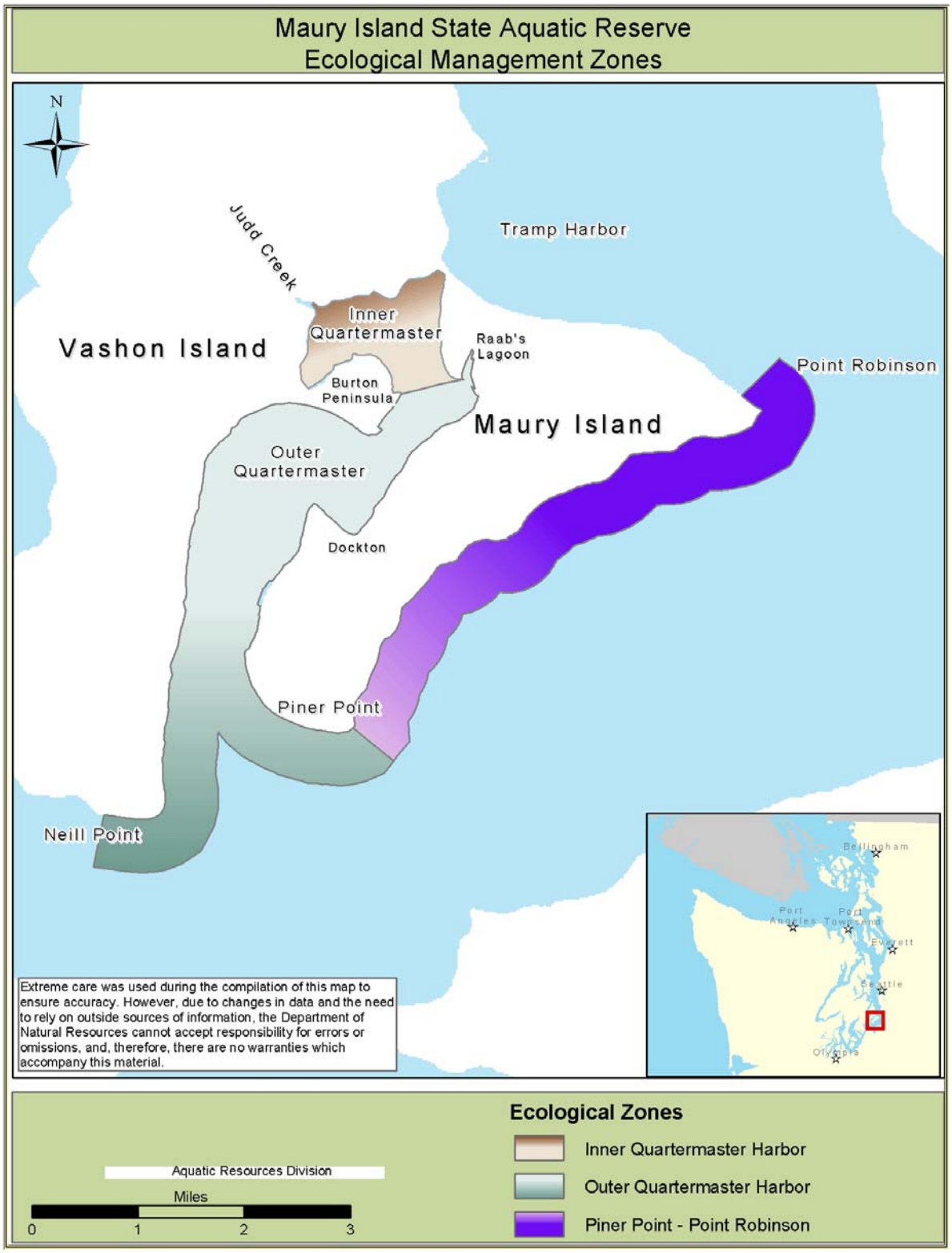
4.1 Ecological Zones

The reserve is divided into three distinct ecological zones (Figure 2), each with substantial differences in the associated natural resources, ecological processes, and management needs. The following management units have been established for the reserve:

1. Inner Quartermaster Harbor: Inner Quartermaster Harbor is the most protected portion of the harbor with very weak or indeterminate currents created by tide and wind conditions (Turnbeaugh 1975). The subtidal sediments in this area are classified as mud, but the mud is much deeper than areas in outer Quartermaster Harbor (Blau 1975).
2. Outer Quartermaster Harbor: The delineation between inner and outer Quartermaster Harbor is the transition area between Burton Peninsula and Raab's Lagoon (Figure 2). With the exception of the area around Dockton, outer Quartermaster Harbor experiences much higher wave exposure, currents, and circulation. The waters in inner and outer Quartermaster Harbor are warmer, less saline, and have a higher residency time than waters offshore of Maury Island's east shore.
3. Piner Point - Point Robinson Nearshore (also referred to as the east shore of Maury Island). The east shoreline of Maury Island from Piner Point to Point Robinson are much more exposed and transition to deeper offshore waters. Nearshore currents direct sediment movement towards the northeast, supporting the sand spit known as Point Robinson.

Figure 2: Ecologic Management Zones

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm



4.2 Habitats

Quartermaster Harbor is a relatively shallow, protected embayment between Vashon and Maury Islands. The eastern shoreline of Maury Island includes a high-energy marine shoreline that extends from the mouth of Quartermaster Harbor north to Point Robinson. Significant habitats in the reserve include: extensive eelgrass (*Zostera marina*); kelp beds (*Laminaria saccarhina* and *Nereocystis leutkiana*); a relatively uninterrupted drift cell along the east shore of Maury Island moving northeast to Point Robinson; a sand spit at Point Robinson; and other sand and mudflats. Transition zones between freshwater surface flows and the marine waters of the reserve include the estuaries at the mouth of Judd Creek, Fisher Creek, and Raab's Lagoon. Numerous smaller streams and seeps deliver freshwater to Quartermaster Harbor and Maury Island's east shoreline and can have large seasonal effects on habitat conditions.

4.3 Species

While fish and wildlife populations have not been thoroughly inventoried, the reserve appears to support a high level of biodiversity. Compared to urban bays in central Puget Sound, Quartermaster Harbor supports a larger diversity of fish and invertebrates. Studies of fish species found in both Puget Sound urban bays and Quartermaster Harbor reveal that the fish within Quartermaster Harbor were significantly larger in size. Fish species found in Quartermaster that are absent from urban bays include: Spiny dogfish, spotted ratfish, longnose skate, rock sole, starry flounder, speckled sanddab, pile surfperch, striped surfperch, bay goby, blackbelly eelpout, bay pipefish, and plainfin midshipman (Gibson et al. 2000).

Species lists (Appendix C) for Vashon and Maury Island suggests that 78 bird species associated with marine or shoreline habitats are found on the islands (Blau 1975). The highest occurrences and diversity of bird species are found in Quartermaster Harbor during winter and occur at much lower levels or are absent during the rest of the year. Marine mammals that visit the reserve include river otters, harbor seals, and less frequently killer whales, harbor porpoises and California sea lions. Regionally important species or populations and associated habitats of interest within the reserve include: forage fish spawning grounds, including herring, surf smelt and sand lance; salmonid (i.e., Chinook, coho, chum, steelhead, cutthroat) rearing areas and migratory corridors, bottom fish rearing habitat, and an important wintering ground for migratory marine birds including western grebes. Herring spawning grounds and western grebe wintering grounds of the quality found within the reserve are not replicated anywhere else in the central Puget Sound sub-basin.

4.4 Archaeological, Cultural, and Historical Resources

The following sites of archaeological, cultural, and/or historical importance have been identified adjacent to the reserve boundaries, on private or public uplands and tidelands (no sites have been identified inside the reserve):

- Point Robinson Lighthouse: Located at the northeast corner of Maury Island, the Point Robinson Lighthouse is on the National Register of Historic Places. The lighthouse was originally constructed as a fog signal in 1885, but was rebuilt to current conditions in 1915.
- Historical portage from the northeast corner of Quartermaster Harbor to the Puget Sound: The historical portage site is not registered on a historic register. During the period when the portage was still submerged at high tide, the area was a favorite fishing and hunting ground of the Nisqually people. Nets in this area were used to capture abundant waterfowl (Larkin 1975).
- Historic Clam Middens: Clam middens were excavated on the north shore of the Burton Peninsula within Quartermaster Harbor in 1996 by University of Washington's Department of Archaeology (Joseph 1996).

4.5 Desired Future Conditions of Reserve Resources

This section identifies the desired future conditions for each of the resources targeted for conservation in the reserve. Each resource is described in greater detail in Appendix C. Desired future conditions represent the goal for the resources in the future and include proposed activities for achieving these desired conditions. Details of management activities can be found in Section 5.0.

4.5.1 Physical Resources

An objective of reserve management is to decrease shoreline hardening on state owned aquatic lands and, through volunteer cooperation, on adjacent private and public lands to less than 30 percent within and around the reserve during the 90-year term of the reserve.

4.5.2 Water and Sediment Quality

The interim desired future conditions for water and sediment quality within the reserve include: 1) Improve the water and sediment quality to a level in which no areas within the reserve are closed to recreational shellfish harvesting by the WDOH due to health concerns; and 2) Meet clean water act standards for water and sediment quality. While preliminary threats to water and sediment quality have been identified, additional work needs to be done to document both their extent and sources. As a result, DNR currently has not determined the exact level of improvement in water or sediment quality needed to achieve these two interim goals. The long-term desired future conditions for water and

sediment quality will be adjusted and refined as DNR gains information through the applicable research and monitoring identified in Section 5.1.

4.5.3 Nearshore Drift Cells

Waves typically approach the shore at an angle, creating longshore currents and moving sediments by a process call nearshore (littoral) drift. A simple example is sand built up on one side of a fallen tree or boat ramp and eroded on the other. Shorelines develop discrete neashore drift cells, which are bounded by headlands, or rock outcroppings that provide a barrier to the continued flow of sediment along the shore. These cells may be several mile in length, or just a few hundred feet. A littoral cell includes a source area for beach sediment, such as a stream mouth or eroding bluff, and an area where sediment accumulates, typically a low-lying sand spit or barrier beach.

Nearshore drift cells (Appendix D) are an important component of shoreline environments and shall be preserved, restored, and enhanced throughout the reserve. Quantifiable goals for this resource will be established after inventory activities in Section 5.1.1 are completed.

Nearshore drift occurs in intertidal and subtidal areas of the nearshore. The subtidal portions of seven drift cells are included in the reserve. The majority (88 percent) of the shoreward portion of the drift cells lies on privately owned tidelands. As such, the DNR will rely on voluntary stewardship actions on private lands to maintain and improve nearshore drift cells by promoting land use practices that provide for uninterrupted sediment flow, while protecting private property. Management of activities on state-owned aquatic lands will also rely on recognized cause and effect relationships of proposed activities to avoid and minimize potential adverse impacts on nearshore drift cells.

4.5.4 Stream Mouth Estuaries

There are at least 36 freshwater seasonal or perennial streams that flow into the reserve (Appendix E). Existing knowledge regarding the status of estuaries within the reserve is not sufficient to identify specific goals for this resource. In the long-term, DNR will attempt to protect, restore, and enhance the existing conditions of stream mouth estuaries while deferring quantifiable goals until the research inventory in Section 5.1.1 is completed. In the interim, DNR will identify sources of surface freshwater entering the reserve and work cooperatively with private and government entities to ensure that freshwater sources maintain their natural hydrologic functions and minimize inputs of point and non-point source pollutants that may adversely impact the habitats and species within the reserve.

4.5.5 Intertidal Sand and Mudflats

In the long-term, the DNR will seek to ensure that the sand and mudflat areas within the reserve are functioning adequately to support their habitat values. Since the level of function of these habitats in the reserve is currently not known, an interim goal is to protect the existing sand and mudflat areas within the reserve until their functions have been studied. The quantifiable, long-term goals for this resource will be established after activities in Section 5.1.1 are completed. In the interim, management of activities will rely on recognized cause and effect relationships of proposed activities to avoid and minimize potential adverse impacts on sand and mudflat habitats.

4.5.6 Eelgrass

Shoreline surveys found continuous or patchy eelgrass beds offshore of 78 percent (18.65 of 23.88 miles) of the shoreline within the reserve (Appendix F). Existing knowledge regarding the status of eelgrass within the reserve is not sufficient to identify long-term, quantifiable goals. In the interim, DNR will rely on recognized cause and effect relationships of proposed activities to preserve, restore, and enhance the existing eelgrass beds within the reserve (with the goal of achieving no net-loss of eelgrass) and defer quantifiable goal setting until the inventory identified in Section 5.1.1 is completed.

4.5.7 Kelp

There is no evidence of continuous kelp beds within the proposed reserve, but patchy distributions have been reported along the western and eastern shorelines of Maury Island (Appendix F). The existing knowledge regarding the extent and status of kelp within the reserve is not sufficient to identify long-term, quantifiable goals. In the interim, DNR will rely on recognized cause and effect relationships of proposed activities to preserve, restore, and enhance the existing kelp within the reserve (with the goal of achieving no net-loss of kelp) and defer quantifiable goal setting until the inventory identified in Section 5.1.1 is completed.

4.5.8 Forage Fish Habitat

Over the 90-year period of the reserve designation, DNR will seek to ensure that both the quantity and quality of forage fish rearing and spawning habitat (Appendix G) within the reserve is not diminished and look for opportunities for improvements. Baseline inventories specified in Section 5.1.1 will be an integral part of quantifying this goal. In the interim, the DNR will work on a site-by-site, project-by-project basis to quantify this habitat and ensure its protection and improvement. Herring spawn throughout Quartermaster Harbor and along the southeast shoreline of Maury Island. There is only one documented area of sand lance spawning habitat representing approximately 0.3 miles of shoreline habitat within the reserve. There are 5.71 miles of documented surf smelt spawning beaches (primarily) adjacent to the reserve.

4.5.9 Salmonid Spawning, Rearing, and Migratory Habitat

Although DNR has no management authority over the salmonid spawning streams in the area, it is DNR's goal to protect and improve conditions of the streams and nearshore areas through cooperative efforts. The DNR will rely on recognized cause and effect relationships of proposed activities to preserve, restore, and enhance existing levels of salmonid rearing and migratory habitat within the reserve. Quantification of desired future conditions for salmonid habitat is deferred until the conclusion of the inventory specified in Section 5.1.1. In the interim, DNR will work on a site-by-site, project-by-project basis to quantify this habitat and ensure its protection and improvement.

4.5.10 Marine Bird Habitat

Aside from specific areas with substantial human development (i.e., Gold Beach, Sandy Shores, Dockton, and Burton), the areas adjacent to the reserve have riparian habitat that is largely intact and supports a number of bird populations, both seasonal and resident. The DNR does not have management authority over human development activities on private property adjacent to the reserve, which is where much of the bird habitat in the area exists (Appendix H). However, DNR's goal is to protect and improve the existing bird habitat through cooperative efforts with adjacent landowners, King County, and the Washington Department of Fish and Wildlife (WDFW). The DNR's ultimate goal is to sustain habitat that supports important bird populations in the area through existing regulatory and conservation efforts.

4.5.11 Archaeological, Cultural, and Historical Resources

The DNR does not have management authority over the geographic areas that contain archaeological, cultural, or historical resources near the reserve. The DNR will rely on the Washington State Office of Archaeology and Historic Preservation, Puyallup Tribe, and local knowledge and interest in these sites to dictate their future management. The DNR goal is that activities within the aquatic reserve cause no harm to the archaeological, cultural, or historical resources near the reserve.

5.0 Aquatic Reserve Management

The reserve management plan can be divided into three primary categories of activities:

- Research and monitoring activities within the reserve (Section 5.1);
- Management guidance for existing and future activities by DNR on state-owned aquatic lands (Section 5.2); and
- Voluntary stewardship activities on private property and public lands adjacent to the aquatic reserve (Section 5.3).

Since most of the long-term goals and management strategies for the reserve depend on understanding the baseline ecological conditions within the site, a major emphasis during the first ten years of reserve designation will be placed on establishing these baseline conditions (Section 5.1.1). After baseline conditions are determined for resources, specific quantifiable goals will be developed and incorporated into the management plan. During this same period, management of the site will also focus on activities that DNR has direct proprietary authority over, such as existing, pending, and proposed uses of state-owned aquatic lands.

Since impacts to sensitive habitats and species within the reserve may also be attributed to activities that DNR does not have explicit authority to manage, DNR will seek management cooperation and collaboration from other public and private entities, specifically local governments and citizens. The DNR will work cooperatively with the Washington Deparment of Ecology, WDFW, and King County to incorporate relevant best management practices (BMPs) into the management of the reserve.

5.1 Research and Monitoring

There are three components to research and monitoring within the reserve:

- Establishing baseline conditions;
- Monitoring to determine the effectiveness of management activities and document natural variation; and
- Researching, to better understand observed changes and the interaction between management activities and natural resource conditions.

5.1.1 Establishing Baseline Conditions

Baseline monitoring will document current conditions by combining existing research with inventories of resources and ecological processes that are not adequately documented. Understanding baseline conditions is important to the development and implementation of the management plan; therefore, establishing baseline conditions will be emphasized immediately after reserve designation. The reserve has been included in several survey efforts associated with the Puget Sound Ambient Monitoring Program. Additionally, regional surveys have included monitoring sites within or adjacent to the reserve for bottom

fish abundance, paralytic shellfish poisoning (Determan 2003b), and marine birds, as well as nearshore fish community studies, and shoreline inventories (Bloch et al. 2002). However, considerable gaps exist in our understanding of ecological processes and the distribution and abundance of natural resources within the aquatic reserve. As our understanding of ecological processes and natural resources improves, management activities can be further refined and targeted.

To address these needs, a thorough inventory of the resources present will be undertaken during the first ten years of reserve status. Natural resources and ecological processes will be inventoried, including the biological, chemical, and physical components of the reserve, on both a multi-year and multi-season schedule. Timelines and sampling protocols will be established for gathering this information. The description of baseline conditions will form the basis for future goal determination, adaptive management, change detection, and assessment of the benefits accrued from management activities associated with the reserve. The DNR will seek to partner with the Washington Department of Ecology, WDFW, the King County Department of Natural Resources, and local community groups to coordinate baseline inventory efforts.

After baseline ecological conditions are identified, specific management actions will be refined following an adaptive management process (Section 6.0). Quantifiable management goals and actions will be developed and adjusted over time based upon the established baseline conditions to aid in attaining the desired long-term future conditions for the resources of the aquatic reserve (Section 4.5).

5.1.2 Monitoring for Effectiveness

The purpose of effectiveness monitoring is to assess the success of management actions in attaining or exceeding the goals delineated in Section 3.0. Effectiveness monitoring will be used to report to the public and DNR on the patterns and conditions of natural resources at the Maury Island site over time. In addition to annual updates and activity reports, effectiveness monitoring results will be compiled in a monitoring report that will evaluate management effectiveness once every five years. The DNR will also develop a monitoring database to coordinate and compile the data collected by DNR and other entities during ongoing monitoring activities within and adjacent to the reserve.

5.1.3 Research

The DNR will seek to partner with the Washington Department of Ecology, WDFW, the King County Department of Natural Resources, academic scientists, and local community groups to identify and develop research projects within the reserve.

Possible research topics include:

- Identifying and developing remediation plans for sources of observed herring egg mortality in the vicinity of Dockton.
- Prioritizing areas and approaches for shoreline softening to benefit migrating salmonids, forage fish, and wintering birds.
- Identifying historic conditions and ecological functions of important ecosystem components such as Judd Creek, "portage," Fisher Creek, Point Robinson, and Raab's Lagoon.
- Identifying socioeconomic incentives for private preservation, restoration, and enhancement within and around the aquatic reserve.
- Determining the ecological connectivity of this site to other protected areas throughout Puget Sound.
- Describing nearshore habitat use by salmonids, and the role of nearshore habitat corridors in the development of salmonids.
- Identifying and describing relationships between riparian and upland conditions and marine nearshore ecological function.
- Examining the potential impacts and benefits of re-establishing the connection at "portage" between Quartermaster Harbor and Tramp Harbor.

A long-term research goal will be to provide resource managers with information that accurately describes the effects of management actions on the ecological processes and natural resources of the reserve.

5.2 Management Guidance for Existing and Future Use Authorizations

Uses of state-owned aquatic lands take many forms and involve a diversity of activities. DNR employs different forms of use authorizations (i.e., rights-of-entry, licenses, leases, and easements) to authorize activities such as marinas, piers, public access sites, utility crossings, outfalls, and a variety of other uses. The proper management of activities within the reserve will be a critical component of DNR's overall strategy for the reserve as WAC 332-30-151(2) states that "leases for activities in conflict with reserve status shall not be issued."

Proposals for pending, new, or a continuation of existing uses within the reserve will be evaluated by DNR using the guidance in this section in consideration of the relationship between the potential impacts of the proposed activities and the existing habitats and species of the site. In addition, any activity proposed within the reserve must obtain all required state, local and federal permits for the project prior to final DNR authorization. The focus of management will be on avoiding cumulative, long-term effects to the reserve habitats, species, and ecological processes. For those existing uses within the reserve, discussed in Section 5.2.3, the management emphasis will be to reduce their existing impacts over the 90-year time frame of the reserve. The reduction and elimination of impacts to the natural

environment will be implemented using available and reasonable technologies as the remaining economic life of any existing structure is realized or there are expansions or upgrades to a facility. New and expanding activities will be managed according to the general management strategies described in Sections 5.2.1 and 5.2.2. The determination of whether new, expanding, or continuation of existing activities support the objectives of the reserve will be made based on a case-by-case evaluation.

Section 5.2 identifies three "screens" that DNR will use to determine if uses are appropriate in the reserve:

- General programmatic principles (Section 5.2.1);
- General management strategies for specified uses (Section 5.2.2); and
- Specific management strategies for currently authorized uses or pending use applications (Section 5.2.3).

These screens essentially serve as an interpretive statement of WAC 332-30-151(2) regarding activities that are in conflict with the reserve. Each proposal for pending, new, or a continuation of existing uses within the reserve will be evaluated using these screens.

5.2.1 General Programmatic Principles

First, to meet the purpose of the reserve program and achieve the specific goals and objectives for the reserve, the basic principles below will be applied by DNR for existing, pending, and future proposed use authorizations within the reserve. The activities must:

- Primarily serve the objective of the reserve;
- Reduce site-specific impacts over time;
- Monitor impacts; and
- Apply adaptive management strategies.

5.2.1.1 Primarily Serve the Objective of the Reserve

In general, the DNR issues use authorizations throughout Washington State for water-dependent uses, non-water dependent uses, public use and access, natural resource extraction, revenue generation, and environmental protection. The lease activities within the reserve must primarily serve the objective of the reserve designation. Since the objective of the reserve is environmental protection, lease activities within the reserve must primarily serve to protect the environment (i.e., engage or support conservation activities). A lease activity will be considered to primarily serve the objective of the reserve if it meets the conditions below.

- The lease activity does not create additional reserve-wide or localized temporal or spatial loss of reserve habitats, species, or ecological processes identified for conservation. The DNR will only permit new or expansion of existing activities within the reserve that do not adversely affect the ability of

site managers to achieve the goals detailed in Section 3.0. In general, no net loss—in time or space—of natural resources identified for conservation in Section 4.0 and Appendix C will be permitted. The primary emphasis will be placed on avoidance and minimization to eliminate the need for compensatory mitigation. New and expanding activities proposed for the reserve will not be permitted if they do not first avoid and minimize all possible impacts. Any remaining short or long-term impacts must then be fully compensated for. In cases where compensatory mitigation is required to offset impacts, the habitat improvement or activity proposed for compensatory mitigation must be implemented and/or constructed prior to construction of the proposed (impacting) project.

- All lease activities within the reserve must also implement conservation actions in support of the desired future conditions described in Section 4.5. The conservation activities must be proportionate to the type of activity and the area encumbered by a lease. Environmental conservation activities may include, but are not limited to, direct implementation of, or funding for implementation of management activities that are identified within this plan, such as:
- Monitoring and scientific research identified in Section 5.1;
- Habitat improvement, land acquisition, long-term management and maintenance, or reduction of spatial impacts of existing uses consistent with the desired future conditions for the reserve identified in Section 4.0;
- Education and outreach identified in Section 5.3.5; and
- Reduction of existing or potential threats to habitats and species identified in Section 4.0 and Appendix C.

The project proponent, in consultation with DNR staff, will be responsible for demonstrating the temporal and spatial scope of the environmental benefit that would result from an applicant's proposed activities. Factors for determining equitable environmental benefits for an activity will include, but not be limited to, the following:

- Size of the area;
- Intensity and frequency of use;
- Location of activity in relation to specific habitat and species use; and
- Exclusivity of use (the level at which other activities are precluded in the area).

5.2.1.2 Reduce Impacts Over Time

For existing uses in Section 5.2.3, site management plans must be developed and implemented cooperatively between DNR and project proponents. The site plan must identify measures that will reduce site-specific environmental impacts from existing

facilities and uses over time based on recognized cause and effect relationships of these activities. The management emphasis for an existing activity or facility will be to reduce their existing impacts over the 90-year time frame of the reserve. The reduction of impacts of a facility will be implemented as the remaining economic life of the existing structure is realized or there are expansion or upgrades to the facility.

5.2.1.3 Monitor Impacts

Plans must be developed and implemented by project proponents to monitor potential environmental impacts from existing and proposed activities.

5.2.1.4 Apply Adaptive Management

Adaptive management strategies must be developed and implemented by project proponents to ensure improved operations and reduced environmental impacts over time.

5.2.2 General Management Strategies for Uses

New activities proposed within the reserve will be evaluated based on their potential environmental impacts relative to the ecologic zone in which the activity is proposed (Section 4.1). The following section discusses the impacts that are likely associated with each type of activity and management strategies that DNR will employ to address these issues. Appendix O includes a matrix summarizing the management strategies for the various activities discussed in this section.

5.2.2.1 Stormwater Outfalls

Description: Stormwater is often collected in either pipes or ditch systems for discharge into surrounding waterways. Such systems prevent upland areas from being impacted by most rainfall events. Stormwater is often collected in a settling pond or infiltration area prior to discharge to receiving waters.

Environmental Impacts: Stormwater collects nutrients and toxics from the surfaces of streets, agricultural, industrial, and residential properties. Stormwater that is discharged directly into an outfall without any treatment may contain considerable quantities of nutrients, toxics, and sediment, and this discharge may affect the flow, chemistry, mixing, and temperature of receiving waters. Stormwater temperature may be artificially elevated if shallow detention ponds are used or if water is collected off of surface streets. The discharge of stormwater into the receiving waters may cause a localized decrease in salinity levels, and biological activity resulting from nutrient inputs may result in depressed dissolved oxygen (DO) levels (Figure 3).

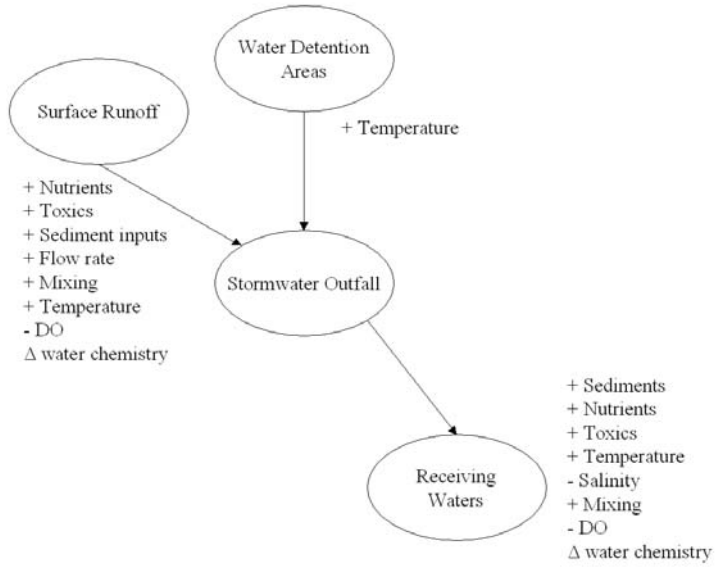


Figure 3: Conceptual diagram of relationship between stormwater outfalls and impacts to the natural environment.

Management Strategy: Areas in inner and outer Quartermaster Harbor lack sufficient depth or mixing to incorporate direct stormwater inputs without causing impacts to habitats and species. As a result, outfalls on state-owned aquatic lands in these areas will not normally be allowed as they are in conflict with the reserve. Along the area from Piner Point to Point Robinson, DNR would prefer no direct discharge to the reserve area. Upland treatment and infiltration to groundwater, streams, or wetlands, thereby allowing freshwater to be re-introduced to marine waters through natural hydrologic processes is preferred for all areas of the reserve. The DNR may consider a discharge if the area of impact extends beyond the reserve boundary and does not affect species or habitats of concern (eelgrass, herring holding area, salmon migratory habitat, nearshore zone).

5.2.2.2 Sewage Outfalls

Description: Sewage is collected at a central location for treatment. Treated wastewater is discharged through a pipe to receiving waters.

Environmental Impacts: Municipal wastewater is usually permitted to discharge elevated amounts of nutrients, minerals, and freshwater to receiving waters for dilution. Impacts in the “dilution zone” include increases in ambient water temperatures, salinity, fecal coliform bacteria, phosphorus, nitrogen, other pollutants, diminished dissolved oxygen levels in the receiving waters, and potential localized sediment contamination (Figure 4).

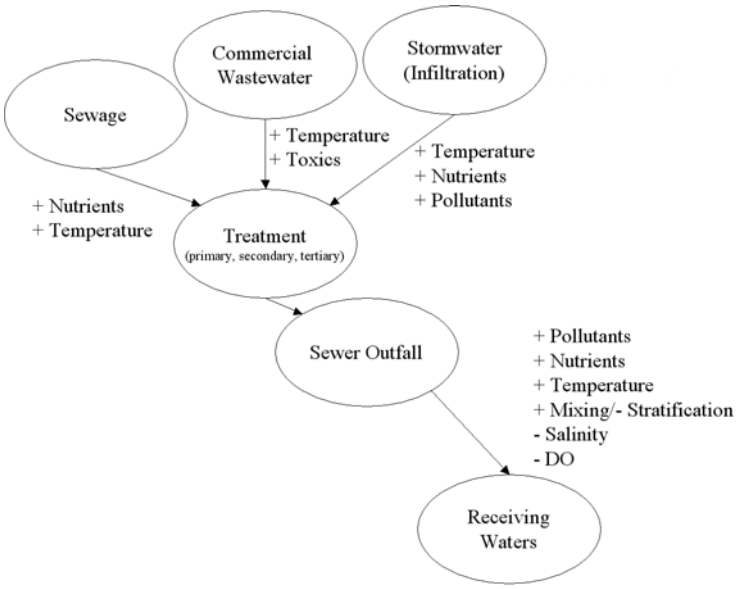


Figure 4: Conceptual diagram of relationship between sewer outfalls and impacts to the natural environment.

Management Strategy: Areas in inner and outer Quartermaster Harbor lack sufficient depth or mixing to incorporate municipal wastewater inputs without environmental impacts. As a result, outfalls on state-owned aquatic lands in these areas will not normally be allowed as they are in conflict with the reserve. Along the area from Piner Point to Point Robinson, DNR would prefer no direct discharge to the reserve area. Upland treatment and infiltration to groundwater, streams, or wetlands, thereby allowing freshwater to be re-introduced to marine waters through natural hydrologic processes is preferred for all areas of the reserve. The DNR may consider a discharge if the area of impact extends beyond the reserve boundary and does not affect species or habitats of concern (eelgrass, herring holding area, salmon migratory habitat, nearshore zone).

5.2.2.3 Water Intakes

Description: A water intake is a mechanism for withdrawing water, usually through a pipe, from a waterbody for industrial, municipal, or private uses. Marine water intakes can be used to supply marine water for aquaria, cooling, desalinization, or industrial uses.

Environmental Impacts: The intake of marine water can result in impacts to localized habitat (due to the intake pipe), mortalities to fish and fish larvae, disruption of larval dispersal, and entrainment of marine species (Figure 5).

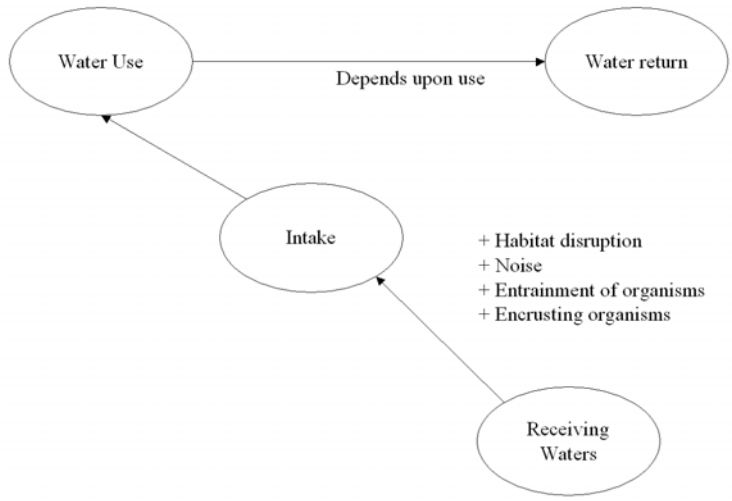


Figure 5: Conceptual diagram of relationship between intakes and impacts to the natural environment.

Management Strategy: No intakes will be allowed near fish spawning, migratory, or rearing areas as this would be in conflict with the reserve. Intakes should be placed deeper than –30 feet MLLW along the east shore of Maury Island and will not be permitted in Quartermaster Harbor. Intake design must adhere to WDFW screening requirements.

5.2.2.4 Desalinization Facilities

Description: Desalinization of seawater can be done in two ways. Both require the withdrawal of seawater through a seawater intake as described in section 5.2.2.3. One desalinization method uses distillation and the other uses osmosis. Both of these systems require external power sources to operate. In distillation, the water is boiled and the steam produced is channeled off so that it cools and recondenses and is collected as freshwater. Impurities, including salt, are left behind in the boiling chamber. Osmosis employs a filter membrane that allows pumped water to pass through it, but not impurities. Rates of desalinization of water will depend on the size of the operation, the rate of pumping, and the capacity of the system for the collection of impurities before it needs to be cleaned.

Environmental Impacts: Impacts associated with desalinization facilities will include those identified for intakes (Section 5.2.2.3). In addition, desalinization facility wastewater is very high in salinity (compared to receiving waters) and contains other impurities that are byproducts of the process. This waste stream is usually discharged into marine receiving waters. Disposal of this waste water could alter the habitat and species use in the area of influence of the outfall disposal pipe (Figure 6).

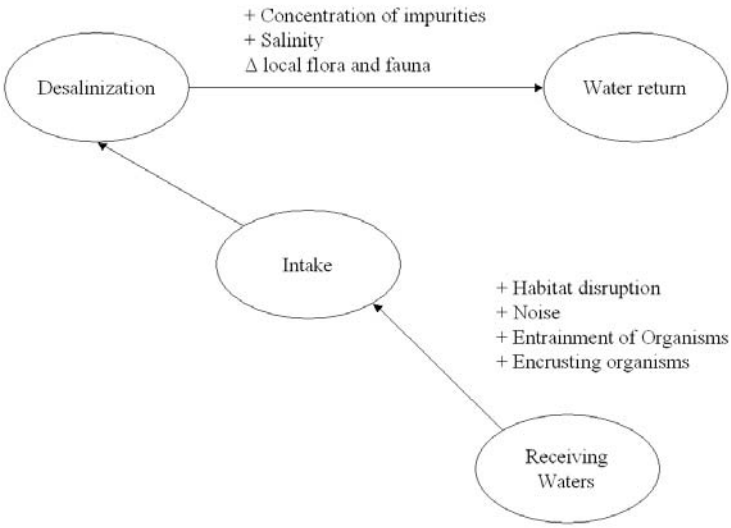


Figure 6: Conceptual diagram of relationship between a desalinization facility and impacts to the natural environment.

Management Strategy: Management strategies for the intakes associated with desalinization facilities are described in Section 5.2.2.3. Until the impacts associated with desalinization facilities on receiving waters are understood, the discharge of desalinization wastewater to marine waters will not be allowed within inner or outer Quartermaster Harbor. The DNR would prefer no direct discharge to reserve area along the area from Piner Point to Point Robinson. The DNR may consider a discharge area of impact that extends beyond the reserve boundary and does not affect species or habitats of concern (eelgrass, herring holding area, salmon migratory habitat, and shellfish).

5.2.2.5 Cable Crossings (Telecommunications and Power lines)

Description: Cable crossings are frequently needed to provide power, phone, or other entertainment or communication services to island or coastal communities.

Environmental Impacts: Construction of a cable crossing involves the drilling, burial or laying of a cable. Impacts that are likely to be associated with cable crossings include construction-related increases in turbidity, habitat disturbance, and increases in noise levels (Figure 7). The small profile of most cable crossings means that there are few documented, long-term environmental impacts associated with a cable once it is installed. Appropriate selection of installation methods and cable right-of-way can avoid many environmental impacts and minimize those associated with construction. These impacts are most likely to affect aquatic vegetation and migratory fish and wildlife. Some older electricity cables may be fluid-filled and therefore may leak lubricants if damaged. These lubricants can have long lasting, toxic impacts on the

natural environment. Cables laid on the top of the seafloor may create localized seafloor scouring after installation and have a higher risk of damage due to anchor drag or marine debris due to their exposure (Figure 7).

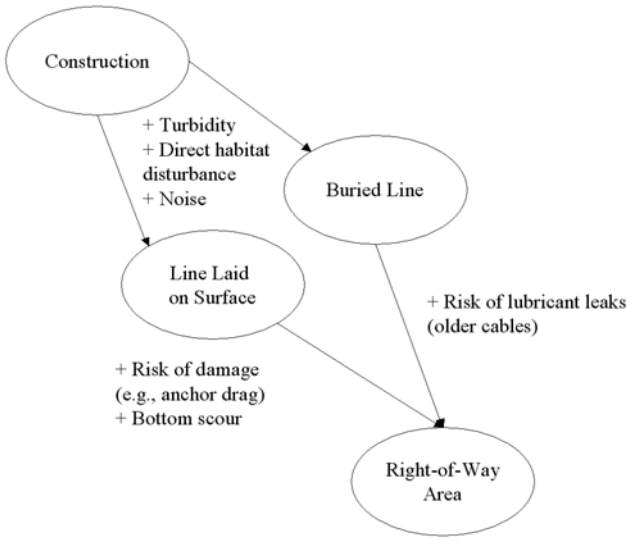


Figure 7: Conceptual diagram of relationship between cable crossing and impacts to the natural environment.

Management Strategies: In general, cable crossings are permissible throughout the reserve area when all general management criteria are met in Section 5.2.1. In addition, project proponents will be required to avoid critical habitat identified at the site by routing cable around or below habitat. Installation must avoid all surface and sub-surface impacts to critical aquatic habitat and species identified in the management plan. Proponents shall be required to survey and video the seabed to show that the planned installation site is free of native vegetation. The installation period must avoid times during migration and spawning in accordance with WDFW hydraulic permit in-water work periods. The DNR prefers that shore-ends use directional drilling or rock-pinning/split-pipe remedial protection if the shore-end is either rocky or an erosion area. When burial is an acceptable installation method, plowing is preferred over using a water-jetting remote operated vehicle. Burial must occur landward of the deepest documented occurrence of native aquatic vegetation.

5.2.2.6 Oil, Gas, Water, and Other Pipelines

Description: Pipelines can carry a number of different types of substances through an enclosed conveyance system. While most easement crossings for pipelines distribute or transmit materials across aquatic lands, some lead to actual discharge points. Pipelines leading to discharges typically carry treated water through marine outfalls. Impacts associated with such discharges are discussed in the outfall sections (Sections 5.2.2.1 and 5.2.2.2).

Environmental Impacts: Pipelines are likely to have both construction related and post-construction environmental impacts (Figure 8). The construction impacts are similar to those for other easement crossings, however larger pipelines typically have larger construction impacts and are more likely to have a profile that may be attractive to encrusting and reef-loving organisms. The operational impacts of a pipeline increase as the size and capacity of a pipeline increase, and is dependent on the type of material being conveyed in the pipeline. Additionally, larger pipelines typically convey larger quantities of materials and therefore may discharge larger quantities of materials if damaged. The type of material being conveyed also dictates the severity of potential impacts from a spill as a result of a damaged pipeline.

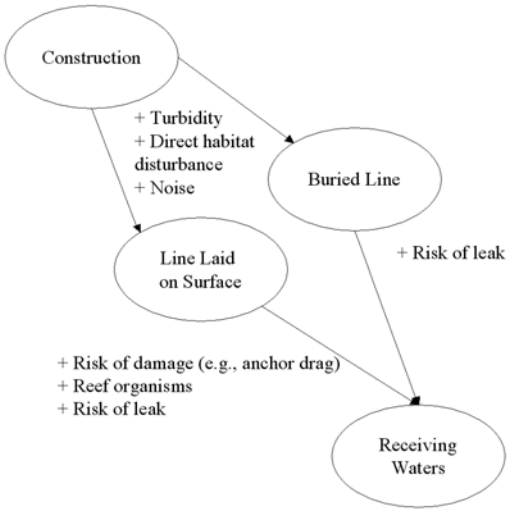


Figure 8: Conceptual diagram of relationship between pipelines and impacts to the natural environment.

Management Strategies: Pipelines are generally permissible in the reserve. In addition to the management strategies for cable crossings, DNR will require that pipelines be directionally drilled below the reserve out to water depths of minus 70 feet at MLLW. Between this depth and ½ mile from the extreme low tide line, pipelines shall be buried leaving no pipeline structures exposed on the seafloor. Additionally, for pipes carrying potentially toxic substances, the project proponent must demonstrate the ability to detect leaks of less than 0.1 percent of total flow (FERC requirements) for the pipeline. Periodic maintenance monitoring will be required for all pipelines to demonstrate that the pipeline is in functioning condition, there is minimal risk of break, and so that it can be repaired or replaced before the end of its functional lifetime.

5.2.2.7 Fish Pens

Description: Floating fish pens are utilized for a variety of purposes: to rear fish, typically salmon, in a confined area to market size, to rear or hold immature fish for

acclimation prior to release, or to hold fish, such as herring, in order to "condition" them for a particular market (e.g., bait).

Environmental Impacts: Fish rearing and holding pens cause shading, concentrate fish waste, and can result in disease outbreaks due to the confinement of a large number of fish in a relatively small area. Some fish pen rearing operations can distribute feed and antibiotics that are not all consumed by the fish and can potentially impact local habitat and aquatic species. There are also threats of negative interactions with native species, predation, and impacts to the local benthic community (Figure 9).

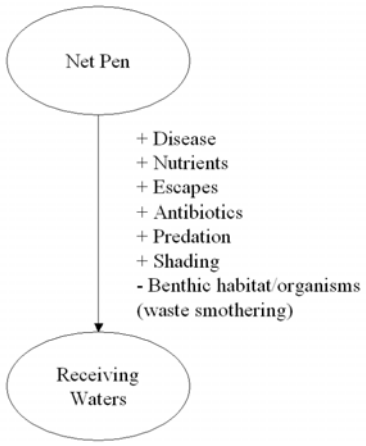


Figure 9: Conceptual diagram of relationship between net pens and impacts to the natural environment.

Management Strategy: Net pens will not be allowed in inner Quartermaster Harbor as this would be in conflict with the reserve. Net pens will be allowed under conditional circumstances in outer Quartermaster Harbor and the Maury Island eastern shore. In these areas, the net pens will be required to avoid habitat identified for conservation, must be sited outside of the intertidal zone in areas with adequate flushing, and may not be located in an area that could cause any impacts to native aquatic vegetation or documented spawning habitat. Herring holding will not be allowed during herring spawning (January through mid-April).

5.2.2.8 Commercial Geoduck Harvest

Description: The Washington Department of Natural Resources, the Washington Department of Fish and Wildlife (WDFW), and the Puget Sound Treaty Indian Tribes (Tribes) jointly manage the wildstock geoduck fishery in Washington State. The State and the Tribes are responsible for estimating geoduck population size, determining sustainable yield, establishing annual harvest rates, and ensuring adverse effects to

the environment from harvest practices are minimized. Treaty fishing rights require a 50/50 split of the geoduck resources between the state and treaty tribes. The DNR has proprietary management interest in the State's half of the harvest and auctions the right to harvest the wildstock geoducks to the private sector. Management of the geoduck resource is dynamic due to changes in market demand, and new information on geoduck biology and population dynamics.

Presently, only the following five commercial geoduck tracts, identified in the 2004 Geoduck Atlas, are within the reserve boundary (Appendix I):

- 10100 – Point Robinson East
- 10150 – Maury Island
- 10250 – Rosehilla
- 10300 – (X) bed (closed to fishing due to pollution)
- 10350 – Neill Point

Environmental Impacts: The largest impact of the commercial geoduck fishery is the removal of a large sessile biomass. Natural recovery is thought to take an average of 30 years (2001 SEIS). Commercial geoduck harvest creates noise associated with commercial boat operations that is above ambient levels. Harvest creates a temporary disturbance to the substrate and water column resulting in impacts to the habitat and species in the area. Additionally, sediment plumes generated from harvest are transported by the currents and settle in other areas within and adjacent to the harvest area resulting in siltation above ambient levels that can potentially impact some resident and migratory fish, adjacent aquatic vegetation, and local benthic communities (Figure 10).

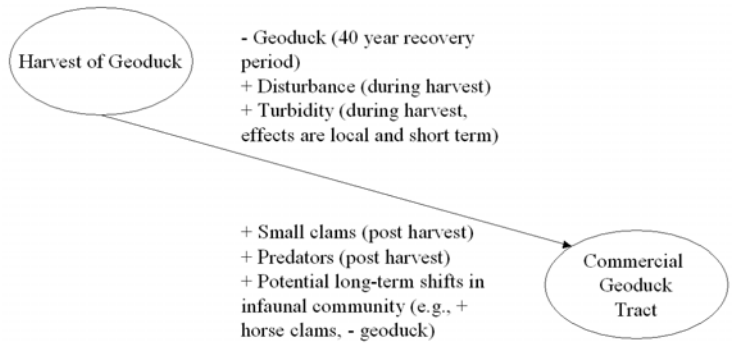


Figure 10: Conceptual diagram of relationship between commercial geoduck harvest and impacts to the natural environment.

Management Strategy: In 2004, only tract 10150 is being fished by the Puyallup Tribe. Harvest agreements between the State and Puyallup Tribe require that harvest must not impact native aquatic vegetation, forage fish spawning or forage fish spawning habitat. There are no immediate plans by the state to fish any tract in the reserve. Present state regulations do not permit the state fishery to be conducted at the Maury Island tract, and only a portion of tract 10100 could be available for the state run fishery because it is beyond 200 yards from the MHHW line. State regulations (RCW 75.24.100) exclude the state geoduck fishery shoreward of 200 yards from MHHW. A State commercial fishery could be conducted on all or parts of tracts 10250 and 10350 that are more than 200 yards from shore. If there is a proposed harvest by the state, DNR must:

- Assess if the commercial harvest can be performed without conflicting with the basis for reserve designation; and
- Manage consistently with the most current version (presently 2000) of the state of Washington Commercial Geoduck Fishery SEIS and associated harvest management plans (Washington State Department of Natural Resources. 2001b).

5.2.2.9 Shellfish Aquaculture

Description: Shellfish Aquaculture is the commercial seeding, growing, and harvesting of marine mollusks and shellfish or other invertebrates in a natural or manufactured environment. Shellfish can be raised on the seafloor, in intertidal or subtidal areas, or can be raised off the bottom. Off-bottom techniques use lengths of line suspended from the surface attached to floating rafts or buoys and anchored to the bottom. Shellfish are then hung on the lines using mesh tubing, bags or trays. Off-bottom techniques are primarily used for mussel aquaculture. Preparation of a site for intertidal cultivation of shellfish can include the removal of competing aquatic species, predators, and aquatic vegetation. Intertidal cultivation of shellfish is conducted through a series of actions that includes cultivation, a period of growth (depending on the species), and harvest.

Environmental Impacts: Some commercial shellfish aquaculture practices result in impacts to aquatic vegetation and substrate in preparation of a new intertidal or subtidal shellfish growing area. Site preparation and ongoing maintenance may have direct and indirect impacts to local fish migration, spawning, and rearing habitat. Aquaculture can change an area of naturally diverse habitat and species into a controlled monoculture (Figure 11).

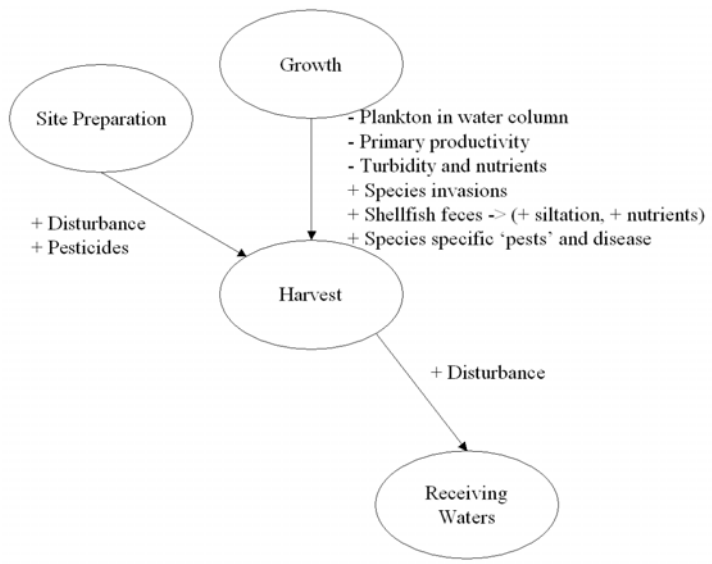


Figure 11: Conceptual diagram of relationship between shellfish aquaculture and impacts to the natural environment.

Management Strategy: Commercial shellfish activities are permissible throughout the reserve, when all general management criteria are met (Section 5.2.1). Use of herbicides and pesticides, cutting, tilling, or otherwise disturbing native vegetation on state-owned aquatic lands will not be permitted. Additional research is needed to fully clarify the potential impacts and benefits of shellfish aquaculture on aquatic habitat and species in the reserve.

5.2.2.10 Marinas and Public Docks

Description: Marinas and public docks provide moorage facilities for commercial or recreational vessels. Typically, marinas are comprised of a series of docks or moorage areas used for transient or permanent vessel moorage. These facilities can include other services such as sewage waste pump-out, fueling facilities, vessel maintenance/repair, upland storage, or upland parking and residential use. Marinas provide important public access for a variety of watercraft and important regional recreational opportunities.

Environmental Impacts: The siting and construction of a marina can cause extensive physical damage to the environment. Pilings and bulkheads all cause major disruptions to aquatic habitat. Poorly designed dock construction can change wave and sediment patterns, leading to the loss of sand and beaches. Marina slips are commonly leased to third parties, which complicate efforts to monitor and prevent impacts. Because of the risk of pollution from marinas, the Department of Health will establish a shellfish closure zone around marinas unless the marina has a pump-out facility and a watch person on-site to ensure that best management practices are

followed. Marinas and public docks cause shading, resulting in changes to the euphotic zone and associated primary production, including impacts to aquatic vegetation. They can also impact water quality and may result in sediment contamination (caused by the use of toxic materials, such as materials treated with creosote), hydrologic alterations, and refuge for predators (Figure 12). Boats that are moored and left in the water year round or seasonally commonly have their hulls painted with a biocide to restrict growth of marine organisms. Boat launching areas can also be entry point for invasive species.

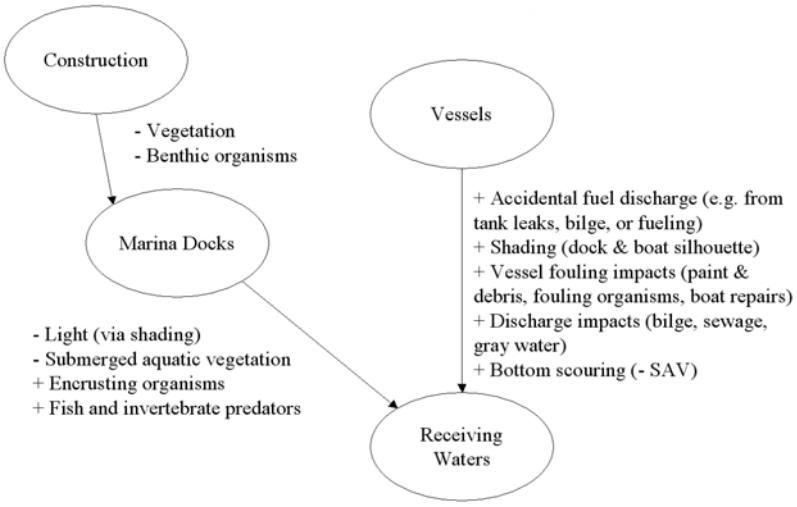


Figure 12: Conceptual diagram of relationship between marinas and public docks and impacts to the natural environment.

Management Strategy: In addition to meeting the general principles and management guidance in Sections 5.2.1 and 5.2.2, new marinas will have to implement specific management strategies described in Sections 5.2.3.1 through 5.2.3.3. The siting of new marinas is contingent on a sitting study to be conducted for the reserve. This study will be done in coordination with local user groups and applicable local, state, and federal government agencies. New marinas are not permissible along the east shore of Maury Island from Piner Point to Point Robinson

The Department of Natural Resources requires all new marinas to have pump-out facilities and to adopt best management practices to assure that no discharges occur, and will work with existing marinas to bring pump-out facilities on-line as soon as possible.

New covered or enclosed moorage will not be allowed within the reserve, as it can cause greater environmental impacts than open moorage. Covered or enclosed

moorage causes greater environmental impacts because it shades the water. It also causes greater aesthetic impacts to surrounding communities.

A marina lease must include provisions for sufficient maneuvering room for entering and exiting the marina. The department does not guarantee that adjacent open-water areas will be available for access to marina facilities, unless the marina owner secures a DNR use authorization for these adjacent areas.

The development of new marinas or expansion of existing marinas will be contingent on a siting study to be conducted for the reserve, in coordination with the local community, existing marina operators, and local, state, tribal and federal governments. This study will assess current and projected future moorage demand in the reserve area.

5.2.2.11 Breakwaters

Description: Typically a large floating or fixed structure placed in the water, breakwaters are used to dissipate and reflect wave energy away from nearshore structures, such as a marina, mooring area, or shoreline structure.

Environmental Impacts: Breakwaters create diversions to the natural hydrology impacting drift cells and the transport of sediment. They can also cause shading of aquatic vegetation and provide additional opportunities for predators of fish that utilize the shallow nearshore zone for migration and feeding (Figure 13). Solid fill breakwaters have greater impacts to the natural environment because they completely displace aquatic habitats.

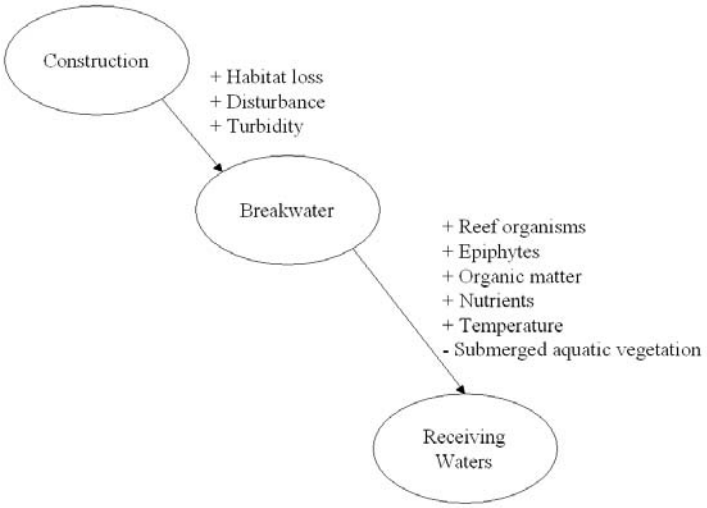


Figure 13: Conceptual diagram of relationship between breakwaters and impacts to the natural environment.

Management Strategy: Breakwaters are allowed within the reserve on a conditional basis as a last resort for uses that can document the immediate need to protect property from imminent threat. Only floating breakwaters will be considered and must be sited to promote circulation and minimize barriers, limit shading, and use environmentally neutral materials.

5.2.2.12 Boat Repair Facilities

Description: Boat maintenance and repair facilities are engaged in any of the following aspects of building and repairing all types of boats: painting, surface preparation, engine maintenance and repairs, and pressure washing.

Environmental Impacts: The variety of practices grouped into this activity can collectively contaminate stormwater and surface water bodies with toxic organic compounds, oils and greases, heavy metals, nutrients, suspended solids, and abnormal pH (Figure 14). Wastes generated by boat repair activities include spent abrasive grits, spent solvent, spent oils, pressure wash wastewater, paint over spray, paint drips, various cleaners and anti-corrosive compounds, paint chips, scrap metal, welding rods, wood, plastic, resins, glass fibers, and miscellaneous trash such as paper and glass. These pollutants may enter the wastewater stream through the application and preparation of paints and the painted surface; the handling, storage and accidental spills of chemicals, leaks or drips of paints, solvents, thinners; the fracturing and breakdown of abrasive grits; and the repair and maintenance of mechanical equipment.

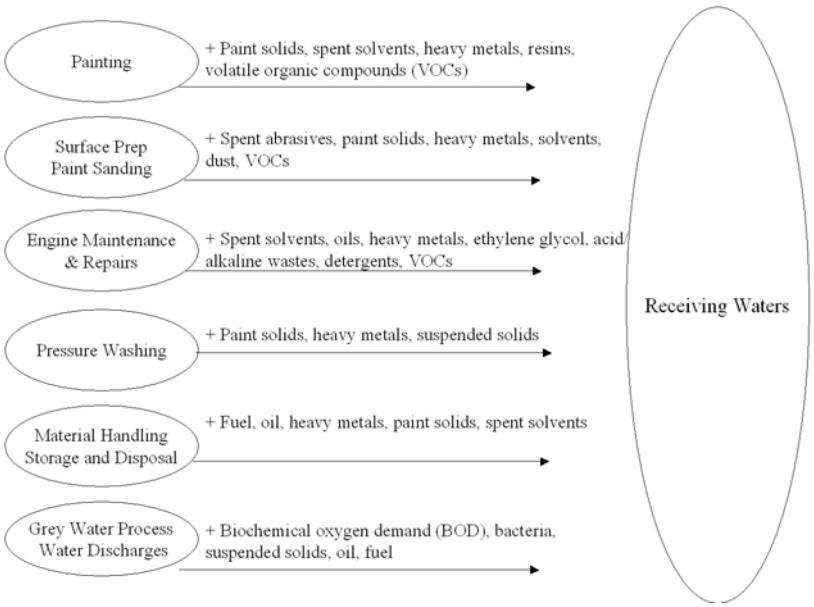


Figure 14: Conceptual diagram of relationship between boat maintenance and repair facilities and impacts to the natural environment.

Management Strategy: Boat repair facilities will not be allowed within the reserve as they would create an overwater use that would be in conflict with the reserve. The following activities are allowed within the reserve: engine repair or maintenance conducted within the engine space without vessel haul-out, topside cleaning, detailing and bright work, electronics servicing and maintenance, marine sanitation device servicing and maintenance that does not require haul-out, vessel rigging, minor repairs or modifications to the vessel's superstructure and hull above the waterline which are not extensive (i.e., 25% or less of the vessel's surface area above the waterline).

5.2.2.13 Industrial Wharves and Piers

Description: Industrial wharves and piers are typically large pier, or moorage facilities and associated support structures (e.g., dolphins). These wharves and piers support upland industrial facilities that need water access to ships or receive materials as part of their industrial operations. There is a great deal of variation in the size of structures, regularity of use, and magnitude of impacts for industrial wharves and piers.

Environmental Impacts: Industrial wharves and piers are typically high impact, heavily used facilities that transport large amounts of material. Environmental impacts tend to be highly correlated with the size of structures, and regularity of use with smaller structures often having proportionately less impacts on the natural environment. Industrial wharves and piers can impact water quality, create diversions in the local hydrology, disrupt sediment flow along drift cells, shade aquatic vegetation, and diminish the euphotic zone in the area of the facility. There is also potential for impacts from noise, prop wash, ballast water and waste discharges, fuel spills, hydraulic fluid spills, material spills, and other activities associated with these facilities that may directly and indirectly impact aquatic flora and fauna (Figure 15).

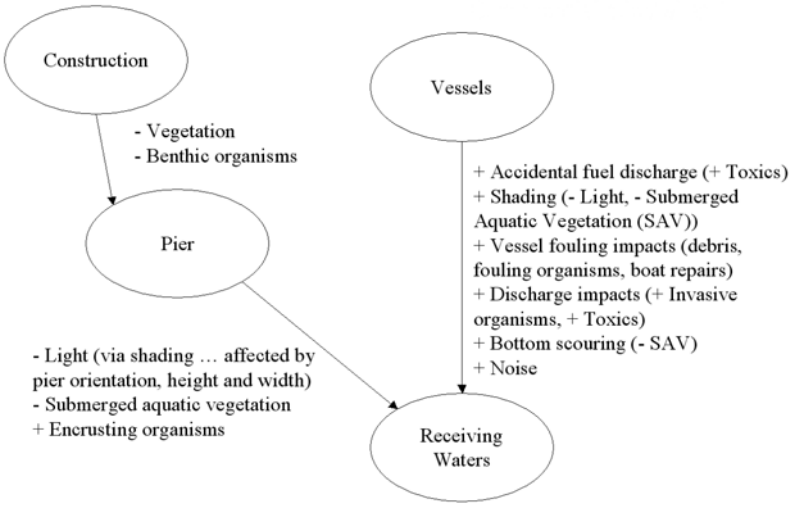


Figure 15: Conceptual diagram of relationship between wharves and piers and impacts to the natural environment.

Management Strategy: New low to no impact industrial wharves and piers may be conditionally allowed in inner and outer Quartermaster Harbor if new structures create no additional impacts to habitat and species identified for conservation at the site.

Locating industrial wharves and piers along the east shore of Maury Island is limited to the area adjacent to the uplands that are zoned by King County for mineral extraction. The construction or maintenance of such facilities must also be consistent with local shoreline designations and other applicable regulations. New structures can create no additional impacts to habitat and species identified for conservation at the site. More specific management actions regarding the existing industrial pier along the eastern shoreline of Maury Island is provided in Section 5.2.3.4.

5.2.2.14 Recreational Mooring Buoys and Docks

Description: Numerous recreational floats, docks and mooring buoys exist within the reserve. These structures are important aspects of island living for local residents because they provide moorage for recreational vessels and local access to the aquatic resources of the area. These structures can serve a vital role in facilitating and promoting appropriate public use and access and in decreasing impacts caused by anchoring within the reserve. Aerial photos show 84 overwater structures within and adjacent to the reserve that shade a minimum of 3.22 acres of habitat (Anchor Environmental 2004). Most of these structures are associated with single-family residences and many are located entirely on private tidelands.

There appears to be two areas within the reserve that currently support a congregation of mooring buoys; one is located in inner Quartermaster Harbor and the other is in outer Quartermaster Harbor adjacent to Dockton Park. There may be other individual mooring buoys located throughout the reserve. As of the publication date of this management plan, few, if any, of the mooring buoys within the reserve were authorized by DNR. The DNR does not know the number of mooring buoys located on state-owned aquatic land within the reserve.

Environmental Impacts: Recreational mooring buoys may cause scouring of aquatic vegetation and other substrate. If properly installed these impacts may be minor or eliminated. In addition, numerous buoys congregated in one area create the potential for shading of aquatic vegetation and discharge impacts associated with the moored vessels (Figure 16).

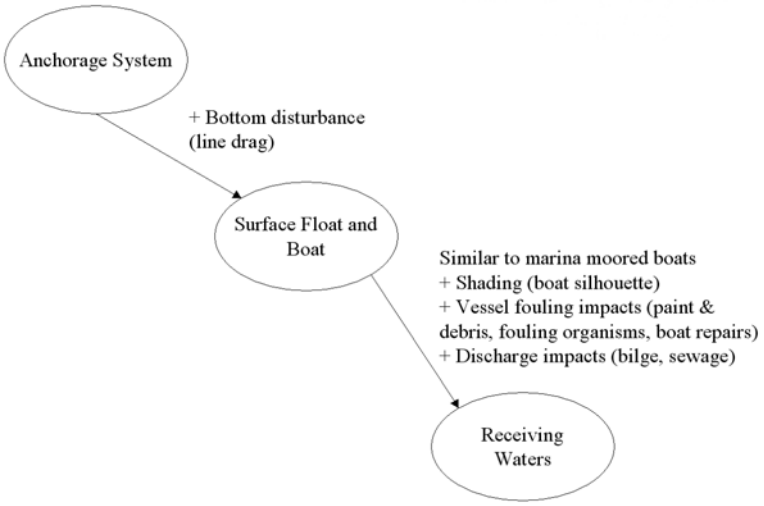


Figure 16: Conceptual diagram of relationship between mooring buoys and impacts to the natural environment.

Recreational docks and floats may cause the same types of negative impacts as those related to marinas and public docks, such as shading, impacts to water quality, sediment contamination, hydrologic alterations, use of toxic materials (such as materials treated with creosote), and provide refuge for predators (Figure 12).

Management Strategy:
Mooring buoys and recreational docks are managed by DNR under RCW 79.90.460 and 79.90.105. Under RCW 79.90.105, residential owners of lands adjacent to state-owned aquatic shorelands, tidelands, or bedlands may install and maintain a mooring buoy and recreational dock without paying a fee to DNR. DNR's current policy is to not require recreational docks to be authorized in writing but to rely on local and state permit requirements for the installation of recreational docks. Mooring buoys located

on state-owned aquatic lands should be authorized by DNR through a no-fee authorization as well as obtain other required local and state permits. Recreational mooring areas will be allowed throughout the reserve based on the following specific management actions:

- Inventory existing buoys and docks on state-owned aquatic lands and identify ownership;
- Cooperate with local authorities and residents to identify appropriate installation methods, locations, and maintenance practices;
- Authorize buoys on state-owned aquatic lands;
- Remove mooring buoys and recreational docks on state-owned aquatic lands that appear to be abandoned as soon as practical, if ownership of inventoried buoys and docks cannot be determined;
- Ensure that all buoys are installed to avoid scouring of aquatic habitat;
- Minimize shading where possible; and
- Promote public awareness of location of eelgrass and forage fish spawning locations.

5.2.2.15 Residential Use (live-aboards)

Description: Residential use includes any person or succession of persons who resides in a specific location or area on state owned aquatic lands for more than 30 days during a 40-day period in a floating vessel or any person who resides in a structure designed to serve primarily as a residence (WAC 332-30-171).

Environmental Impacts: Impacts caused by residential use are similar to those caused by a personal residence and include the discharge of wastewater, house cleaning and maintenance materials, and pet waste, and accumulation and storage of personal property on site. In addition, the potential shading and scouring impacts associated with vessel moorage would also apply to live-aboards.

Management Strategy: Residential use will be limited to ten percent of slips (or local regulations) in accordance with WAC 332-30-171.

5.2.2.16 Log Storage/Booming

Description: Log storage is not as widely used in the aquatic environment as it was historically. Log booming is typically limited to those areas that are adjacent to an area being logged or in areas where raw logs are staged for transport or processing. There are no logging, shipping, or processing facilities within the reserve area.

Environmental Impacts: Log storage and booms cause shading and can impact the euphotic zone, substrate, and aquatic vegetation below the stored logs. In addition, wood and bark fall from the logs and collect on top of the sediment causing an anaerobic benthic environment (Figure 17).

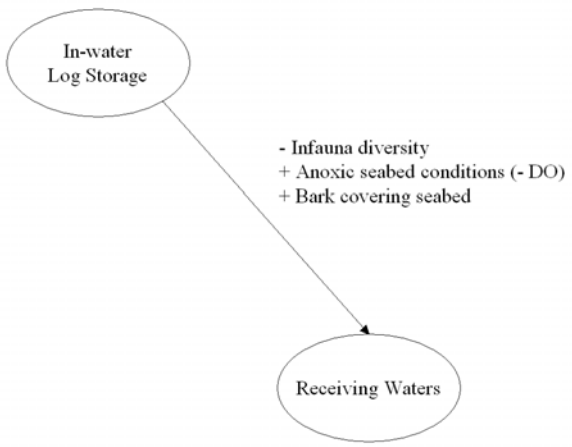


Figure 17: Conceptual diagram of relationship between log storage and impacts to the natural environment.

Management Strategy: Log booming and storage will not be allowed in the aquatic reserve as they would be in conflict with the reserve.

5.2.2.17 Dredging

Description: Dredging may be required to improve navigation and access to facilities that support shoreside industries or recreation and can also be used to mine valuable materials or for commercial shellfish harvest.

Environmental Impacts: Dredging impacts are severe and can permanently alter the substrate, and aquatic vegetation in the area that is dredged. Dredging activities also impact water quality and can disturb migratory and spawning behavior of fish inhabiting the area during the time it is occurring (Figure 18).

Management Strategy: Dredging activities will not be allowed in the reserve unless authorized by the federal government for transportation, flood control, or security purposes as it would be in conflict with the reserve.

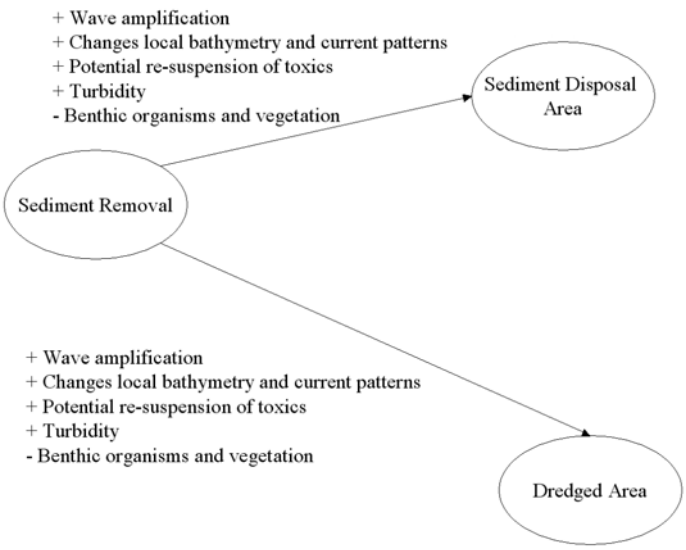


Figure 18: Conceptual diagram of relationship between dredging and impacts to the natural environment.

5.2.2.18 MTCA/CERCLA Sites

Description: State jurisdiction for cleanup of contaminated sites is derived from the Model Toxics Control Act (MTCA), which is administered by the Department of Ecology. The primary federal authority for contaminated sites is the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), which is commonly known as the Superfund program. CERCLA and MTCA are focused primarily on historical contamination problems and involves those sites which are considered to be the highest priorities in terms of potential risks to human health and the environment. The DNR acts as a land manager as well as a trustee under these programs, representing the state's interests (in cooperation with Ecology and WDFW) in clean-up actions and liability responsibilities. There are presently no MTCA or CERCLA sites identified in the aquatic reserve.

Environmental Impacts: Contaminated aquatic sites can produce a number of adverse environmental impacts including alteration of benthic communities, poisoning of aquatic animals that feed in the benthic environment, alteration of aquatic vegetation composition and abundance, degradation of water quality, and other related effects.

Management Strategy: The DNR will allow for impacts from clean up of MTCA or CERCLA sites in the reserve. Clean up must include:

- MTCA/CERLA clean up must be consistent with the management guidance for the reserve described in section 5.2.1.
- Existing and future uses in the reserve must avoid contamination.

- Allowable uses in the reserve will not degrade contaminated sediment clean-up sites.

5.2.2.19 Voluntary Restoration and Enhancement

Description: Voluntary restoration and enhancement activities include projects not required by regulatory agencies. Restoration includes those activities that return an ecosystem to a close approximation of its condition prior to disturbance. Enhancement refers to the modification of specific structural features of an existing habitat to increase one or more functions based on management objectives. Although this term implies gain or improvement, a positive change in one ecological function may negatively affect other ecological functions. Restoration or enhancement projects may be initiated by DNR or other interested parties.

Environmental Impacts: Restoration and enhancement projects will contribute to the improvement and recovery of specific aquatic habitat in the reserve. However, restoration and enhancement activities may cause the physical or functional loss of habitat by temporarily (during the construction of the habitat improvement) or permanently (when "creation" is used as the habitat improvement project) altering existing priority habitat in the reserve.

Management Strategy: Restoration and enhancement activities will be encouraged throughout the reserve based on priorities to be developed through the management plan and the conservation objectives of the reserve. Other actions include:

- Review of existing restoration inventories completed by King County and other entities;
- Completion of a reserve-wide inventory for potential restoration and enhancement projects;
- Evaluation and prioritization of potential projects;
- Securing funding for habitat improvement and restoration projects; and
- Implementation of restoration and enhancement projects.

5.2.2.20 Mitigation

Description: Mitigation is the sequential process of avoiding, minimizing, and compensating for impacts to wetlands and aquatic resources. For activities on state-owned aquatic lands, all practical measures to avoid and minimize impacts must be accomplished before compensatory mitigation is considered. Compensatory mitigation shall only be used to offset impacts that cannot be avoided or minimized.

The DNR will follow Standard Practices Memorandum (SPM) 04-03, Compensatory Mitigation on Aquatic Lands, as interim guidance for authorization of compensatory

mitigation activities on state-owned aquatic lands until new guidance is developed. The goal of SPM 04-03 is to ensure environmental protection by appropriately authorizing compensatory mitigation activities on state-owned aquatic lands. Compensatory mitigation may be required by local, state, and federal regulatory entities under laws such as the federal Endangered Species Act, the federal Clean Water Act, the National and State Environmental Policy Acts, the state Shoreline Management Act, and the state Hydraulic Code (among others).

Agencies require that project proponents identify any potential impacts and mitigate for these impacts in order to reduce the severity of their action. Mitigation sequencing, according to the Washington State Environmental Policy Act (Chapter 197.11 WAC) involves the following steps:

- Avoiding impacts altogether.
- Minimizing impacts by limiting the degree or magnitude of the action.
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- Reducing or eliminating the impact over time.
- Compensating for the impact.
- Monitoring the impact and taking appropriate corrective measures.

Environmental Impacts: Compensatory mitigation projects themselves are intended to offset impacts from other projects, typically some form of development project. As such, compensatory mitigation projects normally result in the improvement of habitat at the compensatory mitigation site. However, compensatory mitigation activities may cause the physical or functional loss of habitat by temporarily (during the construction of the habitat improvement) or permanently (when "creation" is used as the habitat improvement project) altering existing priority habitat in the reserve.

Management Strategy: All impacts within the reserve must be fully mitigated for within the reserve. The mitigation sequence of avoidance, minimization, and compensation will be strictly adhered to and must be consistent with the management guidance described in Section 5.2.1. Compensatory mitigation activities that offset impacts to resources outside the reserve will be allowed if they improve the habitats within the reserve. Compensatory mitigation activities that offset impact to resources inside the reserve must be successfully installed before construction can begin on the associated project. Compensatory mitigation will not be allowed to alter existing priority habitat in the reserve.

5.2.2.21 Mitigation Banking

Description: A mitigation bank is a site where wetlands or aquatic resources, or both, are restored, created, enhanced, or in exceptional circumstances, preserved expressly

for the purpose of providing compensatory mitigation in advance of authorized project impacts to similar resources. The environmental improvements produced at these sites are sold as credits to project proponents needing to fulfill compensatory mitigation.

Environmental Impacts: Mitigation banks are a form of regional compensatory mitigation, with the goal of providing greater resource protection and benefit to the public. Mitigation banking promotes the restoration of an aquatic system to provide off-site compensation for multiple small mitigation projects or single large projects, resulting in economies of scale in planning, implementation, and management. Consolidation can result in aquatic systems of greater value because of their size and the commitment to long-term management. Mitigation banking can also result in aquatic systems of greater ecological value by reducing the effects of habitat fragmentation and through the restoration of historic aquatic habitat diversity and distribution within an ecoregion.

Management Strategy: Mitigation banking shall be encouraged throughout the reserve based on priorities identified in the management plan or other documented publications.

5.2.2.22 Non-Water Dependent Uses

Description: WAC 332-30-106(43) defines non-water dependent use as:

> *Non-water dependent activities are uses that can exist and operate in a location other than the waterfront. Examples include, but are not limited to, hotels, condominiums, apartments, restaurants, retail stores, and warehouses not part of a marine terminal or transfer facility (RCW 79.90.465).*

Environmental Impacts: Non-water dependent uses create modifications to the shoreline and aquatic environment.

Management Strategy: Non-water dependent uses are not preferred uses, and will be evaluated based on the management of activities discussed in this management plan.

5.2.2.23 Shoreline Modifications on State-Owned Aquatic Lands

Description: Shoreline modifications include bulkheads and armoring of state-owned shorelines.

Environmental Impacts: Shoreline modifications interfere with natural shoreline erosion by interrupting and exacerbating shoreline erosion processes, disrupting surface and groundwater hydrology, interfering with fish migration and spawning habitat, and resulting in the removal of shoreline vegetation.

Management Strategy: There is very little state-owned shoreline within the reserve boundary. New shoreline modifications that create environmental impacts (described above) will not be allowed on state-owned aquatic lands throughout the reserve. The DNR will inventory state lands for existing modifications. Plans will be developed to remove or replace, if appropriate, shoreline modifications to minimize impacts.

5.2.2.24 Public Use

Description: Providing public use to state-owned aquatic lands is one of DNR's primary mandates. To accomplish this mandate, DNR typically authorizes structures and facilities (such as boat ramps, marinas, and public boardwalks) through the issuance of leases or easements. There are currently four public access sites near or within the reserve. These include King County's Marine Park, Burton Acres, Point Robinson Park, and Dockton Park. Dockton Park is the only public access site that is within the aquatic reserve on state-owned aquatic land. The other three public access sites are on lands that are not owned by the state and do not require further management action (i.e., authorization) on behalf of DNR. In addition, public uses within the reserve such as shellfish harvest, boating, fishing, crabbing, beach walking, leisure time, the 4th of July fireworks display, and other uses are discussed in section 5.3.4.

Environmental Impacts: Public facilities like docks and marinas produce the same possible impacts as described in section 5.2.2.10. Public use can result in the removal of aquatic life and potential impacts associated with overuse or misuse.

Management Strategy: DNR would promote and encourage appropriate, legal public use within the reserve conducted in a manner that preserves the habitats and species of the reserve. In addition, DNR, through cooperation with local residents and interest groups, assess whether additional public access is needed and where within the reserve it should be sited.

5.2.2.25 Unauthorized Structures

Description: There may be in-water and over-water structures within the boundaries of the reserve that have not been authorized by DNR, such as fish pens, non-recreational docks and piers, and dolphins.

Environmental Impacts: Expected impacts are the same as those identified for the specific types of structures (i.e., docks, fish pens, etc.) that are in trespass.

Management Strategy: DNR will develop an inventory of structures, determine the types of uses, and determine possible impacts to habitats and species identified in this plan. Those activities determined to pose no or minimal environmental concerns relative to the intent of the reserve, as described in this management plan, and that can be authorized will be identified and documented by DNR staff and allowed to

remain until owners can be contacted. The DNR will then work cooperatively with the owners of the structures to secure an authorization, as appropriate, and eliminate or reduce any associated impacts to the habitats and species identified for conservation in the reserve. When a structure is not authorized and is deemed an inappropriate use of state-owned aquatic lands (such as a nonwater-dependant floating commercial operation) or derelict/abandoned (such as excess and orphaned pilings and dolphins), the structure will be treated as a trespass. The DNR will take appropriate legal actions as needed to rectify the trespass.

5.2.3 Specific Management Strategies for Existing and Pending Uses

Use authorizations for activities that were granted prior to the establishment of the reserve (Appendix J) will be honored throughout the duration of their current authorized periods. In addition, pending uses of state-owned aquatic lands that were proposed prior to reserve establishment will be evaluated in the same manner as existing uses.

DNR recognizes that existing uses were constructed and initiated prior to reserve designation and that there may be current and continuing environmental impacts to the species and habitats targeted for conservation within the reserve associated with these uses. Under the management plan, existing authorized uses and those currently negotiating authorizations within the reserve would be subject to the same general programmatic requirements and the management strategies described in section 5.2.2 and Appendix O. Existing uses may be re-authorized, expanded, or upgrading if planned operations make use of available and reasonable technologies and result in fewer impacts to the natural environment than under existing conditions. The DNR staff will work cooperatively with lessees to develop site plans that will identify measures to reduce ongoing site-specific environmental impacts related to existing facilities and implement these over the course of the 90-year term of the reserve.

In addition to the general management principles for activity types presented in Section 5.2.1 the specific management provisions below will apply to existing authorized and proposed uses.

All use authorizations that were in good standing and existed within the reserve at the time of reserve designation, whether in normal or holdover status:

- May conduct maintenance and construction activities as per the existing terms and conditions of the original agreement;
- May be re-assigned to another entity under the existing terms and conditions of the original agreement; and
- May be processed for re-authorization upon expiration, including an evaluation based on the adopted site management plan to assess their compatibility with the reserve and reserve goals. Activities determined to be compatible may be re-authorized. Activities determined not to be compatible will be addressed to determine if and how, over time, the activities could be modified to make them

compatible. If, after all appropriate strategies have been attempted, the activities remain incompatible with the reserve; the activity will not be re-authorized.

There are currently eight existing and proposed activities on state-owned aquatic lands within or near the reserve (Appendix J). These include:

- Quartermaster Yacht Club – Lease 20-011434;
- Quartermaster Harbor Marina – Lease 20-010075;
- Dockton Marina – Lease 20-009814;
- Glacier Northwest's Gravel Barge Loading Facility – Lease 20-012778 (application pending);
- Puget Sound Energy Utility Rights-of-Way (three separate crossings) – Leases 51021507, 51027510, and 51033836; and
- Comcast Utility Right-of-Way Lease 51-075015.

5.2.3.1 Quartermaster Yacht Club

The Quartermaster Yacht Club is a non-profit organization that provides private boat mooring. The yacht club has 94 slips, although only approximately 92 of the slips are located within the 2.97-acre area of the DNR lease. In addition, there is approximately 200-feet of dock that provides transient moorage to members of other yacht clubs with which Quartermaster Yacht Club has reciprocal agreements. The yacht club is currently filled to capacity and has a waiting list for individuals that wish to join. There is a pump house on site for use by the club's members and their guests. Effluent from the pump house is directed to a storage tank, which is emptied and disposed of by a contracted operator. The current lease of the yacht club expired on January 9, 2001, and has been in holdover status since that date, pending the decision on how the Maury Island site should be managed. Since 2001, the yacht club has operated on a year-to-year agreement with DNR based upon the conditions of the original lease. The owners are considering expansion of the marina to accommodate increasing demand.

The Quartermaster Yacht Club will be treated as an existing use within the reserve. As such, DNR will work cooperatively with the lessee to develop a site plan that over time will be implemented to meet the criteria established in the reserve management plan Section 5.0. The activity will be allowed to continue within the reserve if it successfully meets these criteria. The fundamental moorage service of the yacht club serves the primary objective of the reserve by actively reducing impacts to the habitats and species caused by anchoring within the harbor. The DNR will, however, work collaboratively with the lessee to determine additional ways it can serve the objectives of the reserve and consider the management actions described below to reduce the impacts to the habitats and species within the reserve. Future

improvements to Yacht Club facilities to reduce these impacts will be implemented as the remaining economic life of the existing structures is realized or as there are expansions or upgrades to the facility.

Quartermaster Yacht Club-Specific Management Provisions

Marina design and maintenance

- Use pier design that enhances water circulation.
  - Design marina expansions or upgrades with as few segments as possible to promote water circulation.
  - Use open design of for marina expansions or upgrades to minimize barriers that may restrict the exchange of ambient water and water within the marina area.
- Use environmentally neutral materials.
  - Use materials that will not leach hazardous chemicals into the water and that will not degrade in less than ten years time. New pilings or other structures in or above the water could be made of reinforced concrete, coated steel, recycled plastic, plastic reinforced with fiberglass, or other non-leaching materials.
  - Do not use wood treated with creosote, chromated copper arsenate (CCA), ammoniacal copper zinc arsenate (ACZA), or ammoniacal copper arsenate (ACA).
  - Use floatable encapsulated foams to prevent the break-up and release of styrofoam to the aquatic environment.
- Limit shading areas over water.
- Eliminate construction and repair noise during spawning and migration periods, as specified in the Hydraulic Project Approval to be secured from WDFW.
- Employ “soft” shore erosion control measures.
- Comply with local regulations.
- Meet other federal and state permitting requirements.
- Avoid intermittent lighting during construction and operation on or near water during known forage fish spawning periods.

Vessel Maintenance and Repair

- Perform all major repairs in a designated upland area that will not impact aquatic areas.
- Comply with all local regulatory requirements.
- Obtain a valid National Pollutant Discharge Elimination System (NPDES) permit for maintenance and repair yards that discharge to surface waters.

- When washing boats in the water, use soaps sparingly. When washing with soap is necessary, use soaps that are phosphate-free, biodegradable, and non-toxic. Avoid cleansers that contain ammonia, sodium hypochlorite, chlorinated solvents (bleach), petroleum distillates, and lye.
- Recycle used oil, oil filters, and antifreeze at a hazardous waste collection facility.

Waste Containment and Disposal

- Comply with the Federal Clean Water Act that requires any vessel with an installed toilet be equipped with a certified Type I, Type II, or Type III marine sanitation device (MSD).
- Discourage discharge of wastewater at the slips.
- Provide shoreside restrooms.
- The DNR recognizes the need for a better functioning and more publicly accessible boat waste pump-out facility in the Burton area of inner Quartermaster Harbor. The DNR will work with the Quartermaster Yacht Club and the Quartermaster Marina to establish an operable pump-out facility that is accessible to their respective members, patrons, and the general public.

Residential Use

- Provide a pumpout system, require regular mobile pumpout service, or install direct sewer hookups for existing residential use.
- Maintain slips closest to shoreside restrooms for residential users.
- Stipulate in the lease agreement that vessels used as residences may not discharge any sewage to the reserve
- Meet the requirements of the DNR Residential Use rules.
- Comply with local and state regulations.

Suggested Upland Management Practices

- Minimize impervious surfaces.
- Use upland and inland areas to:
- Locate buildings, workshops, and waste storage facilities,
- Locate parking and vessel storage areas,
- Locate boat repair facilities.
- Expand landward - When possible, expand storage capacity by adding dry-stack storage rather than adding wet slips.
- Use upland detention and treatment where possible to control stormwater runoff.
- Meet all local and state requirements for stormwater management.

Monitoring
Monitor impacts of the construction, maintenance, and operation of the facility that are identified in the HPA, local shoreline permit, other permits, and in the DNR lease agreement. Efforts will be made to develop one monitoring plan that will meet all agency requirements.

5.2.3.2 Quartermaster Harbor Marina

The Quartermaster Harbor Marina, owned and operated by Polaris Development, LLC, is under a DNR lease for the use of 3.09 acres of state-owned aquatic lands. The marina consists of a 65-slip structure that supplies private vessel moorage. The marina provides a portable pump unit for use by clients. The pump unit is emptied into the marina's drain field. A permanent pump house is not provided at the site to ensure that fuel or hydraulic fluids do not contaminate the drain field. Except for two vessels, boats moored at the site are not to be used as residences. Sediment surveys conducted in 1992 found that the sediments in the area are relatively clean. The current lease expires on November 14, 2004. An expansion is being considered by the marina owner to accommodate increasing demand.

Quartermaster Harbor Marina-Specific Management Provisions
The Quartermaster Harbor Marina will be treated as an existing use within the reserve. As such, DNR will work cooperatively with the lessee to develop a site plan that over time, will be implemented to meet the criteria established in the reserve management plan (Section 5.2). The activity will be allowed to continue within the reserve if it can successfully meet these criteria. The fundamental moorage service of the marina serves the primary objective of the reserve by actively reducing impacts to the habitats and species caused by anchoring within the harbor. The DNR will, however, work collaboratively with the lessee to determine additional ways it can serve the objectives of the reserve. Future improvements to marina facilities to reduce these impacts will be implemented as the remaining economic life of the existing structures is realized or as there are expansions or upgrades to the facility.

Quartermaster Marina-Specific Management Provisions
Management strategies will be the same as those identified for the Quartmaster Yacht Club in Section 5.2.3.1.

5.2.3.3 Dockton County Marina

King County and DNR have entered into an interagency agreement for the use of 0.81 acres of state-owned aquatic lands for the purposes of a public pier and boat dock. The boat dock provides 58 slips for transient small boat moorage and a utility building that includes restroom and laundry facilities. All sewage from the utility building is pumped to an upland facility. The pier is a wood and concrete structure primarily suspended by wooden piles, with a wooden deck on Styrofoam floats for the mooring slips. There is a concrete seawall along the shoreline of the majority of

the park. The park also includes a public boat ramp to the west of the pier. Sediment sampling conducted in 1992 found that the area is relatively clean of hazardous substances. The current inter-agency agreement expires in 2012.

Dockton County Marina-Specific Management Provisions
The Dockton County Marina will be treated as an existing use within the reserve. As such, DNR will work cooperatively with the lessee to develop a site plan that over time, will be implemented to meet the criteria established in the reserve management plan (Section 5.2). The activity will be allowed to continue within the reserve if it can successfully meet these criteria. The fundamental moorage service of the marina serves the primary objective of the reserve by actively reducing impacts to the habitats and species caused by anchoring within the harbor. The DNR will, however, work collaboratively with the lessee to determine additional ways it can serve the objectives of the reserve and consider the management strategies identified for the Quartermaster Yacht Club in Section 5.2.3.1 to reduce the impacts to the habitats and species within the reserve.

Future improvements to Dockton County Marina facilities to reduce environmental impacts will be implemented as the remaining economic life of the existing structures is realized or as there is expansion or upgrades to the facility.

The DNR recognizes the need for a better functioning and more publicly accessible boat waste pump-out facility in the Dockton Area. The DNR will work with King County Parks to maintain an operable pump-out facility that is accessible to the general public.

5.2.3.4 Glacier Northwest's Maury Island Gravel Barge Loading Facility

Glacier Northwest's Maury Island gravel mine is located along the southeastern shoreline of the island between the communities of Gold Beach and Sandy Shores. Mining has occurred on the site since the early 1940s. The actual mine site is located upland and comprised of approximately 235 acres of which only about 40 acres have been disturbed by previous mining activities. Mining is currently permitted on the site under King County Grading permit No. 1128-714 and DNR Surface Mining Reclamation Permit No. 1128-714. These permits allow mining on approximately 193 acres of the site. The site contains a portable screening plant, dock, and conveyor system. Current mining activities consist of occasional sand and gravel extraction for local use. Approximately 10,000 tons per year have been extracted from the site under the existing grading permits. However, removal of gravel from the site has not occurred via the existing dock and conveyor system located on state-owned aquatic lands within the reserve for over 20 years.

A use authorization application was submitted to DNR in 2000 to replace the existing dock and conveyor system in order to undertake more intensive gravel extraction

activities at the site; the application was denied at that time. Glacier NW resubmitted an application to DNR in 2001. The 2001 application will not be considered by DNR until this management plan is finalized and the project proponent has obtained all required local, state and federal permits. Glacier's current proposal is to rebuild the existing loading dock, which would moor up to four 10,000-ton barges (330 feet long by 80 feet wide) or a greater number of smaller barges per day during the 11 to 50-year period that mining could be conducted at the site (King County 2000). All local, state and federal permits must be secured prior to consideration by DNR of this activity in the aquatic reserve. King County (2004) recently denied Glacier Northwest their shoreline substantial development permit for this revised project. This decision was appealed to the Shorelines Hearings Board. At the time this plan was printed, the future of the new barge loading facility was uncertain.

Glacier Northwest-Specific Management Provisions

The Glacier Northwest gravel barge loading facility will be treated as an existing use within the reserve. As such, DNR will work cooperatively with the proponent to develop a site plan that over time meets the criteria established in the reserve management plan (Section 5.2). In addition, barge loading will be considered within the reserve if the facility secures all necessary local, state and federal regulatory permits, and can successfully meet the criteria below:

Facility Design and Maintenance

- Removal of existing pilings and over-water structures treated with creosote and other toxic materials. New construction should include environmentally neutral materials for pilings and structures in or above the water. Examples include construction materials made of reinforced concrete, coated steel, recycled plastic, or plastic reinforced with fiberglass.
- All stormwater from upland facilities must be infiltrated on upland locations to eliminate any direct discharges to marine waters. Stormwater facilities should be designed to mimic the natural hydrology of subsurface water and natural surface water flows to receiving waters.
- Vessel and facility maintenance and repair materials, such as paints, solvents, and cleaners, should be stored and used in a manner and location that will not impact aquatic areas.
- All upland mining and loading operations should implement BMPs to eliminate impacts of turbidity on native aquatic vegetation, spawning substrate, and resident and migratory fish populations that utilize the surrounding aquatic areas.
- Existing and new facilities should not increase shading of the euphotic zone over existing levels.
- Shoreline hardening and vegetation removal should be avoided.

- Facilities should be constructed to minimize hydrologic alterations and disruption of nearshore drift cells and longshore currents.
- Construction, maintenance, and operational noise should be eliminated during known forage fish spawning periods (January through mid-April) if facility is located in or near spawning areas.
- Noise impacts from operation and barge traffic should be minimized to eliminate impacts during critical fish and wildlife migratory periods.
- Intermittent lighting during construction and operation on or near the water during known forage fish spawning periods must be eliminated.
- Lighting during operations that will impact fish migration or behavior patterns must be eliminated.
- "Propeller wash" especially from large vessels should not result in scouring of the tideland and bedland areas, which disturbs plant and animal life.
- Practices to minimize spillage of any materials during loading and off-loading must be established in addition to practices that will contain and recover any potential spillage that could occur during operations.
- While the fundamental objective of issuing the Glacier Northwest lease would be to support water dependent uses, (i.e., shipping gravel from their gravel mining operations), DNR will work collaboratively with the lessee to determine ways in which their use authorization can serve the objectives of the reserve.

Prior to considering a lease for this operation, DNR will continue to review local, state, and federal permits to evaluate if the resources (identified in Section 4.0 and Appendix C) are provided adequate long-term protection to achieve the desired future conditions described in Section 4.5. Supplemental lease provisions (in addition to the provisions specified by regulatory entities) may be required to ensure long-term conservation of habitat features and species within the reserve.

Monitoring
The proponent must monitor impacts of construction, maintenance, and operation of the facility, as identified in the HPA, local shoreline permit, other permits, and in the DNR lease agreement. Efforts will be made to develop one monitoring plan that will meet all agencies requirements.

If the gravel barge loading facility is eventually not built, the DNR will work with the owners to develop a schedule to remove the existing pier.

5.2.3.5 Puget Sound Energy Utility Rights-of-Way

Puget Sound Energy has three rights-of-way agreements for submarine cables. These cables cross the Maury Island site at the Luana Beach area on the northeast shore of

Maury Island. The cables are used for telecommunications, power, and natural gas, which are important services to the residents of Vashon and Maury islands. The authorization of the use of these state-owned aquatic lands is valid in perpetuity. The existing utilities are static in the environment and pose no noticeable impacts to existing habitats.

Puget Sound Energy-Specific Management Provisions
The Puget Sound Energy utility rights-of-way will be treated as existing uses within the reserve. Since these cables are buried and do not require active management or access, they do not impact the habitats and species identified for protection in this plan. It is not anticipated that Puget Sound Energy will need a site plan to meet the criteria established in the reserve management plan. Repairs and maintenance activities will be required to consider impacts to the habitats and species identified for conservation. Emergency repairs will be managed through the appropriate local, state, and federal regulatory agencies. Since the easements are perpetual, there will not be an opportunity to "re-open" or re-authorize the conditions of the rights-of-way. Puget Sound Energy will not be required to undertake activities that primarily support the objectives of the reserve. However, DNR will seek opportunities for voluntary and collaborative changes, as they are identified, to support the reserve.

5.2.3.6 Comcast Utility Right-of-Way

The project proponent, Comcast, is proposing to lay a submarine fiber optic cable from the mainland to Maury Island, landing at Luana Beach, to provide enhanced video and high-speed internet services. A right of way will have to be obtained from DNR for this use. At the time of this writing, Comcast has had preliminary communications with DNR about acquiring a right of way.

Comcast-Specific Management Provisions
The DNR will review the project proposal as per Section 5.2.2.5 to ensure that it will not impact any of the habitats and species identified in this plan for conservation. Other aspects of the lease will be managed under normal leasing criteria.

5.3 DNR Led and Partnering Activities

The following section describes a number of activities to be implemented within the reserve that may not require a use authorization but could be implemented by DNR alone or in partnership with other entities. These activities (i.e., derelict vessel removal, aquatic nuisance species management) would be conducted in an effort to better meet the goals and objectives for the reserve.

5.3.1 Derelict Vessels

Description: A vessel is considered derelict if the vessel's owner is known and can be located, and exerts control of a vessel that:

- Has been moored, anchored, or otherwise left in the waters of the state or on public property contrary to RCW 79.01.760 or rules adopted by an authorized public entity;
- Has been left on private property without authorization of the owner; or
- Has been left for a period of seven consecutive days; or
- Is sunk or in danger of sinking, is obstructing a waterway, or is endangering life or property.

Derelict vessels can be a hazard to navigation, public safety, and the environment. The DNR has the authority under RCW 79.100 to manage the Derelict Vessel Removal Program. At the time this plan was published, it was unknown how many, if any, derelict vessels existed within the reserve. At least one derelict or abandoned vessel is located at the mouth of Judd Creek, but it is uncertain whether this structure is on state-owned aquatic land.

Environmental Impacts: The scope of impacts to the natural environment resulting from derelict vessels is dependent on the size, location, and contents of a derelict vessel. Vessels in immediate danger of sinking are most likely to release toxic substances or become a potential navigational hazard. Most vessels carry some quantity of petroleum products that if released, would harm fish and wildlife and potentially contaminate human food and water supplies. Sunken vessels also smother aquatic habitat and may cause scour if vessels shift around due to currents or tidal changes.

Management Strategies:
The DNR will inventory existing derelict or abandoned vessels throughout the reserve, regularly identify the arrival of new derelict or abandoned vessels, and remove vessels per DNR Derelict Vessel Program guidelines.

5.3.2 Land Acquisition for Habitat

Description: The DNR may acquire aquatic habitat through exchanges that are consistent with RCW 79.90.455, or through special land transaction (through the DNR Natural Resource Conservation Area and Natural Areas Programs). Presently, DNR has no specific authority and has no dedicated funding to purchase aquatic lands.

Environmental Impacts: The acquisition of critical habitat adjacent to the aquatic reserve will enhance opportunities for conservation of the habitats and species identified in this plan.

Management Strategy: Habitat acquisition priorities throughout the reserve will be developed through the management plan and include the following actions:

- Work with King County, the Vashon-Maury Island Land Trust, local citizens, and other interested parties to establish priorities for habitat acquisition;

- Identify opportunities to acquire prioritized habitat that will complement the existing habitats and species within the reserve;
- Secure funding for habitat acquisition;
- Where acquisition of important aquatic habitat is not an option, work cooperatively with owners of adjacent lands (on a voluntary basis) to identify and address specific habitat restoration and conservation opportunities on their properties; and
- If after the reserve is established, intertidal areas directly adjacent to and shoreward of the reserve area come into state ownership, DNR can choose to include these areas into the aquatic reserve. The new area would be managed according to this management plan.

5.3.3 Aquatic Nuisance Species Management

Description: Aquatic nuisance species can include both plants and animals. Readily observed examples of aquatic invasive species in the inland marine waters of Puget Sound and the Georgia Basin include cordgrasses (*Spartina spp.*), Japanese eelgrass (*Zostera japonica*), oyster drill (*Ceratostoma inornatum*), varnish or dark mahogany clam (*Nuttalia obscurata*), and the European green crab (*Carcinus maenas*). Species of concern for marine waters, identified by WDFW, include Spartina, European green crab, Chinese Mitten Crab *(Eriochier sinensis)*, and purple varnish clam (*Nuttalia obscurata*). *Spartina* was first discovered on Vashon Island in 1993 at Fern Cove on the northwest side of Vashon Island. Since then, *Spartina* has been found near the Maury Island site in Raab's Lagoon, Point Heyer, and Tramp Harbor. Several other invasive species have been detected within or near the aquatic reserve. No systematic survey has attempted to assess which species are present. Table 3 of Appendix C describes non-native and cryptogenic species that have been detected in Puget Sound and several species on this list are likely to occur within the reserve.

Environmental Impacts: Plant and animal aquatic invasive species pose a serious threat to compete, displace, disturb and consume native species. With improvements in travel technology, the rate of introductions of nonnative species has increased dramatically.

Management Strategy: Aquatic nuisance species that are identified in the reserve will be managed in cooperation with the Washington Department of Agriculture, WDFW, and the King County Noxious Weed Board. Priorities for aquatic nuisance management will be developed through implementation of the management plan.

5.3.4 Public Recreational Use

Description: While DNR promotes public use through proprietary authorizations, DNR does not have regulatory authority to manage public recreational activities such as boating, fishing, shellfishing, swimming, and beach walking. Beach walking likely occurs extensively along the reserve boundary on privately owned and state-owned aquatic tidelands. Recreational clam harvests are known to occur at Burton Acres and Point

Robinson parks and likely occur at the other public beaches within the reserve. Boating and fishing are other common activities that occur within the reserve. Reports from local citizens indicate that water-skiing is another favored activity within Quartermaster Harbor due to the relatively calm waters in the area.

Environmental Impacts: Transient recreational activities, if not conducted responsibly, could produce adverse impacts on the aquatic habitats and species within the reserve.

Management Strategy: The DNR will promote and encourage appropriate, legal transient public recreational activities within the reserve (such as boating, water-skiing, fishing, shellfishing, swimming, and beach walking) conducted in a manner that preserves the habitats and species of the reserve.

To accomplish this, DNR will:

- Inventory the types, magnitude, and location of transient public recreational activities;
- Determine if inventoried activities are causing impacts to the habitats and species targeted for conservation within this plan; and
- If it is determined that impacts are occurring, DNR will work cooperatively with user groups and appropriate regulatory agencies to identify opportunities for voluntary efforts that avoid and minimize the impacts.

5.3.5 Outreach and Education

Description: The DNR's outreach and education efforts will focus on identifying the site as an aquatic reserve and working collaboratively with the King County Maury Island Aquatic Steward, the entities identified in Appendix B, and local residents to promote and protect the reserve.

Environmental Impacts: Outreach and education can produce beneficial environmental impacts by bolstering understanding of the importance of aquatic habitats, species, and ecological processes. Such efforts can lead to individuals, businesses, and government entities working together to improve the environmental features of the reserve.

Management Strategy: DNR will work with user groups, local environmental groups, local clubs, region staff, and other interested citizens to implement a number of education and outreach actions including:

- Placement of signs and boundary markers in and adjacent to the reserve;
- Dissemination of information on BMPs related to bulkheads, riparian management, septic tanks/fields, docks, and mooring buoys to local residents;
- Dissemination of information on BMPs for commercial activities (e.g., docks and marinas) to businesses;

- General education activities such as school visits, shoreline stewardship walks, and interpretive signage;
- Identification of opportunities (such as locating funding sources) to interface voluntary management of private aquatic lands with the aquatic reserve management; and
- Development of a process for working with local jurisdictions, regulatory agencies, and adjoining landowners to identify and minimize off-site impacts.

5.4 Private and Public Land Adjacent to the Aquatic Reserve

Approximately 88 percent of the tidelands in Quartermaster Harbor and the east shore of Maury Island are not owned by the state. Private property ownership makes up most of the aquatic lands and uplands adjacent to the aquatic reserve. The Vashon Park District owns and manages the Point Robinson Light House, which is on the National Historic Register, and the Burton Acres Park Northeast. King County owns and manages the Maury Island Marine Park, Dockton Park, and an undeveloped site (of about 50 acres, including about 600 feet of shoreline) along the lower western shore of Quartermaster Harbor. King County also has regulatory jurisdiction over land-use in and adjacent to the aquatic reserve through the County's Shoreline Master Program (Appendix K), Comprehensive Land Use Plan (Appendix L), and King County Code.

The DNR does not have proprietary authority over aquatic lands and uplands that are not owned by the State of Washington. However, DNR has identified activities, such as shoreline modifications, non-point source pollution, and private docks and floats, that occur on aquatic lands and uplands adjacent to the reserve that may impact habitats and species identified for conservation in the reserve (Broadhurst 1998).

Therefore, the successful conservation of critical habitats and species that occur adjacent to the aquatic reserve will be enhanced by implementation of existing local and state government regulations, as well as voluntary stewardship activities undertaken by shoreline property owners. The success of the reserve will be improved with the cooperation and willingness of the local government and local citizens to address and manage potential impacts outside of the reserve boundaries on adjacent privately and publicly owned aquatic lands and uplands.

5.4.1 Shoreline Modification

Approximately 60 percent of the shoreline surrounding the reserve has been modified in some manner (Appendix M). Shoreline modification can lead to cumulative impacts to the reserve by interfering with natural erosion processes, scouring the beach, and the removal of shoreline vegetation. These impacts can lead to long-term effects on the physical

structure and biological composition of the beaches. The DNR will rely on King County[5] and WDFW[6] to properly manage and permit activities on lands adjacent to the reserve to conserve these habitats and ecological processes.

While DNR recognizes that there may be instances where threats to private property may need to be addressed through engineered solutions, in many instances soft techniques that mimic natural processes are as effective as traditional hard solutions (King County 2002; Menashe 2001; Williams and Thom 2001). The DNR will support King County's existing regulations for soft armoring solutions, as well as provide guidance for local property owners. The County's guidance will be considered when seeking preferred option for the repair and replacement of existing hard armor and to resolve current and future threats to private property.

Management Strategy:
The DNR will:

- Work in cooperation with adjacent landowners (on a voluntary basis) in efforts to gain support for the reserve and to help reduce impacts caused by shoreline modification; and
- Seek funding opportunities and create incentives for the adoption of best management practices (BMPs) and improvement of shoreline conditions, through "soft" armoring techniques such as beach nourishment, riparian plantings, and other alternative strategies to reduce shoreline impacts.

5.4.2 Non-Point Source Pollution

Non-point sources of pollution are difficult to address because they are diverse in nature and are caused by a variety of sources spread over a relatively large geographic area. Non-point sources of pollution around the reserve are a relevant issue for DNR because they can degrade water quality within the site and contribute to reduction in light penetration, which inhibits growth of eelgrass. Non-point pollution sources can cause eutrophication of receiving water, which increases opportunities for growth of *ulva* (sea lettuce), which competes with eelgrass. In addition, failing sewage systems located on surrounding property can contribute fecal bacteria and excess nutrients to the nearshore area and contaminate local shellfish populations. As a consequence of polluted waters and paralytic shellfish poisoning (PSP), shellfish harvesting is prohibited or conditionally limited by the Washington Department of Health in some areas within or adjacent to the reserve.

[5] King County Shoreline Master Program Chapter 25 – Shoreline Master Program: Repair of Replacement of Shoreline Protection, Piers, Moorage Facilities, or Launching Facilities (May 4, 2000), and King County Comprehensive Plan sections E-107, E-124, E-168, E-169, and E-170, and rules that regulate the construction, repair and replacement of shoreline armoring structures.

[6] Washington Department of Fish and Wildlife regulations defined in WAC 220-110-285 – Single-family residence bulkheads in saltwater and WAC 220-110-050 – Bank protection.

Management Strategy:
The DNR will:

- Review past and present non-point source pollution programs;
- Identify sources of non-point pollution and prioritize areas of concern;
- Work cooperatively with the King County Health Department, local entities, and property owners to formulate and implement strategies to address non-point source impacts; and
- Seek funding sources to assist with repairing and improving sewage systems and for clean up.

5.4.3 Docks, Floats, and Mooring Buoys on Private Property

Numerous recreational docks, floats, and mooring buoys exist on privately owned aquatic lands adjacent to the reserve. These structures are important aspects of island living for local residents, as they provide moorage for recreational vessels and local access to the aquatic resources of Puget Sound. While recreational docks, floats, and mooring buoys have beneficial aspects, they may also cause some cumulative negative impacts associated with shading, toxic construction materials (i.e., creosote treated piling), and scouring (i.e., improper buoy installation). The DNR does not have management authority over private recreational docks and mooring buoys that are on privately owned tidelands and shorelands. King County and WDFW are the regulatory agencies with the primary responsibility to manage these structures and DNR will rely on their regulatory authority to minimize impacts from docks and mooring buoys on privately owned lands.

Management Strategy:
The DNR will:

- Provide adjacent landowners information and establish partnerships to promote conservation of the habitats and species within the reserve; and
- Work cooperatively with adjacent landowners (on a voluntary basis) to locate funding sources for the adoption of BMPs and improvements to their structures.

6.0 Adaptive Management and Plan Updates

The management plan shall be reviewed and updated every ten years throughout the 90-year term of the reserve designation. Adaptive management of the reserve will integrate changes in scientific knowledge concerning the site, conditions of habitats and species, and existing uses of state-owned aquatic lands. Data and reports generated from research and monitoring activities will be also be used to guide DNR in determining if management actions are meeting the goals and objectives of the reserve. If management actions are not successfully contributing to the goals and objectives for the reserve, then they will be modified, monitored, and evaluated during the following 10-year review process in accordance with adaptive management strategies.

DNR will include new scientific findings into adaptive management - and that should not be restricted to every 10 years. Existing uses within the aquatic reserve will also be evaluated during the ten-year management plan review process. Leases in good standing will continue to be honored for the term of the lease, but lease-related activities will be reviewed based on the existing plan, to evaluate the progress that has been achieved in implementing the conditions of their site-specific plans. The review will include an evaluation of whether lease-related activities are showing progress in decreasing or increasing impacts to the habitats and species of the reserve. During the review process of the management plan, site-specific plans of lessees may require updating. An evaluation will be made on the progress and success of lessees on their efforts to implement specific actions to achieve the objectives of the reserve. During and after the ten-year management plan review process, DNR will continue to work cooperatively with lessees to meet the conditions of the lease and the development and implementation of site-specific management plans.

6.1 Modification to Reserve Boundary

Boundaries can be expanded or decreased during the regular 2-year reserve nomination process. The DNR staff may recommend changing the reserve boundaries based on new information or conditions at the site identified through the 10-year management plan review process.

7.0 Capital and Management Funding

The DNR has identified numerous actions that should be taken to achieve the objectives of the reserve. These actions include, managing activities on state-owned aquatic lands, working cooperatively with the local community and regulatory agencies, reaching out to recreational user groups, and undertaking research and monitoring activities. These actions will take time and funding to implement.

The DNR currently has an assistant regional manager, district manager, and land manager who are responsible for the management of field activities on state-owned aquatic lands in the geographic area of King County that includes the reserve. The DNR headquarters has an assistant division manager, planning unit supervisor, aquatic reserve program manager, and lead scientist who are responsible for the programmatic development and implementation of the aquatic reserve program at the state level. The DNR will attempt to implement components of this management plan with a percentage of time from these existing six staff until additional funding and staffing can be allocated specifically for the management of the reserve. The implementation of this management plan will compete with existing activities and priorities of these staff.

Under ideal circumstances, an aquatic reserve site manager would be dedicated to working at the reserve. The site manager's responsibilities may include management of other regional aquatic reserves established in the future. The reserve manager would likely serve at a level equivalent to a Land Manager 2, within the state system. Land Manager 2s are currently at Range 48, with a salary level of approximately $35,000 to $45,000 per year (This figure does not account for other benefits and overhead, which could add approximately 15 percent per year). This position could work directly for the DNR or for an external government or non-government agency that agrees to partner with the DNR in the management of the aquatic reserve. In either case, in the event that a reserve manager position was funded in the future, the position would ideally be physically located at the reserve area (or manage multiple sites and located part time at each site) where they could integrate into the local community and participate at the local level in the implementation of the reserve management plan. Funding for the reserve manager position could come from future legislative appropriations to the DNR, donations from private entities or individuals, grants, and/or dedications of funding from lessees (as a means to primarily serve the objective of the reserve).

Funding needs for other, more intensive management efforts (such as research and monitoring) and capital improvement projects (such as structure modifications, restoration projects, or acquisition projects), will be determined when specific components of this management plan are being implemented.

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Appendices

Appendix A - Boundary Legal Description

The tidelands and bedlands of navigable waters, owned by the State of Washington, described as follows:

Those tidelands and bedlands surrounding Maury Island, which are fronting and abutting Government Lot 4, excepting there from the west five acres, of Section 14, Sections 20-23, inclusively, and Sections 28-32, inclusively, Township 22 North, Range 3 East, W.M.;

Together with, those tidelands and bed lands lying westerly of said Maury Island which are fronting and abutting only those portions of Sections 9 and 16, which are fronting on Quartermaster Harbor, Township 22 North, Range 3 East, W.M.;

Together with, those tidelands and bedlands lying southerly of said Maury Island, which are fronting and abutting Sections 5 and 6, Township 21 North, Range 3 East, W.M.; and said reserve extends waterward to a water depth of 70 feet below mean lower low water OR one-half mile from the line of extreme low tide, whichever line is further waterward.

Those tidelands and bedlands lying southerly and easterly of Vashon Island, which are fronting and abutting Section 1, Township 21 North, Range 2 East, W.M.;

Together with, those tidelands and bedlands lying easterly of said Vashon Island, which are fronting and abutting Sections 24, 25, and 36 Township 22 North, Range 2 East, W.M.;

Together with, those tidelands and bedlands lying easterly of said Vashon Island, which are fronting and abutting Sections 17-20, inclusively, Township 22 North, Range 3 East, W.M.;

Together with, those tidelands and bed lands lying southerly and westerly of said Vashon Island, which are fronting and abutting only those portions of Section 8, which is fronting on Quartermaster Harbor, Township 22 North, Range 3 East, W.M.; and said reserve extends waterward to a water depth of 70 feet below mean lower low water OR one-half mile from the line of extreme low tide, whichever line is further waterward (Figure 1).

Situated in King County, Washington.

Prepared by Steven B. Ivey, PLS
Date: May 7, 2004

Appendix B - Administrative Lead and Cooperative Management Entities

- **King County:** King County is the primary manager of adjacent land use through the King County Comprehensive Plan, King County Shoreline Master Program, and King County Code. King County Parks also manages Dockton County Park and the Maury Island Marine Park. The DNR will seek to work consistently with the existing regulations and management plans administered by King County Water and Land Resources Division, Department of Development and Environmental Services, the Maury Island Aquatic Steward, King County Department of Natural Resources, and King County Parks and Recreation.
- **King County Noxious Weed Control Board**: The King County Noxious Weed Control Board sets county weed control priorities, annually adopts the county weed list, and administers the Noxious Weed Control Program throughout the County according to the requirements of RCW 17.10. The Board also provides education to the public by informing them of the County weed list, why it is necessary to control noxious weeds, and appropriate methods of eradication or control.
- **King County Conservation District**: The King Conservation District (KCD) is a natural resources assistance agency authorized by the State of Washington and guided by the Washington State Conservation Commission. The KCD promotes conservation through demonstration projects, educational events, providing technical assistance, and, in some cases, providing or identifying funds that may be available for projects. The KCD has no regulatory or enforcement authority and only works with those who choose to work with them.
- **Washington Department of Fish and Wildlife (WDFW)**: The WDFW has authority over the management of commercial and recreational fisheries, including shellfish harvest licensing and seasons. The WDFW also helps protect aquatic resources from degradation through its Hydraulic Project Approval (HPA) process. The WDFW plays an important role in the management of the reserve in oil spill response, ballast water monitoring, and Natural Resources Damage Assessments. The DNR will seek to cooperate with the WDFW North Puget Sound Region (Region 4), Marine Protected Area Program, Fish Program, and Habitat Program to aid in achieving the goals for the reserve.
- **Washington Department of Ecology (Ecology):** The Department of Ecology manages oil spill response, wastewater discharge, oversees the state shoreline master program, and administers state water quality standards. The DNR will seek to cooperate with Ecology's Northwest Regional Office and Stormwater Section.
- **Washington State Deparment of Health:** The Washington Department of Health (WDOH) regulates commercial harvest of shellfish and advises the public on the healthy recreational harvest of shellfish. The DNR will seek to cooperate with WDOH's Food Safety and Shellfish programs.

- **U.S. Coast Guard:** The U.S. Coast Guard manages vessel activity and responds to pollution reports within Puget Sound through the Marine Safety Office. The Coast Guard also helps ensure the safety of vessels during transit and while in port.
- **U.S. Army Corps of Engineers**: The Corps of Engineers supports navigation through the maintenance and improvement of water channels, development projects to reduce flood damage, and regulation of dredging and filling activities in wetlands and waterways of the U.S.
- **U.S. Fish and Wildlife Service:** The U.S. Fish and Wildlife Service is charged with protecting plant, terrestrial animal, and some fish species listed under the federal Endangered Species Act and the Migratory Bird Treaty Act and the habitats those species rely upon. They are also mandated to coordinate with state agencies through the Fish and Wildlife Coordination Act.
- **National Oceanic and Atmospheric Administration-Fisheries (NOAA-Fisheries):** NOAA-Fisheries is responsible for the protection of marine mammals and anadromous fish species under the federal Endangered Species Act, the Magnuson-Stevens Act and the Marine Mammal Protection Act. NOAA-Fisheries is also charged with conservation and protection of living marine resources within the United States Exclusive Economic Zone.
- **Puyallup Tribe:** Tribes are responsible for managing tribal harvests of fish and shellfish species, protection of historical and cultural resources, and management of tribal lands. The tribes also co-manage the state's fisheries resources along with WDFW and DNR (geoduck fishery).
- **Vashon Parks District:** The Vashon Parks District manages Burton Acres and the Point Robinson parks.
- **Non-Governmental Organizations:** A wide variety of non-governmental organizations play important roles regarding citizen representation for environmental protection, property rights, education and outreach, and monitoring. These entities include the Vashon Community Council, Vashon/Maury Island Land Trust, Preserve Our Island, Vashon Audubon, and People for Puget Sound

Appendix C – Aquatic Reserve Habitat and Species Description

The nearshore environment along the reserve is a complex, productive environment that provides important habitat structures and ecosystem functions for a wide variety of aquatic flora and fauna. While urbanization and human development have altered much of the nearshore environment in the Central Puget Sound, much of the habitat along the reserve remains relatively unaltered, which makes it a crucial component of the area's aquatic environment. Achieving preservation of this area requires an understanding of the processes, functions, species assemblages, species abundance, and habitat types so that management strategies can be developed to best protect the aquatic resources at the reserve. While the reserve area is limited to those submerged lands managed by DNR that are in state ownership, approximately 88% of the tidelands adjacent to the reserve are in private ownership. This section examines all natural resources found in the vicinity of the reserve, including those on privately owned and managed lands adjacent to the reserve.

1.0 Physical Environment

1.1 Ecological Zones

The reserve can be effectively divided into three ecological zones (Figure 2 in main body). The lines delineating the differences between each of these zones are neither exact nor constant and may change seasonally or annually as a result of local environmental conditions. Inner Quartermaster Harbor is the most protected part of the harbor with very weak or indeterminate currents during most tide and wind conditions (Turnbeaugh 1975). The subtidal sediments in this area are classified as mud, but the mud is much deeper than areas in Outer Quartermaster Harbor (Blau 1975). The delineation between inner and outer Quartermaster Harbor is the transition area between Burton Peninsula and Raab's Lagoon. With the exception of the Dockton area, outer Quartermaster Harbor experiences much higher wave exposure, currents, and circulation. The waters in outer Quartermaster Harbor are still warmer, less saline, and have a higher residency time than waters offshore of Maury Island's east shore. The east shoreline of Maury Island from Piner Point to Point Robinson is much more exposed and grades to deeper offshore waters.

1.2 Hydrology

1.2.1 Freshwater

An estimated 61 streams and outfalls empty into the reserve with the majority draining into Quartermaster Harbor (Anchor Environmental 2004). Larger, perennial streams on Vashon and Maury islands generally originate from groundwater seeps in higher elevation areas (300 to 500 feet above sea level). In these higher elevation reaches, the streams are typically low gradient and meander across the landscape. As the streams approach the marine shoreline, elevations change rapidly and water flows through a network of high-gradient ravines before entering Quartermaster Harbor. Streams with lower flows and smaller watershed areas generally originate in steeper gradient reaches (10 to 15 percent) and flow rapidly to marine waters (Kerwin and Nelson 2000).

Maury Island is not divisible into watersheds, and it appears that the majority of freshwater flow from the island enters Quartermaster Harbor through intermittent creeks and freshwater seeps. Two watersheds, Judd and Fisher creeks, flow into Quartermaster Harbor from Vashon Island (Appendix E). Judd Creek has an annual base flow of approximately 2.0 cubic feet per second (cfs) at the mouth and drains about 3,149 acres. Fisher Creek has an annual base flow of approximately 1.0 cfs, with a drainage area of about 1,549 acres (Kerwin and Nelson 2000). Limited water quality monitoring was undertaken in these tributaries in the early 1990s and Judd Creek was found to comply with all state standards. Although several samples from Fisher Creek exceeded the acute standard for lead, the Creek was within limits for all other parameters (Kerwin and Nelson 2000). The Burton Water Company withdraws water from Fisher Creek for domestic use, which may limit base flows during low flow periods.

Freshwater seeps along the marine shoreline are known to exist, but the number of seeps and the amount of water entering the reserve through freshwater seeps is unknown.

1.2.2 Estuary

The Puget Sound is a large estuary, where fresh and marine waters mix. Estuarine waters function as a partially blended, two-layer system, with less saline surface waters flowing seaward and denser, more saline ocean water returning landward at lower depths. Surface water flows can be augmented by inflow from any number of rivers and streams throughout the estuary. While there are several large rivers and a multitude of smaller streams in the general region, the bulk of the freshwater flowing into the Central Puget Sound Basin comes from the Puyallup and Duwamish Rivers, which account for 20 percent of the total drainage area. Tidal energies in the Central Basin are relatively strong and the water mixes freely throughout most of the year. However, during summertime dry seasons, stratification increases as freshwater inputs decrease (Williams et al. 2001).

The accumulated data indicate that Quartermaster Harbor is subject to wide seasonal fluctuations of most oceanographic and water quality parameters and is typical of a shallow Puget Sound embayment with a relatively high ratio of drainage area to receiving water (NORTEC 1984). An estimated 61 streams and major outfalls empty into the reserve with the majority draining into Quartermaster Harbor (Anchor Environmental 2004). Rainy winters and dry summers common to the Pacific Northwest drive observed seasonal variations. The wetter winter period causes marked declines in salinity, pH and temperature, while coliform bacteria levels increase (NORTEC 1984; Turnbeaugh 1975). While vertical salinity gradients are generally present within Quartermaster Harbor, observations vary in how pronounced these gradients are, with Turnbeaugh (1975) noting more pronounced gradients than NORTEC (1984).

Quartermaster Harbor is a rather shallow embayment that covers approximately 3,050 surface acres with water depths in the inner harbor averaging about 16 feet, while in the outer harbor water depth averages approximately 72 feet and reaches maximum depths of about 100 feet (NORTEC 1984). Circulation within the harbor may be reduced due to the closure of a historic opening at portage; however, circulation appears to be adequate to flush Quartermaster Harbor (Turnbeaugh 1975). An area of "less active" circulation is located between Judd Creek and Burton Peninsula. The implication is that water-polluting activities in less active regions should be minimized or completely eliminated to achieve and maintain adequate water quality standards (Turnbeaugh 1975). Historically, water flowed freely in and out of the harbor during high tides through an inlet known locally as "portage" located between Vashon and Maury Islands. Portage, is an isthmus connecting Vashon and Maury Islands. While George Vancouver's initial observations of the islands in 1792 indicate only one island, Captain Charles Wilkes charted two islands in 1841 (Lynn 1974). The opening was closed through the construction of two roads, one from Portage to Ellisport in 1916 and another from Portage to Dockton in 1925 (Van Olinda 1935). Current water movement is primarily northward into the harbor. While water quality impacts resulting from the complete enclosure of Quartermaster Harbor are not fully understood, the decrease in flushing may have led to an increase in the harbor's water temperature regime and may be contributing to eutrophication (Battelle et al. 2000).

Several stream mouth estuaries or stream-influenced areas exist within Quartermaster Harbor (Appendix E). These sites are of particular importance as habitat and refuge for juvenile salmonids and are a source of detritus and nutrients for food webs in the harbor. However, human-caused inputs into the streams may also cause negative impacts to water quality in Quartermaster Harbor.

Along the eastern shore of Maury Island, water depth increases rapidly across moderate to steep slopes to approximately 540 feet (152 meters) in the main channel of southern Central Puget Sound (Battelle et al. 2000). This reach of shoreline is considered semi-protected, with lower wave energy than other locations in the Puget Sound region. The northerly transport of surface waters along the shoreline is believed to concentrate plankton and nutrients along the beach, providing relatively high levels of primary production.

No information was found pertaining to water quality sampling along the eastern shore of Maury Island, although the waters in the area are considered "extraordinary" and are therefore subject to the most stringent state standards.

1.3 Geology

The Maury Island site is underlain by glacial till, sand, and gravel. Glacial till is a relatively unsorted mixture of clay, sand, gravel, and rocks (ranging in size from pebbles to boulders) left by receding glaciers. The source of the till in the area is from the Vashon glacier that occupied the Puget Sound basin approximately 13,000 to 16,000 years ago. Till in the Puget Sound is often thick, sometimes 100 feet or deeper (King County 2000).

The soil and sediments near the surface of the nearshore and bedland areas of Maury Island are most likely derived from submarine erosion and glacial bluff erosion along the shoreline. In Quartermaster Harbor, tributary streams such as Judd and Fisher creeks also deliver sediments (Appendix E). While the upper intertidal substrates include mud, sand, gravel, and cobble, the lower intertidal is predominantly sandy and more than 90 percent of the subtidal areas within Quartermaster Harbor are classified as mud (Blau 1975). For the central Puget Sound basin as a whole, Lavelle et al. (1986) found marine sediment accumulation rates of 0.003 to 0.001 grams per square foot per year (as referenced in Williams et al. 2001). These accumulations of material, primarily from bluffs, supply fine substrates to the intertidal zone, maintaining the structure and profile typical of central Puget Sound beaches (Bloch et al. 2002).

An inventory describing parts of the Vashon and Maury Island shorelines found that approximately 88 percent of the shoreline contained bluffs or banks, with an average height of about 44 feet. The highest banks were along the southeast side of Maury Island, where the elevation at the top of the bluff is more than 300 feet at some locations (Bloch et al. 2002). The bluffs in this area are composed primarily of glacial till and are important sources of sediments for surrounding beaches (Mumford et al. 2000). The shoreline inventory found that un-vegetated scars, usually an indication of a recent landslide and potential supply of sand to beaches, were continuous for seven percent of the Vashon and Maury Island shoreline, while 34 percent had patchy scars, and 36 percent had at least some undercutting at the base of the bluff or bank (Bloch et al. 2002).

1.4 Water and Sediment Quality

Based upon uses in the area, the Department of Ecology (Ecology) considers the waters within the Maury Island site as “extraordinary” (WAC 173-201A-210). Such waters have the most stringent water quality standards. There is limited water quality data for Quartermaster Harbor, although sampling conducted in the area was sufficient to prompt Ecology to include the embayment on the 1998 Washington State 303(d) list for violating state water quality standards for dissolved oxygen (DO) and dieldrin (Washington State Department of Ecology Water Quality Program 1998).

Section 303(d) of the federal Clean Water Act (CWA) requires that states keep an inventory of water bodies that violate water quality standards and that total maximum daily loads (TMDLs) be established for each parameter that is in violation of the standards. Ecology is currently updating the 303(d) list. Ecology’s recent draft 303(d) update for 2004 suggests that Quartermaster Harbor will not be included on the list (Washington State Department of Ecology Water Quality Program 2004). However, the site conditions have not necessarily improved and the site is being removed from the 303(d) list because no recent monitoring has taken place.

Water quality within Quartermaster Harbor has been adversely affected by several sources. Historic studies found a correlation between the presence of occupied vessels at the Dockton Park public dock and increases in fecal coliform populations in the water

(NORTEC 1984). The effect of sources other than boats to the overall bacteriological conditions appears to be significant (Bulman 1975). Possible sources impacting water quality include:

- Improperly functioning residential septic systems;
- Past and current agricultural and residential land use practices in watersheds surrounding the reserve;
- Residual contamination from historic commercial activities such as ship building and agriculture; and
- Boat wastewater discharges.

Concentrations of fecal coliform in Quartermaster Harbor tend to increase during the rainy winter months by as much as two orders of magnitude (NORTEC 1984). Judd Creek is a major source of coliform during the winter months as are other seasonal streams that drain non-point sources.

Water quality within the harbor has been adversely impacted by a number of human-related sources, including: failing residential septic systems; residential landscaping; gray water discharges from residences and/or boats; historic industrial activity; and both current and historic agricultural practices in watersheds surrounding the Maury Island site. In addition, elevated fecal coliform pollution and episodes of paralytic shellfish poisoning (PSP) have led to the decertification of several shellfish harvest areas within Quartermaster Harbor (Determan 2003b; WDOH 2004). The Washington State Department of Health (WDOH) monitors Quartermaster Harbor for fecal coliform to assess whether fecal waste is reaching the water and to determine whether pollution levels could be pathogenic. Recent reports suggest that certified shellfish growing areas in Quartermaster Harbor are not being adversely affected by fecal pollution (Determan 2003a).

While only three sets of water quality samples exist, these samples indicate that low dissolved oxygen (DO) conditions may be widespread and persistent within Quartermaster Harbor. In 1975, October observations found DO levels varied between a low of 3.80 mg/L at 16 feet deep within inner Quartermaster Harbor to a high of 6.30 mg/L at 25 feet deep near the mouth of Quartermaster Harbor (Turnbeaugh 1975). All fifteen Quartermaster Harbor observations from 1975 were below the extraordinary standard of 7.0 mg/L. Sampling in September 1982 found low DO levels (5.6 mg/L at 13 feet and 3.5 mg/L at 16.4 feet) at only one sampling station located between Judd Creek and Portage. February 1983 observations found that in addition to low DO at this sampling station (6.7 mg/L at 18 feet depth), one additional station, located near the Quartermaster Harbor Marina, also had low DO levels (6.6 mg/L at 14.7 feet). September 1983 observations found that low DO conditions were widespread within Quartermaster Harbor at depths of 16.4 feet or more with all sampling stations showing low DO conditions at or deeper than 16.4 feet (NORTEC 1984). DO levels observed in the Quartermaster Harbor in 1998 are described as being at a level that may begin to induce biological stress (Newton et al. 2002). Whether these low DO concentrations are being influenced by anthropogenic sources is a separate

issue. However, as a result of chronic low DO levels, the harbor was placed on the 303(d) list in 1998. However, Ecology recognizes that the low DO levels observed were likely due to natural conditions. Under state water quality standards, in waters where low DO is a natural occurrence, levels may be degraded by up to 0.2 mg/L by human caused activities (WAC 173-201A-320).

Environmental contaminants can include those potentially arising from natural sources such as Paralytic Shellfish Poisoning (PSP). In both 2001 and 2002 Quartermaster Harbor had one of the highest index scores for PSP. Index scores are based upon the number of days PSP levels at the site exceed the Food and Drug Administration (FDA) action criteria as well as the magnitude by which PSP levels exceed FDA action criteria (Determan 2003b). PSP is the result of a toxin that accumulates in marine animals that feed either directly on toxic phytoplankton or on consumers of phytoplankton. As there is considerable uncertainty associated with the causative agent of PSP, it is not possible to determine whether its presence in Quartermaster Harbor is brought about by disturbed nutrient cycles in the area or by regional phenomena outside of the harbor. Although shellfish health is unaffected by the presence of the toxin, PSP is capable of causing mass mortalities among shellfish-eating animals such as birds, fur seals, foxes, sea otters, and humpback whales (Kvitek and Beitler 1988, Geraci et al. 1989). In addition, PSP can be harmful to humans that consume toxic shellfish. Due to concerns regarding fecal coliform levels and PSP, commercial geoduck tracts along the western shoreline of Quartermaster Harbor, including (X) tract 10300 (Appendix I), are not certified for harvest by the Washington Department of Health.

Sediment quality is degraded in portions of Washington's waters as evidenced by chemical contamination, toxicity, and adverse alterations to benthic infauna. In studies of sediments from central Puget Sound, approximately 4.9 percent of the area sampled exhibited degraded or partially degraded sediment quality (Long et al. 2003). The majority of these contaminated sediments were found in highly urbanized areas such as Elliott Bay. Sediment Quality has been assessed for Quartermaster Harbor at a coarse scale as part of a regional assessment (Long et al. 2002). None of the three samples within Quartermaster Harbor showed high chemical concentrations, and one of the three stations showed no toxicity or chemical contamination and abundant and diverse infaunal assemblages. The other two stations were impaired for one of the three parameters – toxicity (Long et al. 2002). Examinations of groundfish tissue samples from Quartermaster Harbor found little contamination, suggesting that sediments in the area are relatively clean. Elevated concentrations of mercury and Polychlorinated Biphenyls (PCBs) were found in flounder samples, although the concentrations were similar to other non-urban bays in the central Puget Sound Basin (Crecelius et al. 1989). No exceedances of state criteria for sediment toxicity or chemical concentrations have been reported at the Maury Island site.

Complicating the water quality and PSP issues is the fact that Quartermaster Harbor is a poorly flushed system. The inner portions of the harbor are potentially nutrient sensitive and are showing signs of eutrophication (Harrison et al. 1994; Battelle et al. 2000). Assessments of sediment contamination within the harbor (utilizing fish tissue) showed

relatively low levels of contaminants in fish, suggesting little risk to humans who consume fish from this area (Crecelius et al. 1989). However, elevated concentrations of two pollutants were found - flatfish contained elevated mercury levels, while PCB loads were in the higher range (201 to 2000 micrograms/kg) compared to other areas in Puget Sound. Although the fish tissue PCB levels were similar to other non-urban bays in central Puget Sound, they were higher than non-urban bays outside the sub-basin (Crecelius et al. 1989).

Tissue samples from fish in Quartermaster Harbor have been found to exceed the acute criteria for dieldrin. The Washington State standard for acute concentrations of dieldrin in marine waters is 0.71 µg/L or higher, with the chronic level 0.0019 µg/L or higher. Dieldrin is an insecticide that bioconcentrates in aquatic organisms and causes permanent hormonal changes in fish. Dieldrin readily binds to soil particles and as a result is persistent and widespread in the environment. While acute exposure in humans can lead to neurological effects such as headache, dizziness, and convulsions, the effects have not been shown to be permanent (GPA 2001). However, chronic exposure will lead to dieldrin bioaccumulation in humans and may be fatal (GPA 2001).

2.0 Ecological Processes

After sediments enter the marine environment, shore drift is the process for material transport along shorelines. A drift cell, or littoral cell, is a partially compartmentalized zone along the coast that acts as a somewhat closed system with respect to shore drift. Drift cells are systems in which sediment is suspended by waves or currents and transported along the shoreline in a cycle of suspension and deposition. The direction of shore drift is determined by the prevailing direction of the waves and currents in the drift cell. Direction of wave approach, and the resulting shore drift, may change frequently (e.g., daily, weekly, or seasonally), but over a long period of time one of the two directions along the coast will be the primary direction of net shore drift (Schwartz et al. 1991).

Drift cells are important because they are the mechanism that supplies the sediments needed to maintain nearshore habitat quality. Drift cells nourish sand and gravel beaches, provide fine sediments to tideflats, and maintain sand spits and other coastal landforms.

The Maury Island site contains a number of individual drift cells (Appendix D). Along the northern shore of Maury Island, drift occurs in a southeasterly direction toward Point Robinson. The eastern shore of Maury Island supports a nearly continuous, uninterrupted drift cell that runs 5.50 miles from the southern edge of the island, northeast to Piner Point to a convergence zone at Point Robinson, with no reversals in direction (Schwartz et al. 1991). The drift cell creates an eddy at the south of Point Robinson that provides feeding opportunities for juvenile fish. Point Robinson also provides the confluence of this drift cell with another that flows southeast along the northern shore of Maury Island (Schwartz et al. 1991). This drift cell is among the longest found in Puget Sound, and relatively uninterrupted drift cells such as this are becoming rare in the central Puget Sound basin. Healthy sediment drift and drift cells are critical for the maintenance and development of shoreline features, including forage fish spawning beds and vegetative communities. The drift of sediments within Quartermaster Harbor is primarily to the

north, although there are local reversals of transport and convergence zones within the harbor where fine sediments are deposited in coves and embayments (Schwartz et al. 1991).

Nearshore drift has been significantly altered at two locations within Quartermaster Harbor. The second location where nearshore drift has been altered is in Raab's Lagoon, an area initially purchased for oyster cultivation that had a dike built for the road between Portage and Dockton (Van Olinda 1935). While the dike allows tidal exchange between the lagoon and Quartermaster Harbor, nearshore drift no longer enters the lagoon.

Nearshore drift throughout the reserve has been impacted by shoreline development. Shoreline hardening through the construction of bulkheads has increased wave energy in the nearshore and altered sediment movement along the shorelines. An estimated 13.75 miles or 57.6 percent of the shoreline within the reserve has been hardened or modified (Appendix M) (DNR 2001). Ramps, docks and piers can also impact water movements and drift cells. In addition to two public boat launches, seventeen private ramps have been identified within the reserve. Aerial photos show 84 overwater structures within and adjacent to the reserve that shade a minimum of 3.22 acres of habitat (Anchor Environmental 2004). Efforts to determine whether shoaling or sediment fill-in has occurred within Quartermaster Harbor suggest that any changes are below detection limits (Turnbeaugh 1975).

3.0 Vegetation and Habitat Resources

3.1 Estuarine and Shoreline Habitat

Sand and mudflats are gently sloping areas, generally surrounded by salt marsh communities that support a high biomass of aquatic invertebrates (i.e., clams, shrimp, and worms) and dense mats of microalgae (i.e., diatoms). They are highly productive areas and are a significant food source for shorebirds, fish, otters, and raccoons. Mud and sandflat communities are vulnerable to damage from floating structures that ground, increases in temperature associated with a loss of riparian vegetation, changes in substrate composition due to shoreline armoring, as well as increased nutrient and sediment loads and invasive plant introduction (i.e. *Spartina spp.*).

3.2 Upland Habitat

Upland land use and vegetation adjacent to marine shorelines affect the habitat and habitat quality of marine systems by affecting food sources such as the insect assemblages and freshwater hydrology. Perhaps the single most dramatic and pervasive impact of urbanization on the functions and values of a watershed is the replacement of the natural landscape with pavement and other water-impervious (impenetrable) material such as roads, parking lots, driveways, sidewalks, and rooftops. Increased levels of impervious surfaces interrupt the hydrologic cycle, alter stream structure, and degrade the chemical profile of the water that flows through streams. These changes affect fish and wildlife in various ways, and are cumulative within watersheds. Research indicates that when the total impervious area (TIA) in a watershed reaches 10 percent, stream ecosystems begin to show evidence of degradation (Booth and Jackson 1997). Only one of the four watersheds adjacent to the reserve approaches 10 percent total impervious area – East Vashon (King County 2003). A total of approximately 1,460 acres within these four watersheds has been

converted into impervious surfaces. The concentration of houses and roads near marine shorelines has resulted in a higher proportion of lands converted into impervious surfaces near the marine shorelines. Adjacent to the aquatic reserve, 16.9 percent of the lands within 200 feet of the marine shoreline are classified as impervious. It is generally recognized that ecological effects become severe as total impervious area approaches 30 percent in stream systems (Arnold and Gibbons 1996; Booth and Jackson 1997; Schueler 1994; Schueler and Holland 2000), but the impacts on marine systems are poorly understood.

Upland land use can be an indication to planners that potential threats and activities are occurring adjacent to the reserve. Approximately 43 percent of the land within 200 feet of the marine shorelines adjacent to the reserve is classified as either Urban/High Density (6 percent) or Mixed Urban/Low Density (37 percent) (King County 2002). The rest of the lands are classified as forested, shrub vegetation, or herbaceous vegetation. Washington DNR classified approximately 28 percent of the shorelines adjacent to the reserve as containing 'riparian vegetation' during the ShoreZone Inventory (Nearshore Habitat Program 2001). These data suggest that urban land pressures are present adjacent to this aquatic reserve and have affected between 43 and 72 percent of the shoreline habitats. Due to the concentration of activities near the marine shoreline these developments may be adversely impacting habitats and natural ecological processes that support the local aquatic ecosystem.

3.3 Submerged Aquatic Vegetation

The euphotic zone is the uppermost portion of the water column where light levels are high enough for photosynthesis to occur. Overall light transmission rates are affected by latitude, seasons, water quality, and suspended particulate matter (i.e., sediments and phytoplankton). In nutrient rich areas, the depth of the euphotic zone decreases as the incidence of algal blooms increases.

Within Puget Sound, nearshore ecosystem boundaries are generally defined by the depths at which aquatic vegetation can, or does, occur (Battelle 2003), although substrate and water current are also factors for vegetative growth. As a result, in some regional literature the outer limit of the nearshore and euphotic zones are defined similarly and placed at approximatly minus 66 feet (- 20 meters) below mean low low water (MLLW) (Williams et al. 2001).

Although there is no data regarding the historic depth of the euphotic zone within the reserve, work done between 2000 and 2002 can be used to establish a baseline for the euphotic zone and the extent of the nearshore. The DNR's Nearshore Habitat Program documented the mean eelgrass depths at five monitoring sites around Vashon and Maury Island to range from 0.0 feet MLLW to minus 17.4 feet (- 5.3 meters) MLLW (Berry et al. 2003). Battelle utilized compensation depths[1] for eelgrass, diatoms, and phytoplankton to estimate a maximum euphotic zone off the eastern shore of Maury Island at minus 46.9 feet

[1] Compensation depth is the depth at which photosynthesis produces oxygen at the same rate it is consumed by decomposition (Reid and Wood 1976).

(- 14.3 meters) extreme low low water (ELLW) (Battelle 2003). No data exists for Quartermaster Harbor.

Eelgrass (Zostera marina)
Eelgrass is a subtidal grass that spreads by rhizomes and prefers sandy/silt substrates. It can be found as individual plants, small patches, or large meadows in the low intertidal and shallow subtidal zones. Central Puget Sound eelgrass beds have been found at depths ranging from an extreme minimum depth of +5.25 feet (1.6 meters) and an extreme maximum depth of –24 feet (7.3 meters) relative to MLLW (DNR 2003). The primary factor controlling distribution at the upper boundary is desiccation stress, and at the lower boundary is light penetration (Thom et al. 1998). Similar to terrestrial grasses, eelgrass meadows are most dense in the spring and summer, going dormant and decaying during the fall and winter. In addition to protecting shorelines from wave and current driven erosion, eelgrass roots help anchor sediments and keep shallow subtidal environments moist and cool during low tides. Eelgrass is a key element in Puget Sound food webs and supports a variety of organisms, including zooplankton, juvenile salmonids, small crabs (such as the spider crab, nudibranch, larval forage fish (e.g., herring)), and a variety of small fish such as pipefish and gunnels.

Shoreline surveys found continuous or patchy eelgrass beds offshore of 78 percent (18.65 of 23.88 miles) of the shoreline within the aquatic reserve. Eelgrass observations in Quartermaster Harbor suggest that while the abundance of eelgrass may have changed within or between beds, the distribution of eelgrass has changed little over the past thirty years (WDFW, unpublished data). There are significant eelgrass beds scattered throughout the Maury Islands site, both within Quartermaster Harbor and along the eastern shore of Maury Island, making it an important area for salmonids, forage fish, and a variety of piscivorous birds and mammals (Appendix H).

Kelp (sp.)
Kelp is a common macroalgae that occurs in water depths of 50 to 100 feet (15 to 30 meters) at various locations within the Maury Island site. Unlike eelgrass, which actually roots in the sediments, kelp is held in place by structures called holdfasts that anchor the algae to rocky substrates (Nybakken 1997). Similar to eelgrass, kelp serves to decrease erosion impacts from waves and currents on nearshore environments. Growth rates for kelp can exceed 2.4 inches (6.0 centimeters) a day and at maturity, individual kelp may be 65 to 100 feet (20 to 30 meters) in length. Kelp is an important component of nearshore primary production rates (Nybakken 1997) and in Puget Sound it provides important habitat for a number of grazers (e.g., snails and sea urchins), filter feeders (e.g., anemones), scavengers (e.g., crabs), predators (e.g., rockfish, starfish, and salmonids), as well as a variety of smaller algae. Bladder kelp forests are located in areas where the seafloor is covered by rocky outcrops and boulders near the mouth of Quartermaster Harbor, south of Rosehilla and northeast of Neill Point (Blau 1975). There is no evidence of continuous kelp beds within the proposed reserve, but patchy distributions have been reported along the western and eastern shorelines of Maury Island (Appendix F).

4.0 Wildlife

A species list of fish and wildlife that has been documented to utilize the reserve area and vicinity is included in this attachment.

4.1 Fish

A large diversity of recreationally and commercially important fish species visit and spawn within the aquatic reserve (Miller and Borton 1980). However, it is important to note that most of these fish species do not occur continuously, or even frequently within the reserve (Blau 1975). Quartermaster Harbor has supported a limited commercial fishery for Pacific herring (*Clupea harengus pallasi*), pile perch (*Rhacochilus vacca*), and surf smelt (*Hypomesus pretiousus pretiosus*) (NORTEC 1984). While these fisheries appear to have declined from their historic highs, commercial fishing still occurs in the vicinity of Quartermaster Harbor. Records indicate that the largest pile perch (3 pounds, 9 ounces) and striped surfperch (2 pounds, 1 ounce) caught in Washington State were caught in Quartermaster Harbor in 1980 and 1981 respectively.

4.1.1 Salmonids

Adult and juvenile salmonids, particularly Chinook, chum, and the anadromous form of cutthroat and rainbow trout, have all been documented as occurring in, and dependent upon areas within the Maury Island site. The nearshore environment is also vital to the plant and animal communities upon which salmonids depend. While salmonids exhibit a wide range of specific life histories, there are several requirements that are common to all salmon and trout.

Although anadromous Pacific Northwest salmonids spend the majority of their life maturing in the open ocean, estuaries (such as Puget Sound) and freshwater systems are critical for adults and juveniles. Spawning adults utilize cold water streams and rivers (7 to 18 degrees Celsius) with substrates comprised of loose, silt-free gravel for redds. Substrate size is important not just for spawning, but as shelter for fry and as a diverse source of food from aquatic invertebrates. Spawning substrates generally range from about one inch in diameter up to about six inches in diameter (Raleigh et al. 1986). Complex, meandering channels provide a network of riffles, pools, and side channels for shelter and rearing. Juveniles are dependent upon native riparian vegetation for shading and cooler water temperatures, as well as a source of food from terrestrial insects, and shelter under/in large woody debris. Stable flows and high dissolved oxygen content (≥ 7.0 mg/L) are also critical for the survival of both returning adults and rearing juveniles.

There are four diverse life histories among salmonids - adfluvial (spawn in streams, rear and mature in lakes); fluvial (spawn in natal streams but migrate to larger rivers for rearing and maturation); resident (remain in natal stream through all life stages); and anadromous (spawn and rear in streams, rear and mature in saltwater). The majority of Puget Sound salmonids exhibit the anadromous life history pattern (Wydoski and Whitney 2003). In addition to this variation in life history, salmonids also display a great deal of diversity in terms of juvenile freshwater residency and age at sexual maturity. Juvenile freshwater residency can range from a few weeks up to

several years, while the age at sexual maturity generally ranges from about two to six years (Wydoski and Whitney 2003).

Chinook Salmon (Oncorhynchus tshawytscha)
Chinook, or king salmon, are anadromous and the largest of the Pacific salmon species (Myers et al. 1998). The species' eastern historic range extends from the California to Alaska, and from northeastern Asia to northern Russia (Healey 1991). The Puget Sound Chinook evolutionarily significant unit (ESU) was listed as threatened under the federal Endangered Species Act (ESA) by the National Oceanographic and Atmospheric Administration – Fisheries (NOAA – Fisheries) in March of 1999. The listing includes runs from the North Fork Nooksack River in northeast Puget Sound to the southern Puget Sound watersheds, Hood Canal, and the Strait of Juan de Fuca.

Chinook salmon display two distinct races (ocean and stream-type), with ocean-type fish spending a lesser amount of time in freshwater (Myers et al. 1998). Generally, ocean-type Chinook juveniles outmigrate either as fry during their first spring or fall, or as yearling juveniles during their second spring depending on environmental conditions and local adaptations. Stream-types spend one to two years in freshwater (NMFS 2003). Ocean-type Chinook also tend to remain nearer the coastline throughout their marine residence, with return timing varying from spring to winter depending upon local adaptations, but most fish return during the fall. Stream-type Chinook exhibit extensive off-shore ocean migration and usually return to freshwater they spawn in early fall-but enter freshwater early in spring or summer (NMFS 2003; Myers et al. 1998).

The Puget Sound Chinook salmon ESU is thought to be primarily comprised of ocean-type fish displaying a fall run timing. Fall run Puget Sound Chinook normally return to freshwater in July and August and spawn from September through January, while spring Chinook return to freshwater in April and May and spawn from August through September (Myers et al. 1998). Chinook spawning can occur in streams as small as seven feet wide, although they generally prefer to spawn in larger mainstem habitats. Spring Chinook spawn in middle and upper mainstem reaches, while fall run fish tend to spawn in lower mainstem areas (Cramer et al. 1999).

Both spring and fall run Chinook fry emerge from the gravel during February and March, with the majority of the fall run progeny outmigrating within 60 to 150 days after emergence (Cramer et al. 1999). Chinook fry prefer the lower velocity margins of streams, with fall Chinook moving steadily downstream to the estuary, where they normally spend several months rearing. Streamside and marine riparian habitat provides important cover in the form of wood, root wads, overhanging vegetation, and undercut banks (Healey 1991).

After moving into salt water, Puget Sound Chinook generally migrate north along the Canadian coast, but some fall Chinook spend their entire marine residence within

Puget Sound. Ocean-type Chinook generally remain at sea from one to six years before they mature, with most spending two to four years in the ocean before returning to their natal streams to spawn (Wydoski and Whitney 2003).

Myers et al. (1998) estimated an approximate run size of 690,000 Chinook in Puget Sound at the beginning of the 20th century[2] when hatchery production was negligible. This compares to a recent average run size of approximately 240,000, the majority of which is from hatchery production. An estimated two billion hatchery Chinook have been released into Puget Sound tributaries since the 1950s (Myers et al. 1998) and hatchery returns account for approximately 57 percent of the total spawning escapement (NMFS 2003).

Sampling has documented juvenile Chinook salmon along the shorelines of Maury Island and within Quartermaster Harbor. Coded-wire tag data from these samples suggest that fish found in this area arise from one of several watersheds with Chinook salmon caught from the following hatcheries: Wallace River Hatchery (WRIA 7), Soos Creek Hatchery (WRIA 9), White River Hatchery (WRIA 10), Hupp Springs and Rearing facility (WRIA 15) (Brennan and Higgins 2004). The presence of Chinook salmon from a number of different areas rearing along the shorelines of Vashon and Maury Islands suggest that that juvenile Chinook readily cross open water to reach the island.

While there are suggestions that Chinook may have been observed in the lower reaches of Judd Creek, Brennan and Higgins (2004) suggest that there are no Chinook producing streams or hatchery releases of Chinook on Vashon or Maury islands. Juvenile and adult Chinook have been documented as using the shallow water habitats of Quartermaster Harbor for rearing. These fish prey on the forage fish that inhabit Quartermaster Harbor and the surrounding areas. The eastern shoreline of Maury Island is also an important migration corridor, as Chinook smolts tend to remain in the nearshore environment as they migrate out of the Puget Sound. Brennan and Higgins (2004) found that vegetated shoreline habitats are an important food source for juvenile chinook salmon with juvenile diets numerically dominated by insects characteristic of terrestrial vegetated habitats such as Psocoptera (bark lice), Homoptera (aphids, plant hoppers), and Hymenoptera (ants).

Puget Sound Chum Salmon (Oncorhynchus keta)
The majority of chum stocks in the Puget Sound are fall runs, although summer and winter stocks also exist. In 1993, the Washington Department of Fisheries identified forty-five fall chum populations in Puget Sound, including nine in the northern area (Canada-Washington border to the Stillaguamish River), 30 in the southern area (Snohomish River watershed south and Hood Canal), and six in the Strait of Juan de

[2] This estimate, as with other historical estimates, should be viewed with caution. Fish landings used in this calculation included a portion of fish landed at Puget Sound ports but originating in Canada and other areas outside Puget Sound, and the estimates of exploitation rates used in run-size expansion calculations may not be based on precise data (Myers et al. 1998).

Fuca (Washington Department of Fisheries et al. 1993). The status was *unknown* for 13 of these populations and *healthy* for all others. Hood Canal populations of summer chum were listed as threatened in 1999 under the federal ESA by the NOAA – Fisheries.

Although fall chum runs fluctuated between roughly 156,000 to more than 2.4 million fish from 1968 to 1999, the average runs for the period were between one and almost 1.5 million fish. Unlike other salmonid stocks, chum populations have exhibited a positive trend since the late 1960s. Approximately 37 percent of the total Puget Sound run originates in the Hood Canal, 33 percent in South Puget Sound, 29 percent in North Puget Sound, and just one percent in the Strait of Juan de Fuca (WDFW 2003a).

Chum are anadromous and generally mature between three and five years of age, with a high proportion of Washington stocks maturing at age three. Spawning of fall chum primarily occurs from October through January, while winter chum generally spawn from mid-December through early March (Johnson et al. 1997).
Young of year emerge between February and June and migrate quickly to the estuary where they rear for several months before migrating out of the Puget Sound. Eelgrass beds are extremely important for rearing chum salmon, with two species of copepods that make up a large portion of juvenile's diets found only in eelgrass (Simenstad et al. 1988). Upon leaving Puget Sound, Washington chum generally migrate northward along the coast with their path being closer to shore than coho, Chinook, or steelhead. Chum rear at sea for two to four years before returning to their natal streams to spawn.

From 1991 through 2000, an average of more than 5.1 million hatchery chum salmon per year were released into Puget Sound. Of these, approximately 91 percent were fall chum and one percent were winter chum (Pacific States Marine Fisheries Commission 2002).

While there is no data regarding total abundance of chum at the Maury Island site, both juveniles and adults have been documented in the area. In addition to juveniles using the nearshore for rearing habitat, the WDFW Spawning Ground Survey Database indicates that fall chum spawn in the lower reaches of Judd Creek (Kerwin and Nelson 2000). It is not known whether these fish originated from Judd Creek, or whether they are the progeny of strays from other systems or hatchery plants.

Puget Sound Coho Salmon (Oncorhynchus kisutch)
Coho salmon were historically distributed along the Pacific coast from Mexico to Alaska and from Russia to Japan (Scott and Crossman 1973). NOAA – Fisheries, designated the Puget Sound coho salmon ESU as an ESA candidate species in 1995.

Most coho in Washington, Oregon, and California spend the first year of their lives in freshwater and return to spawn in their third year, although some precocious males

return to spawn at age two (Wydoski and Whitney 2003). The Puget Sound spawning migration begins in August, with spawning generally occurring from September through January (Weitkamp et al. 1995). Wild coho tend to spawn in smaller rivers and tributaries or side channels of larger systems, with fry emerging within six to eight weeks (Wydoski and Whitney 2003).

Weitkamp et al. (1995) noted that while populations of the Puget Sound coho ESU are abundant and that runs and natural spawning escapements are generally stable, there are substantial risks to the remaining native stocks. Although coho are remarkably adaptable and can be found spawning in significantly degraded streams, wild populations continue to decline as a result of habitat loss from human development (Wydoski and Whitney 2003).

Presently, most coho returning to Puget Sound streams are hatchery produced. From 1991 through 2000, approximately 24 million hatchery juvenile coho were released into Puget Sound each year. Over this period, total releases decreased from about 40 million in 1991 to less than 10 million in 2000 (Pacific States Marine Fisheries Commission 2002).[3]

Coho salmon occur in both Judd and Fisher creeks, however there is no information regarding the overall abundance of coho in the Vashon-Maury island area. Hatchery and wild coho smolts feed along the shorelines of Vashon and Maury Islands between May and September of each year with most activity in May and June. Juvenile coho captured within the reserve were found to be from wild stocks, Wallace River Hatchery (WRIA 7), Soos Creek Hatchery (WRIA 9), or Voights Creek Hatchery (WRIA 10). Juvenile coho caught along marine shorelines in King County appear to feed mainly on zooplankton before switching to fish at larger sizes (Brennan and Higgins 2004).

Coastal Cutthroat Trout (Oncorhynchus clarki clarki)
Coastal cutthroat trout exhibit all four salmonid life histories - adfluvial, fluvial, resident, and anadromous (Wydoski and Whitney 2003). Different individuals from the same population can exhibit different life history patterns. Cutthroat trout are capable of repeat spawning and some individuals have been noted to spawn each year for as many as six years.

Anadromous, or sea-run, coastal cutthroat from smaller systems such as the streams on Vashon-Maury Island generally return to freshwater from December through March and spawn from February through late April. Cutthroat fry emerge from March through June, with a peak in mid-April. Anadromous forms of cutthroat rear in freshwater for one to six years before migrating to sea. Outmigration occurs from March through June, with a peak in mid-May.

[3] Data may be incomplete for 2000. Releases in 1999 were about 12 million.

Cutthroat are known to rear extensively in estuarine and nearshore habitats and many do not venture far from their natal streams. In general, sea-run cutthroat do not make long ocean migrations and they rarely overwinter at sea, instead returning to nearby streams to spend the winter.

Nonmigratory coastal cutthroat include fish generally found in small streams and headwater tributaries near spawning and rearing sites. They typically grow more slowly than the other life history forms of cutthroat, are smaller when they reach maturity, and normally do not live longer than two to three years.

Several streams on Vashon and Maury Islands have been documented to support cutthroat trout including Judd, Fisher, Shawnee, Tahlequah, and Mileta creeks (King County 2000). An impassible barrier in the form of a culvert precludes anadromous forms of cutthroat from inhabiting Shawnee Creek. Both resident and sea-run cutthroat are thought to inhabit Mileta, Judd, and Fisher creeks (EVS 2000). Cutthroat trout of all age classes are thought to use Quartermaster Harbor as a rearing area.

Puget Sound Steelhead (Oncorhynchus mykiss)
Like cutthroat, rainbow trout exhibit great diversity in their life history patterns and are capable of repeated spawning across years. The anadromous form of rainbow trout, referred to as steelhead, can be divided into summer (stream-type) or winter (ocean-type) stocks. In Puget Sound the majority of steelhead populations are winter-run, meaning adults normally return to freshwater from November to December, and the peak of spawning occurs between March and May of the following year (Busby et al. 1997).

Steelhead eggs incubate for approximately four to seven weeks, with fry emerging from June through mid-August. After hatching, steelhead typically spend from two to four years in their natal stream before migrating to sea, with smolts outmigrating from April to June. Steelhead trout are thought to move more directly out to sea than other salmonids, although some steelhead rear for short periods in estuarine environments. They spend up to three years in the ocean before returning to spawn and typically live from six to eight years (Wydoski and Whitney 2003).

Total runs for Puget Sound steelhead in the early 1980s were estimated by Light (1987) as approximately 100,000 winter steelhead and 20,000 summer steelhead. Light provided no estimate of hatchery proportions for specific streams, but for Puget Sound and coastal Washington combined, he estimated that 70 percent of steelhead in ocean runs were of hatchery origin.

The only stream in the Maury Island area known to support steelhead is Judd Creek, but it is not known if the population is self sustaining or whether they are strays from other Puget Sound systems (Kerwin and Nelson 2000). There is no data pertaining to the abundance of steelhead in Judd Creek.

Bull Trout/Dolly Varden (Salvelinus confluentus)
Puget Sound and Washington coastal bull trout populations were listed as threatened in November 1999 by the U.S. Fish and Wildlife Service (USFWS). Critical habitat for Puget Sound bull trout populations has yet to be designated.

Bull trout are a char species endemic to western North America that exhibits all four salmonid life history forms - resident, fluvial, adfluvial, and anadromous. They require colder water than most other Pacific salmonids (2 to 10 degrees Celsius), are heavily dependent on instream cover, and prefer low gradient stream reaches with clean, gravel substrates (Goetz 1989; WDFW 1998). These specific habitat requirements are normally found in more pristine environments, thus bull trout are quite vulnerable to habitat modifications.

The 1998 bull trout/Dolly Varden population inventory, conducted by WDFW, identified 80 distinct stocks in Washington State. All bull trout/Dolly Varden populations in Washington are maintained by wild production and of the populations identified, 18 percent are considered healthy, three percent depressed, eight percent critical, and the status of the remaining 58 stocks is unknown (WDFW 1998).

There are no bull trout found in the streams of Vashon or Maury Island, and Quartermaster Harbor is generally too warm to be utilized by rearing, anadromous bull trout. The eastern shoreline of Maury Island could be periodically inhabited by migrating anadromous bull trout, although no observations of the species in this area have been documented.

4.1.2 Forage Fish

The Maury Island site supports an abundance of forage fish stocks including Pacific herring, surf smelt, and sand lance.

Pacific Herring (Clupea harengus)
Pacific herring is a pelagic (lives in open sea) marine species that depends heavily upon the nearshore environment for spawning. Herring spawning grounds are well defined and stocks of the fish show strong fidelity to particular spawning areas. Herring spawning timing is also very specific, seldom varying more than seven days from year to year (WDFW 2000). Most Puget Sound herring spawn from mid-January through March. Herring utilize a variety of marine vegetation in the intertidal and shallow subtidal zones for spawning, primarily in semi-exposed and semi-protected areas. The substantial eelgrass beds and semi-protected environment of Quartermaster Harbor makes for an ideal spawning location (Appendix G). The Quartermaster Harbor herring stock is one of 18 in the Puget Sound. This stock is the largest spawning population in the southern/central Puget Sound and among the largest in the entire Puget Sound region. Surveys conducted from 1994 through 2003 found an average biomass of the Quartermaster Harbor herring stock of 1,123 short tons (Figure 1).

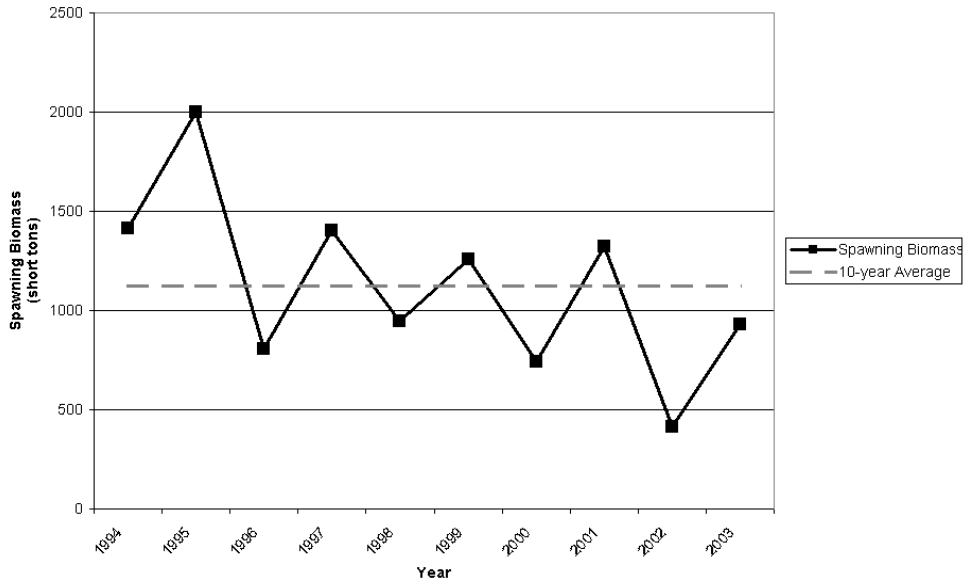


Figure 1: Pacific herring biomass in Quartermaster Harbor (1994-2003). (Source: WDFW 2004).

Herring spawning usually occurs from 0.0 to minus 10 feet (0.0 to 3 meters) in tidal elevation. The documented herring spawning area for the Quartermaster Harbor stock includes more than 962 acres of habitat (WDFW, unpublished data). While spawning has been documented throughout Quartermaster Harbor and along the eastern shore of Maury Island, spawning activity is variable and typically concentrated within this larger area. The eggs incubate for 10 to 14 days prior to hatching. Following hatching, the larvae drift in the currents. When they are approximately 25 to 40 mm in length, juvenile herring begin to form schools and remain in the nearshore environment until they migrate to the open ocean in early fall, although some herring spend their entire lives in the Puget Sound (McCrae 1994; WDFW 2000). Highly productive areas such as eelgrass beds are important habitats for herring of all age classes, which is another reason herring are rather abundant in Quartermaster Harbor. After reaching sexual maturity at age two to four, herring return to their natal spawning grounds. At maturity, herring can reach a maximum size of about 18 inches.

In addition to herring spawning sites along the shoreline of Quartermaster Harbor and the southeast shoreline of Maury Island, there are also two pre-spawning holding locations near Neill and Piner Points (Appendix G). Herring congregate in these deeper water areas prior to migrating to nearshore habitat to spawn.

Data suggests that sustained noise from large fishing vessels and/or small boats can cause avoidance and alarm responses in herring (Schwarz and Greer 1984). However, the data also suggest that herring may habituate to noise from smaller vessels. As a result, there may be different threat levels and threat sources within the reserve. Because most boats in Quartermaster Harbor are recreational vessels, herring may

have habituated to the noise leaving damage to eelgrass spawning and rearing habitat as the primary threat to the species. In addition, we would not expect there to be intensive recreational boating activities during the spawning period. However, noise from large commercial tugboats and ships in and directly adjacent to spawning areas may be a significant threat to spawning herring, as well as in holding areas off Neill and Piner Points. WDFW has also reported chronic herring spawn mortality in the Dockton area, the cause of which is unknown.

Surf Smelt (Hypomesus pretiosus)
Surf smelt are an important food for salmonids, including federally listed Chinook salmon, birds, and other wildlife throughout Puget Sound. The reserve supports several documented spawning areas throughout Quartermaster Harbor, with additional spawning areas reported along the southeastern shoreline of Maury Island and near Point Robinson (Appendix G). These documented spawning beaches represent 5.71 miles of shoreline habitat. Spawning occurs throughout the year in extremely shallow water on mixed sand and pea gravel beaches that are kept moist from freshwater seeps (WDFW 1997). In Quartermaster Harbor most surf smelt spawning occurs between November through early January each year (Blau, 1975). The species is dependant on relatively undisturbed beaches, which makes surf smelt extremely vulnerable to shoreline modifications that alter substrate composition and destroy spawning habitat.

Surf smelt are a pelagic species, although many individuals remain in nearshore environments throughout the year. They feed on a variety of zooplankton and epibenthic organisms, including planktonic crustaceans and fish larvae. Spawning occurs during much of the year on mixed sand-gravel beaches at a tidal elevation between approximately plus 6.5 feet and the mean higher-high water line, or higher (Lemberg et al. 1997). Adults school offshore and may return to the same spawning ground each year. Surf smelt rarely reach greater than five years of age, with most spawning populations comprised of one and two-year-old fish (Lemberg et al. 1997).

Sand Lance (Ammodytes hexapterus)
Although sand lance are broadly distributed throughout Puget Sound, very little is known about their life history (WDFW 1997). These fish spawn in the upper intertidal zone of sand-gravel or sand beaches, normally higher than 3 feet (1.5 meters) in tidal elevation. Spawning occurs from November through February, with the eggs incubating for approximately thirty days before the larvae enter the nearshore environment.

There is only one documented area of sand lance spawning habitat representing approximately 0.3 miles of shoreline habitat within the reserve (Appendix G). Future surveys are needed to determine if this site represents the full extent of spawning activity within the reserve and to quantify spawning activity at this site. Like surf smelt, sand lance depend on sandy beaches and are therefore vulnerable to shoreline modification in the reserve. Sand lance are an important food source for salmonids,

including federally listed Chinook salmon, and other marine aquatic species, as well as terrestrial wildlife.

4.1.3 Other Fishes

Several studies assessing the health of Commencement and Elliot bays have sampled Quartermaster Harbor to serve as control samples (e.g., Malins et al. 1997; Gibson et al. 2000). Compared to the urban bays, samples from Quartermaster Harbor contained a lower abundance of fish, however these samples contained significantly more species and more biomass (Gibson et al. 2000). Additionally, almost every fish species found in both the urban bays and Quartermaster Harbor were significantly larger within Quartermaster Harbor. These studies also identified sensitive species that are more common or significantly larger in the reference areas (Quartermaster Harbor) than in the urban bays. These species include: Spiny dogfish, spotted ratfish, longnose skate, rock sole, starry flounder, speckled sanddab, pile surfperch, striped surfperch, bay goby, blackbelly eelpout, bay pipefish, and plainfin midshipman (Gibson et al. 2000).

Groundfish

Groundfish is a broad term used for fish that spend all or significant portions of their lives on the sea bottom. They are a diverse group that includes species such as spiny dogfish (*Squalus acanthias*), skates (*Raja sp.*), Pacific cod (*Gadus macrocephalus*), rockfish (*Sebastes sp.*), and lingcod (*Ophiodon elongatus*). Of the more than two hundred species classified as groundfish in Puget Sound, only twenty-one are actively managed as commercial or recreational fisheries (Palsson et al. 1998).

While predator-prey interactions are not well understood, groundfish are an important prey item for marine mammals and piscivorous birds. Groundfish are carnivorous, preying upon benthic and epibenthic macroinvertebrates such as shrimp and crabs, as well as small fish, and likely compete with salmon and other fish stocks for habitat and food. Although groundfish populations within Puget Sound are not always well documented, it is known that they are vulnerable to habitat destruction from fishing gear, as well as decreased recruitment from the harvest of large and sexually mature individuals and loss of kelp beds.

Flatfish

Most species of flatfish spawn during winter months on soft mud bottoms at depths of about minus 40 feet (12 meters) or greater. Fertilized eggs are pelagic and hatch within a few weeks, with the larvae slowly sinking as they mature. As juveniles, flatfish are physically similar to other round shaped fish, with a perpendicular orientation and a single eye on each side of their body. As the eye moves to a particular side, the fish swim oriented toward that side and eventually settle on the bottom in the nearshore. It is not until the fish reach adulthood, between two and four years of age, that they sever their relationship with the nearshore and move to deeper water. Flatfish can live as long as fifty years and reach sexual maturity at three to seven years of age.

In 2002, a WDFW bottom trawl of Quartermaster Harbor found a high diversity and concentration of flatfish including English sole (*Parophrys vetulus*), speckled sanddab (*Citharichthys stigmaeus*), Pacific sanddab (*Citharichthys sordidus*), and southern rock sole (*Lepidopsetta bilineata*) (W. Palsson, Research Scientists, Washington Department of Fish and Wildlife, personal communication, July 7, 2003).

Rockfish (Sebastes sp.)
Rockfish bear live young and release them into the environment as larvae. Although males transfer sperm to females in the fall, actual fertilization can be delayed by as much as two to four months. Depending on species and size, each female releases between 200,000 and 800,000 larvae from January through May. Larvae are planktonic, floating near the surface and serving as a food supply for plankton eating animals. After a few months, the juveniles begin to inhabit their preferred habitat of kelp forests and rocky reefs.

Fishing has taken a significant toll on rockfish numbers and reproductive success. Since the 1970s, recreational catches have declined by 50 to 60 percent (Puget Sound Water Quality Action Team 2002), with fishers targeting larger individuals. As rockfish are long-lived species (55 years or greater) and does not reach sexual maturity until 10 years of age or greater, the loss of larger fish may also be having a negative impact on recruitment. The Puget Sound Water Quality Action Team (2002) estimates that rockfish spawning potential has declined 75 percent since the 1970s.

The eastern shore of Maury Island has several rocky reefs and submerged wrecks that are capable of supporting rockfish. Divers from WDFW have documented the presence of several species including lingcod *(Ophiodon anadensi)*, copper *(Sebastes caurinus)* and brown *(Sebastes auriculatus)* rockfishes, as well as red Irish lord *(Hemilepidotus hemilepidotus)* (W. Palsson, Research Scientists, Washington Department of Fish and Wildlife, personal communication, July 7, 2003).

4.2 Birds

The reserve area offers wetland and riparian habitat for several species of migratory and resident marine birds. WDFW winter surveys between 1993 and 2002 identify American widgeon, surf and white-winged scoters, common and barrow's goldeneye, bufflehead, gulls and western grebes as the most common wintering marine birds (WDFW, unpublished data). Average and peak observations for common bird species are shown in Table 1. Common resident birds include glaucous-winged gulls, black brant and the great blue heron (NORTEC 1984). Aside from specific areas with substantial human development (i.e., Gold Beach, Sandy Shores, Dockton, and Burton), the areas adjacent to the Maury Island site has riparian habitat that is largely intact and supports a number of bird populations, both seasonal and resident. In addition to being sheltered and relatively undisturbed by boat traffic, the site offers a plentiful food supply for aquatic piscivorous birds in the form of forage fish, juvenile salmonids, and shellfish.

Table 1: Average and peak observations for wintering marine birds within the Maury Island site (WDFW, unpublished data)

Species	Average annual count (1992 – 2001)	Peak 1-day Count	Date of Peak Count
American Widgeon	152.1	403	12/08/1999
Bufflehead	103.8	144	12/11/2000
Barrow's Goldeneye	36.9	116	12/10/2001
Common Goldeneye	41.3	99	12/11/1992
Unidentified Goldeneye Sp.	144.6	314	12/28/1995
Surf Scoter	267	698	12/11/1992
White-winged Scoter	119.1	294	12/11/1992
Unidentified Scoter Sp.	715.2	1218	12/28/1995
Western Grebe	602.6	1664	12/18/1996
Gull (all species)	252.4	409	1/04/1995

Quartermaster Harbor has been designated an important bird area (IBA) by the Audubon Society of Washington and supports approximately 8 percent of Washington's wintering population of Western grebe (Cullinan 2001). In addition to grebe, the area provides winter refuge for approximately 3,000 individuals from 35 species of aquatic birds annually (Cullinan 2001). The IBA program has two primary goals: 1) to identify the sites in the state of Washington that are the most essential for long-term conservation of birds, and 2) to take action to ensure the conservation of these sites.

Western Grebe (Aechmophorus occidentalis)

The western grebe is considered by WDFW to be a candidate species for inclusion on the state species of concern list (Table 2). Grebes prefer to winter in sheltered, ice-free waters with large supplies of forage fish, which makes Quartermaster Harbor ideal habitat. Although almost 100 percent of the bird's diet is fish, they also eat crustaceans, worms, and insects, spearing their prey with their long, pointed bills. Adult birds range from 22 to 30 inches in length and have long necks, with their feet positioned at the far back of the body, making walking difficult (Pease 2000). The birds migrate north beginning in late April and return to the site during September and October (Kirschenbaum 1996).

The presence of a relatively large population of wintering western grebe in Quartermaster Harbor was the primary reason that Audubon Washington listed the area as an IBA. From 1989 through 1991, surveys found an average winter abundance of 1,435 grebes in the area. Additional surveys conducted from 1999 through 2002 observed an average total of 2,345 individuals in the area during winter months (Willsie 2003). Annual winter flyover surveys from 1992 to 2001 detected an average of 603 grebes per survey year with a peak one-day count of 1664 western grebes in 1996 (WDFW, unpublished data). These surveys illustrate that Quartermaster Harbor area is regularly used by large numbers of wintering western grebes.

Table 2: Bird species of concern present at the Maury Island site.

Common Name	Scientific Name	Federal Listing Status	State Listing Status
Western grebe	*Aechmophorus occidentalis*	None	Candidate
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	Threatened
Harlequin duck	*Histrionicus histrionicus*	Species of Concern	None
Common loon	*Gavia immer*	None	Sensitive
Brandt's cormorant	*Phalacrocorax penicillatus*	None	Candidate
Common murre	*Uria aalge*	None	Candidate
Great blue heron	*Ardea herodias*	None	Monitor
Red-necked grebe	*Podiceps grisegena*	None	Monitor
Horned grebe	*Podiceps auritus*	None	Monitor
Source: Willsie 2003; WDFW 2003c			

Great Blue Heron (Ardea herodias)
The great blue heron is a rather large bird attaining lengths of between 42 and 52 inches. They have long and slender bills, necks, and legs and they fly with a distinctively folded back neck. The great blue heron feeds in shallow waters, standing along the margin and using their long bills like tongs to clamp their prey. They tend to congregate near areas with eelgrass to take advantage of the abundance of forage fish (Quinn and Milner 1999). They are communal nesters that utilize rather tall trees, normally at least 30 feet in height, adjacent to feeding areas. Due to their dependence on nesting trees, the species is sensitive to riparian vegetation clearing, particularly near eelgrass beds.

The Mileta Creek Wildlife Refuge recently supported one of the largest Great Blue Heron rookeries in King County, located on the eastern shore of Quartermaster Harbor. Recent anecdotal reports suggest that this rookery may have been abandoned.

While currently not included on the state list of species of concern, WDFW has noted an apparent decline in the species and is monitoring populations (Table 2). Although there are little data pertaining to the abundance of great blue herons in this area, surveys conducted in Quartermaster Harbor from 1999 through 2001 noted an average of six individuals (Willsie 2003).

Bald Eagle (Haliaeetus leucocephalus)
Bald eagles were first protected by the Bald Eagle Protection Act of 1940 and later listed as endangered under ESA. In 1978, the bald eagle was reclassified as threatened in five states, including Washington. Bald eagles are also listed as a threatened species on the Washington State species of concern list (Table 2). In the past 20 years, the population of

nesting bald eagles has grown about 10 percent per year as eagles reoccupy habitat (Stinson et al. 2001). Recovery is especially dramatic in Washington State, where there are now over 600 nesting pairs, with approximately 300 pairs in Puget Sound alone. Due to the demonstrated recovery of the species, in 1999 the USFWS proposed to remove bald eagles from the list of threatened and endangered species (64 FR 36454). To date, no decision has been made regarding the proposed delisting.

Bald eagles are found wherever food (i.e., fish and waterfowl) is abundant, with nesting typically occurring in forested settings that are relatively free from human disturbance (Stalmaster 1987). Nesting pairs return to the same nesting territories year after year, while wintering groups tend to be more transitory. In Puget Sound, the seasonal home range containing the foraging and nesting habitat of an eagle pair averages about 2.6 square miles (Stinson et al. 2001). Territories usually include large bodies of water, as the species tends to prefer fish to all other types of prey, although they may also feed on small mammals and waterfowl (Stalmaster 1987). Bald eagles are opportunistic feeders and forage most intensively at first daylight and at low tide (Watson et al. 1991). In the Puget Sound, nest initiation begins sometime in February and the breeding cycle ends when the juveniles disperse near the end of August (Stalmaster 1987).

There is one bald eagle nesting area near the Maury Island site and more than 10 additional nests in the local vicinity. The one nest closest to the reserve boundary is near Neill Point. Bald eagle feeding areas extend along the southern shore of Vashon Island into Quartermaster Harbor and along the southern shoreline of Maury Island (Appendix H). There is little information regarding the abundance of bald eagles using the Maury Island site, although surveys conducted from 1999 through 2001 noted an average of four individuals.

Marbled Murrelet (Brachyramphus marmoratus)
Marbled murrelets in Washington, Oregon, and California were listed as a threatened species under the federal Endangered Species Act in 1992 and are also listed as a threatened species on the Washington State species of concern list (Table 2). Classified as diving seabirds, murrelets are small (0.5 pounds) birds. The species primarily feeds on small fish such as sand lance, smelt, and herring, which makes Quartermaster Harbor a suitable location for these birds. They are normally found in small groups of two to 12, although they may form larger groups in abundant feeding areas. They spend the majority of their lives within approximately one mile of the coastline, although they nest up to about 45 miles inland in old growth trees.

There have been reported, although unconfirmed, sightings of marbled murrelets in the vicinity of Point Robinson. There is no information regarding abundance or frequency of use of the species in this area and the Maury Island site is not within the species designated critical habitat.

Other Bird Species

In addition to the species described above, there are a number of other species of grebes, cormorants, ducks, swans, geese, gulls, and loons in the area, some of which are included on the Washington State species of concern list (Table 2). Waterfowl such as mallard, scoters, goldeneye, and bufflehead tend to be the most common bird species in the area.

4.3 Marine Mammals

Both resident and transient species of marine or marine oriented mammals are found in the vicinity of Vashon and Maury Islands throughout the year.

River Otter (Lontra anadensis)

Rivers otters are fairly common throughout Puget Sound and are likely to occur within the Maury Island site. Although river otters hunt and den on land, they also rely heavily on a diet of fish and shellfish and can be expected to feed in the shallow inter- and sub-tidal areas throughout the Vashon and Maury Island areas, as well as at small estuaries such as the mouth of Judd Creek. They require deep and fairly clean water to remain healthy, and their position near the top of the aquatic food web makes them extremely susceptible to bioaccumulation of contaminants such as mercury, PCBs, Dichloro Diphenyl Trichloroethane (DDT), dieldrin, and other pesticides.

Females reach sexual maturity at about two years of age, while males are mature at about five years. Breeding occurs in late winter to early spring, and litters of between one and four are born within nine to twelve months. Pups are weaned within four months, but spend several months with their mothers learning to hunt. Otters can live as long as 13 years in the wild and have few natural predators that would occur within the Maury Island site.

Harbor Seals (Phoca vitulina)

Harbor seals are rather common throughout the Central Puget Sound area and may be present, periodically, at the Maury Island site. They reach about four to six feet in length and weigh between 176 and 300 pounds. They tend to favor nearshore coastal waters and are often seen at sandy beaches, mudflats, bays, and estuaries. They spend about half their time on land and half in water, and they sometimes sleep in water. They are opportunistic feeders, eating herring, sole, sculpin, flounder, salmonids, and other available fish (Marine Mammal Center 2000). There are no harbor seal haul-out sites in the vicinity of the Maury Island site and abundance of the species in the area is not known.

California Sea Lion (Zalophus californianus)

California sea lions are occasionally observed resting on buoy markers “TC” off southeastern Maury Island and “TB” off Point Robinson. They are extremely social creatures and hunt throughout the day and night, feeding on salmon, octopus, and other pelagic fish. Their sizes vary with gender and age. Females weigh about 200 pounds at maturity, whereas males weigh about 600 pounds or greater.

Killer Whale (Orcinus orca)
The Puget Sound Orca population is listed as endangered by WDFW and a review of its listing under the federal Endangered Species Act was ordered in late fall of 2003. Killer whales frequent a variety of marine habitats with adequate prey resources and do not appear to be constrained by water depth, temperature, or salinity (Baird 2000). During early autumn, southern resident pods expand their routine movements to include Puget Sound in addition to Georgia Strait, San Juan Islands, and Strait of Juan de Fuca. During this annual range expansion Orcas are regularly observed in the vicinity of this aquatic reserve and may occasionally feed along the outer shoreline of Vashon and Maury Islands, and less frequently, may enter Quartermaster Harbor. This activity is believed to be in response to chum and Chinook salmon runs (Osborne 1999). Similarly to otter and sea lions, Orca are top predators and extremely susceptible to bioaccumulation of toxins in the food web.

4.4 Invertebrates

In addition to geoduck, species documented within the Maury Island site include: barnacles; mussels; nudibranch; hairy shore crab; heart cockle; chiton; cockle; Dungeness crab; flat worm; tube worm; red rock crab; sand dollar, sea anemone; sea star; sea urchin, and shrimp (Bloch et al. 2002). More than 80 percent of the infaunal bivalves in Quartermaster Harbor are suspension feeders and Manilla clams (*Tapes philippinarum*), bent-nosed clams (*Macoma inquinata*), and macoma clams (*Macoma balthica*) were the most common species comprising 75 percent, 11 percent, and 5 percent of observations (Landahl 1985). Compared to urban bays, samples from Quartermaster Harbor contain larger abundances or sizes of ‘sensitive species’ including sea cucumbers (*Cucumaria miniata*), spotted sea cucumber (*Cucumaria piperata*), crescent sea cumber (*Pentamera populifera*), edible sea cucumber (*Parastichopus californica*), sunstars (*Solaster stimpsoni*), hermit crabs (*Pagurus spp*.) and snails (*Nassarius mendicus*) (Gibson et al. 2000). A 2002 WDFW bottom trawl in Quartermaster Harbor revealed a high abundance of macroinvertebrates including Dungeness crab, red rock crab, red sea cucumber, and sea stars.

Geoduck (Panopea abrupta)
Geoduck clams are found from California to Alaska, although they are most abundant in the Puget Sound and coastal waters of British Columbia. Geoducks are found from the low intertidal zone to at least 360 feet (110 meters) in water depth and are most abundant in sand and silt substrates. The species is the largest of the burrowing clams, and grows rapidly with individuals in Puget Sound averaging 1.5 pounds within four or five years. They attain their maximum size and weight of approximately two pounds within 15 to 25 years (Hoffmann et al. 2000). Geoducks are very long-lived with some individuals reaching ages of over 130 years, with an average age at commercial tracts of about 46 years (Bradbury et al. 2000). Average density in the south and central areas of Puget Sound is approximately 0.18 geoducks/ft^2 (1.9 geoducks/m^2) (Goodwin and Pease 1991).

There are five commercial geoduck tracts located at the Maury Island site. Harvest tract #10300 (62 acres) along the western shoreline of Quartermaster Harbor is currently unavailable for commercial harvest due to pollution concerns associated with failing septic systems in the vicinity (Sizemore and Ulrich 2002) (Appendix I).

The other five geoduck tracts include more than 433 acres and 6.6 million pounds of geoducks (Sizemore and Ulrich 2002). The state is not harvesting at these locations, nor is there any plan to do so in the immediate future. The Puyallup tribe is harvesting at the Maury Island site along the eastern shoreline of Maury Island (harvest tract 10150) (Appendix I). Tract #10150 includes 130 acres along the entire eastern shoreline of Maury Island, with an estimated population of 1,371,000 geoducks weighing a total of about 3,702,000 pounds. Harvest in this area is restricted from January 1 through April 15 to areas deeper than minus 35 feet (10 meters) MLLW to protect herring spawning. There is also a recommended harvest boundary of minus 25 feet (7 meters) MLLW or deeper from April 16 through December 31 to protect herring habitat (WDFW 2003b). In 2002, tribal harvest took approximately 142,086 pounds of geoducks from the southern portion of this tract.

In recent years, the Puyallup tribe also conducted geoduck harvest with tract #10100, along the northern shoreline of Maury Island (Appendix I). This tract is comprised of 43 acres and is estimated to currently support approximately 124,000 geoducks with a total biomass of about 334,000 pounds. Tribal harvest through 2002 accounted for a removal of approximately 423,950 pounds of geoducks (WDFW 2003b). The Puyallup tribe now believes that the tract has been depleted to the point that commercial harvest is not economically feasible and the tract is in recovery, although the post-harvest survey has not been completed. The time required for recovery of a commercial geoduck tract generally averages about 40 years in Puget Sound.

To protect eelgrass, WDFW mandates surveys prior to state harvest and a two-foot vertical buffer must be established around occurrences of rooted eelgrass. In areas with very shallow slopes, a 180-foot horizontal buffer (seaward and deeper than the deepest eelgrass) may be used instead of the vertical buffer (Bradbury et al. 2000).

4.5 Invasive and Exotic Flora and Fauna

Spartina (Spartina sp.)

Spartina is a highly aggressive and invasive aquatic plant species that can degrade the quality of tideflats. *Spartina* grows on tideflats and traps sediment from the water column, causing increased elevation and vegetation changes. These physical alterations can reduce productivity and habitat suitability for many native plant and animal species (Battelle et al. 2000).

Spartina was first discovered on Vashon Island in 1993 at Fern Cove on the northwest side of Vashon Island. Since then, *Spartina* has been found near the Maury Island site in Raab's Lagoon, Point Heyer, and Tramp Harbor. Populations found to date near the Maury Island site are small and have responded well to management (Eisenberg et al. 2001). In recent years, local organizations have surveyed the island by boat and reported findings to Washington Department of Agriculture for management.

While several other invasive species have been detected within or near the aquatic reserve, no systematic survey has attempted to assess which species are present. Table 3 describes non-native and cryptogenic species that have been detected in Puget Sound and several

species on this list are likely to occur within the aquatic reserve. The information in this table on native regions, transport mechanisms and collections is based on Carlton 1979, Cohen & Carlton 1995, Cohen *et al.* 1998 and Mills *et al.* 2000 unless otherwise noted.

Table 3 Exotic and Cryptogenic Species in Puget Sound

Organism	Records
Phaeophyceae	
Sargassum muticum (Yendo, 1907) Fensholt, 1955	Native to Japan and introduced with oyster aquaculture. First recorded on Pacific Coast in 1944 and in Puget Sound in 1948; present throughout Puget Sound by the early 1960s (Scagel 1956; Thom & Hallum 1991).
Anthophyta	
Cotula coronopifolia Linnaeus, 1753	Native to South Africa and probably introduced in solid ballast. First recorded on the Pacific Coast at San Francisco in 1878 and now spread from southern California to British Columbia, including Puget Sound. Often occurs as an ephemeral colonizer in newly restored salt marshes (Frenkel 1991).
Spartina alterniflora Loiseleur-Deslongchamps	Native to the northwestern Atlantic and first reported on the Pacific Coast in Puget Sound, where it was planted in the 1930s for duck habitat. It probably arrived earlier in Willapa Bay, where it may have been introduced in solid ballast, as seeds accidentally transported with oysters imported for culturing, or possibly as packing material for ship-transported goods.
Spartina anglica C.E. Hubbard, 1968	A new species derived from accidental hybridization in southern England and northern France in the 1800s, Introduced to Puget Sound in Susan Bay for shoreline stabilization and cattle forage in 1961 (Frenkel 1987).
Spartina patens (Aiton)	Native to the northwestern Atlantic. Probably introduced as packing material for ship-transported goods, or possibly in solid ballast or as seeds accidentally transported with oysters imported for culturing.
Zostera japonica Ascherson and Graebner, 1907	Native to the western Pacific and introduced with oyster aquaculture. First recorded on the Pacific Coast in 1957 and in Puget Sound in 1974 (Harrison & Bigley 1982).
Foraminifera	
Trochammina hadai Uchio 1962	Native to Japan, and probably introduced either in ballast water, in hull fouling or with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1971 (McGann *et al.* 2000).
Cnidaria: Hydrozoa	
Cladonema radiatum Dujardin, 1843	Native to the Northwestern Atlantic. First collected on the Pacific Coast in Puget Sound in 1988 (Mills 1998).
Cordylophora caspia (Pallas, 1771)	Native to the Black and Caspian Seas. Either an early introduction with ballast water or possibly introduced in hull fouling. First recorded on the Pacific Coast in Puget Sound around 1920. Reported in some literature as *Cordylophora lacustris*.
Cnidaria: Anthozoa	
Diadumene lineata (Verrill, 1869)	Native to Asia. First recorded on the Pacific Coast in San Francisco Bay in 1906, and in Puget Sound in 1939. Either introduced in hull fouling from Asia, or with shipments of oysters from the Atlantic, where it had been introduced (probably in hull fouling) in the late 1880s. Reported in some earlier literature as *Haliplanella luciae*.

Platyhelminthes	
Pseudostylochus ostreophagus Hyman, 1955	An oyster pest native to Japan and introduced in oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1953.
Annelida: Polychaeta	
Hobsonia florida (Hartman, 1951)	Native to the northwestern Atlantic, and first recorded on the Pacific Coast in Puget Sound in 1940.
Neanthes succinea (Frey and Leuckart, 1847)	Native to the Atlantic and introduced by oyster aquaculture to San Francisco Bay by 1896. First recorded in Puget Sound around 1995.
Pseudopolydora kempi (Southern, 1921)	Native to Japan and probably introduced with oyster aquaculture, or possibly in hull fouling or ballast water. First recorded on the Pacific Coast at Nanaimo on the east coast of Vancouver Island in 1951, and in Puget Sound on San Juan Island in 1968. Has generally been listed as exotic on the Pacific Coast (Carlton 1979; Cohen & Carlton 1995; T N & Associates 2002); but was reported as cryptogenic in the Columbia River (Draheim et al. 2003).
Pseudopolydora paucibranchiata (Okuda, 1937)	Native to Japan and introduced with oysters, in hull fouling or in ballast water. First recorded on the Pacific Coast in southern California in 1950, and in Puget Sound in 1993.
Mollusca: Gastropoda	
Batillaria attramentaria (Sowerby, 1855)	A Japanese oyster pest introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1924, or possibly 19i8-19. Reported in some Pacific Coast literature as *B. zonalis* or *B. cumingi.*
Crepidula fornicata Linnaeus, 1758	An oyster pest native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1905.
Crepidula plana Say,1822	Native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in San Francisco Bay in 1901, and in Puget Sound in 1949.
Myosotella myosotis (Draparnaud, 1801)	Occurs on both coasts of the North Atlantic, but may be native only to Europe. First reported on the Pacific Coast in San Francisco Bay in 1871, where it was probably introduced with oyster aquaculture, although possibly carried in solid ballast or hull fouling. The first record in Puget Sound is from 1936, or possibly a 1927 specimen labeled "Juan de Fuca." It has since been reported from many locations in the Sound.
Nassarius fraterculus (Dunker, 1860)	Native to Japan and introduced with oyster aquaculture. First collected on the Pacific Coast in Puget Sound, in Padilla Bay in 1960 and Samish Bay in 1963 (Carlton 1979: 412).
Ocinebrellus inornatus (Recluz, 1851)	An oyster pest native to Japan and introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1924. Reported in some literature as *Ocenebra japonica* or *Ceratostoma inornatum*.
Urosalpinx cinerea (Say, 1822)	An oyster pest native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in San Francisco Bay in 1890-91 and in Puget Sound in 1929.

Mollusca: Bivalvia	
Crassostrea gigas (Thunberg, 1793)	Native to Japan and introduced for aquaculture. First planted on the Pacific Coast in Puget Sound in 1875. It is cultured extensively in South Puget Sound and reproduces successfully in Dabob Bay (Emmett *et al.* 1991).
Musculista senhousia (Benson, 1842)	Native to Asia and introduced with oyster aquaculture. First recorded on the Pacific Coast in Samish Bay on planted Japanese oysters, and found in the wild in central California in 1941 and in Puget Sound at Olympia in 1959. Reported in some literature as *Musculus senhousia*.
Mya arenaria Linnaeus, 1758	Native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in 1874, and in Puget Sound in 1888-89, where it is widely established (Emmett *et al.* 1991).
Nuttallia obscurata (Reeve, 1857)	Native to the northwestern Pacific and probably introduced in ballast water. First recorded on the Pacific Coast in 1991 and in Puget Sound in 1993 (Forsyth 1993).
Venerupis philippinarum (Adams & Reeve, 1850)	Native to the northwestern Pacific, accidentally introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1924, where it is both widely cultivated and established in the wild (Emmett *et al.* 1991). Reported in some earlier literature as *Ruditapes philippinarum*, *Tapes japonica* or *Venerupis japonica.*
Arthropoda: Crustacea: Copepoda	
Mytilicola orientalis Mori, 1935	Native to Asia and introduced in oyster aquaculture. First recorded on the Pacific Coast in Willapa Bay in 1938, and in Puget Sound in 1943.
Arthropoda: Crustacea: Cumacea	
Nippoleucon hinumensis (Gamo, 1967)	Native to Japan and introduced in ballast water. First recorded on the Pacific Coast in 1979, and in Puget Sound in the mid-1990s. Reported in some earlier literature as *Hemileucon hinumensis*.
Arthropoda: Crustacea: Tanaidacea	
Sinelobus stanfordi (Richardson, 1905)	Origin unknown. Possibly introduced in ship fouling or ballast water. First recorded on the Pacific Coast in 1943, and in Puget Sound since the mid-1990s.
Arthropoda: Crustacea: Isopoda	
Caecidotea racovitzai (Williams, 1970)	Native to the northwestern Atlantic and possibly introduced in ballast water or with aquarium or ornamental pond plants. Primarily occurs in fresh water, but has been collected in brackish water including the Snohomish River Estuary in 1997 (Toft *et al.* 2002).
Limnoria tripunctata Menzies, 1951	Origin unknown. Introduced in hull fouling. First recorded on the Pacific Coast in California in the 1870s and in Puget Sound in 1962.

Arthropoda: Crustacea: Amphipoda	
Ampithoe valida Smith, 1873	Native to the northwestern Atlantic, and introduced by ballast water, oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1941, and in Puget Sound in 1966.
Caprella mutica Schurin, 1935	Native to the Sea of Japan and introduced by ballast water or oyster aquaculture. First recorded on the Pacific Coast in 1973-77, and in Puget Sound in 1998. Reported in some literature as *Caprella acanthogaster*.
Eochelidium sp.	Probably native to Japan or Korea, and introduced in ballast water. First recorded on the Pacific Coast around 1993, and in Puget Sound in 1997.
Grandidierella japonica Stephensen, 1938	Native to Japan, and introduced by ballast water, oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1966, and in Puget Sound in 1977.
Jassa marmorata Holmes, 1903	Native to the northwestern Atlantic and introduced in ballast water or hull fouling. First recorded on the Pacific Coast in 1938, and in Puget Sound around 1995.
Melita nitida Smith, 1873	Native to the northwestern Atlantic, and introduced by ballast water, oyster aquaculture, solid ballast or hull fouling. First recorded on the Pacific Coast in 1938.
Monocorophium acherusicum Costa, 1857	Native to the northern Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1905, and in Puget Sound in 1974-75. Reported in the literature as *Corophium acherusicum* until recently.
Monocorophium insidiosum Crawford, 1937	Native to the northern Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1915 and in Puget Sound in 1949. Reported in the literature as *Corophium insidiosum* until recently.
Parapleustes derzhavini (Gurjanova, 1938)	Native to the western Pacific and introduced in hull fouling. First recorded on the Pacific Coast in 1904, and in Puget Sound in 1998.
Kamptozoa	
Barentsia benedeni (Foettinger, 1887)	Native to Europe, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1929, and in Puget Sound in 1998.
Bryozoa	
Bowerbankia gracilis Leidy, 1855	Probably native to the western Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast by 1923, and in Puget Sound by 1953.
Bugula sp. A	First recorded on the Pacific Coast in Puget Sound in 1993.
Bugula sp. B	First recorded on the Pacific Coast in Puget Sound in 1998.
Bugula stolonifera Ryland, 1960	Native to the northwestern Atlantic and introduced in hull fouling. First recorded on the Pacific Coast by 1978, and in Puget Sound in 1998.
Cryptosula pallasiana (Moll, 1803)	Native to the northern Atlantic, and introduced with oyster aquaculture or in hull fouling. First recorded on the Pacific Coast in 1943-44 and, in Puget Sound in 1998.
Schizoporella unicornis (Johnston, 1847)	Native to the northwestern Pacific, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in Puget Sound in 1927.

Urochordata: Tunicata	
Botrylloides violaceus Oka, 1927	Native to Japan, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1973, and in Puget Sound in 1977.
Botryllus schlosseri (Pallas, 1766)	Native to the northeastern Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1944-47, and in Puget Sound in the 1970s.
Ciona savignyi Herdman, 1882	Native to Japan, and introduced in ballast water or hull fouling. First recorded on the Pacific Coast in 1985, and in Puget Sound in 1998.
Molgula manhattensis (DeKay, 1843)	Native to the northwestern Atlantic, and introduced by ballast water, oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1949, and in Puget Sound in 1998.
Styela clava Herdman, 1881	Native to the region from China to the Sea of Okhotsk, and introduced by ballast water, oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1932-33, and in Puget Sound in 1998.
Chordata: Pisces	
Alosa sapidissima (Wilson, 1811)	Native to the northwestern Atlantic, and intentionally introduced to the San Francisco Bay watershed in 1871. Collected in the Columbia River in 1876 (Smith 1896), and fry were stocked there in 1906 (Draheim 2002: 11). Adults and juveniles are common in Skagit Bay, and rare in other parts of Puget Sound (Emmett *et al.* 1991).

5.0 Species Observation Lists for Maury Island Aquatic Reserve

Tables 4 – 9 describe all species observations within or adjacent to the proposed Maury Island Aquatic Reserve. These observations are largely derived from Blau's (1975) efforts. Special status refers to listing by the State of Washington or the Federal Government as threatened, endangered, species of concern or monitor species.

Table 4: Mammals Observed near Aquatic Reserve

Common Name	Scientific name	Special status
Little Brown Myotis	***Myotis lucifugus alascensis***	
Yuma Myotis	***Myotis yumanensis saturatus***	
California Myotis	***Myotis californicus caurinus***	
Silver-Haired Bat	***Lasionycteris noctivagans***	
Big Brown Bat	***Eptesicus fuscus bernardinus***	
Hoary Bay	***Lasiurus cinereus cinereus***	
Black Rat	***Rattus rattus***	
Norway Rat	***Rattus norvegicus***	
Raccoon	***Procyon lotor pacificus***	
River Otter	***Lutra canadensis pacifica***	
Harbor Porpoise	***Phocoena phocoena***	**State Concern**
Killer Whale	***Orcinus orca***	**Federal Concern, State Endangered**
Harbor Seal	***Poca vitulina richardi***	
Minke Whale	***Balaenoptera acutorostrata***	

Table 5: Birds observed near Aquatic Reserve

Common Name	Scientific name	Special status
Common Loon	***Gavia immer***	**State Sensitive**
Red-throated loon	***Gavia stellata***	
Arctic loon	***Gavia arctica pacifica***	
Red-necked Grebe	***Podiceps grisegena holbollii***	
Horned Grebe	***Podiceps auritus cornutus***	
Eared Grebe	***Podiceps caspicus californicus***	
Western Grebe	***Anchamphorus occidentalis***	**State Concern**
Pied-billed Grebe	***Podilymbus podiceps podiceps***	
Leach's Petrel	***Oceanodroma leucorhoa beali***	
Brandt's Cormorant	***Phalacrocorax penicillatus***	**State Concern**
Pelagic Cormorant	***Phalacrocorax pelagicus resplendens***	
Double-crested Cormorant	***Phalacrocorax auritus albociliatus***	
Great Blue Heron	***Ardea herodias fannini***	**State Monitor**
Whistling Swan	***Olor columbianus***	
Aleutian Goose	***Branta canadensis leucopareia***	**Federal Concern, State Threatened**
Canada Goose	***Branta candensis minima***	
Brant	***Branta nigricans***	
White-fronted Goose	***Anser albifrons frontalis***	
Snow Goose	***Chen hyperborea***	
Mallard	***Anas platyrhynchos platy rhychos***	
Gadwall	***Anas strepera***	
Pintail	***Anas acuta***	
Green-winged Teal	***Anas crecca carolinensis***	
Blue-winged Teal	***Anas discors discors***	
American Widgeon	***Anas americana***	
Shoveler	***Anas clypeata***	
Canvasback	***Aythya valisineria***	
Greater Scaup	***Aythya marila nearctica***	
Common Goldeneye	***Becephala clangula americana***	
Barrow's Goldeneye	***Bucephala islandica***	
Bufflehead	***Bucephala albeola***	
Oldsquaw	***Clangula hyuemalis***	
Harlequin Duck	***Histrionicus histrionicus***	
White-winged Scoter	***Melanitta deglandi dixoni***	
Surf Scoter	***Melanitta perspicillata***	
Common Scoter	***Oldemia nigra americana***	
Hooded Merganser	***Lophodytes cucullatus***	
Common Merganser	***Mergus merganser americansus***	
Red-Breasted Merganser	***Mergus serrator serrator***	
Bald Eagle	***Haliaetus leucocephalus alascanaus***	**Federal Threatened, State Threatened**
Osprey	***Pandion haliaetus carolinensis***	
Peregrine Falcon	***Falco peregrinus pealei***	**Federal Concern, State Threatened**
American Coot	***Fulica americana americana***	
Semipalmated Plover	***Charadrius semipalmatus***	

Killdeer	***Charadrius vociferus***	
Black-bellied Plover	***Pluvialis squatarola***	
Common snipe	***Capella gallinago delicata***	
Greater Yellowlegs	***Tringa melanoleucus***	
Pectoral Sandpiper	***Calidris melanotos***	
Knot	***Calidris canutus canutus***	
Least Sandpiper	***Calidris minutilla***	
Dunlin	***Calidris alpina pacifica***	
Short-billed Dowitcher	***Limnodromus griseus caurinus***	
Western Sandpiper	***Ereunetes mauri***	
Marbled Godwit	***Limosa fedoa***	
Sanderling	***Crocethia alba***	
Northern Phalarope	***Lobopes lobatus***	
Parasitic Jaeger	***Stercorarius parasiticus***	
Glaucous-winged Gull	***Larus hyperboreus barrevianus***	
Herring Gull	***Larus argentatus smithsonianus***	
Thayer's Gull	***Larus thayeri***	
California Gull	***Larus californicus***	
Ring-billed Gull	***Larus delawarensis***	
Mew Gull	***Larus canus brachyrhynchus***	
Western Gull	***Larus occidentalia***	
Bonapartes Gull	***Larus philadephia***	
Heermann's Gull	***Larus heermanni***	
Forster's Tern	***Sterna forsteri***	
Pigeon Guillemot	***Cepplus columba columba***	
Marbled Murrelet	***Brachyramphus marmoratum marmoratum***	**Federal Threatened, State Threatened**
Ancient Murrelet	***Synthliboramphus antiquum***	
Rhinoceros Auklet	***Cerorhinca monocerata***	
Snowy Owl	***Nyctea scandiaca***	
Belted Kingfisher	***Megaceryle alcyon caurina***	
Traill's Flycatcher	***Empidonax traillii brewsteri***	
Common Crow	***Corvus brachyrhynchos herperis***	
Northwestern Crow	***Corvus brachyrhynchos caurinus***	
Water Pipit	***Anthus spinoletta pacificus***	

Table 6: Fish observed near Aquatic Reserve

Common Name	Scientific name	Special status
Pacific lamprey	***Entosphenus tridentatus***	
Brown cat shark	***Apristurus brunneus***	
Spiny dogfish	***Squalus acanthias***	
Big skate	***Raja binoculata***	
longnose skate	***Rraja rhina***	
Ratfish	***Hydrolagus colliei***	
Pacific herring	***Clupea harengus pallasi***	
Pink salmon	**Oncorhychus gorbuscha**	
Chum salmon	**Oncorhychus keta**	
Coho salmon	**Oncorhychus kisutch**	Federal Concern
Sockeye salmon	**Oncorhychus nerka**	
Chinook salmon	**Oncorhychus tshawytscha**	Federal Threatened, State Concern
Cutthroat trout	**Slmo clarki**	
Steelhead trout, rainbow trout	**Salmo gairdneri**	
Surf smelt	**Hypomesus pretiosus**	
Longnose lancefish	**Alepisaurus ferox**	
Plainfin midshipman	**Porichthys notatus**	
Pacific cod	**Gadus macrocephalus**	State Concern
Pacific hake	**Merluccius productus**	Federal Concern, State Concern
Pacific tomcod	**Microgadus proximus**	
Walleye pollock	**Thragra chalcogramma**	State Concern
Tube-snout	**Aulorhynchus flavidus**	
Threespine stickleback	**Gasterosteus aculeatus**	
Bay pipefish	**Syngnathus griseolineatus**	
Shiner perch	**Cymatogaster aggregata**	
Striped seaperch	**Embiotoca lateralis**	
Pile perch	**Rhacochilus vacca**	
Northern ronquil	**Ronquilus jordani**	
High cockscomb	**Anoplarchus purpurescens**	
Snake prickleback	**Lumpenus sagitta**	
Saddleback gunnel	**Pholis ornata**	
Arrow goby	**Clelandia ios**	
Ragfish	**Icosteus aenigmaticus**	
Brown rockfish	**Sebastes auriculatus**	State Concern
Copper rockfish	**Sebastes caurinus**	State Concern
Yellowtail rockfish	**Sebastes flavidus**	State Concern
Quillback rockfish	**Sebastes maliger**	State Concern
Black rockfish	**Sebastes melanops**	State Concern
Blue rockfish	**Sebastes mystinus**	
Canary rockfish	**Sebastes pinniger**	State Concern
Shortbelly rockfish	**Sebastes jordani**	
Bocacciao	**Sebastes paucispinus**	State Concern
Sablefish	**Anoplopoma fimbria**	
Kelp greenling	**Hexagrammos decagrammus**	
Whitespotted greenling	**Hexagrammos stelleri**	
Lingcod	**Ophiodon elongatus**	
Silverspot sculpin	**Blpsias cirrhosus**	

roughback sculpin	**Chitonotus pugetensis**	
Buffalo sculpin	**Enophrys bison**	
Red Irish lord	**Hemilepidotus hemilepidotus**	
Pacific staghorn sculpin	**Leptocottus armatus**	
Slim sculpin	**Radulinus asprellus**	
Cabezon	**Scorpaenichthys marmoratus**	
Blacktip poacher	**Xeneretmus latifrons**	
Pacific sanddab	**Citharichthys sordidus**	
Arrowtooth flounder	**Atheresthes stomias**	
Petrale sole	**Eopsetta jordani**	
Rex sole	**Glyptocephalus zachirus**	
Flathead sole	**Hippoglossoides elassodon**	
Rock sole	**Lepidopsetta bilineata**	
Butter sole	**Isopsetta isolepis**	
Slender sole	**Lyopsetta exilis**	
Dover sole	**Microstomus pacificus**	
English sole	**Parophrys vetulus**	
Starry flounder	**Platichthys stellatus**	
C-O sole	**Pleuronichthys coenosus**	
Sand sole	**Psettichthys melanostictus**	

Table 7: Marine Invertebrates observed near Aquatic Reserve

Common Name	Scientific name	status
Sponge	**Haliclona permollis**	
Crumb-of-bread sponge	**Halichondria panicea**	
Hydroid	**Obelia longissima**	
Hydroid	**Obelia spp.**	
Hydromedusae	**Aequorea aequorea**	
Other hydromedusae spp.		
Scphozoans	**Cyanea capillata**	
Stalked anemone	**Metridium senile**	
Anemone	**Pachyceriantus fimbriatus**	
Sea pen	**Ptilosarcus gurneyi**	
Sea pen	**Stylatula elongata**	
Flatworms	**Phylum Platyhelminthes**	
Mussel Nemertean	**Emplectonema gracile**	
Ribbon worm	**Paranemertes pergrina**	
Other nemerteans		
Chiton spp.	**Mopalia lgnosa**	
Chiton spp.	**Mopalia sp.**	
Lined chiton	**Tonicella lineata**	
Shield limpet	**Collisella pelta**	
Limpet	**Collisella spp.**	
Half-slipper shell	**Crepipatella lingulata**	
Chink shell	**Lacuna variegata**	
Checkered periwinkle	**Littorina scutulata**	
Sitka periwinkle	**Littorina sitkana**	
Lean-basket snail	**Nassarius mendicus**	
Mask limpet	**Notoacmea persona**	
Moon snail	**Polinices lewisii**	
Dogwinkle	**Thais emarginata**	
Toothed snail	**Thais lamellosa**	
Sea slugs	**Armina californica**	
Sea slugs	**Dirona albolineta**	
Sea slugs	**Eubranchus olivaceus**	
Sea slugs	**Hermissenda crassicornis**	
Octopus	**Octopus dolfleini**	
Octopus	**Octopus spp.**	
Scallop	**Chlamys spp.**	
Heart cockle	**Clinocardium nuttalli**	
Pacific oyster	**Crassostrea gigas**	
Ringed lucine	**Lucinoma annulata**	
Inconspicuous macoma	**Macoma balthica**	
Polluted macoma	**Macoma inquinata**	
Bent-nosed clam	**Macoma nasuta**	
Sand clam	**Macoma secta**	
Soft-shell clam	**Mya arenaria**	
Truncate soft shell	**Mya truncata**	
Horse mussel	**Modiolus rectus**	
Blue mussel	**Mytilus edulis**	

Geoduck	**Panope generosa**	
Native littleneck clam	**Protothaca staminea**	
Butter clam	**Saxidomus giganteus**	
Jacknife clam	**Solen sicarius**	
Horse clam, Alaska gaper	**Tresus capax**	
Horse clam, Pacific gaper	**Tresus nuttalli**	
Manila clam	**Venerupis japonica**	
Thin-shelled littleneck	**Venerupis tenerrima**	
Pilsbry piddock	**Zirfaea pilsbryi**	
Little transennela	**Transennela tantilla**	
Pacific lugworm	**Abarenicola pacifica**	
Polychete	**Arctoneoe fragilis**	
Bamboo worm	**Axiothella rubrocincta**	
Capitellid	**Cheilonereis cyclurus**	
Feather duster worm	**Eudistyliua vancoveri**	
Capitellid	**Glycera spp.**	
Scale worm	**Halosydna brevisetosa**	
Capitellid	**Hemipodus borealis**	
Capitellid	**Nephtys sp.**	
Capitellid	**Nereis brandti**	
Pile worm	**Nereis vexillosa**	
Ophelidid	**Phyllochaetopterus prolifera**	
Limy-tubed worm	**Serpula vermicularis**	
Ophelidid	**Spirorbis sp.**	
Barnacle	**Cthamalus dalli**	
Rock barnacle	**Balanus cariosus**	
Barnacle	**Balanus crenatus**	
Acorn barnacle	**Balanus glandula**	
Isopod	**Cirolana kincaidi**	
Isopod	**Idotea wosnesenskii**	
Amphipod	**Caprella equilibra**	
Amphipod	**Metacaprella kennerlyi**	
Beach hopper, sand flea	**Orchestia traskiana**	
Ghost shrimp	**Callianassa californiensis**	
Graceful crab	**Cancer gracilis**	
Red crab	**Cancer productus**	
Shrimp	**Crangon sp.**	
Purple shore crab	**Hemigrapsus nudus**	
Green shore crab	**Hemigrapsus oregonensis**	
Black-clawed crab	**Lophopanopeus bellus**	
Hermit crab	**Pagurus armatus**	
Hermit crabs	**Pagurus spp.**	
Shrimp	**Pandalus spp.**	
Pea crab	**Pinnixa faba/ Pinnixa littoralis**	
Spider crab	**Pugettia gracilis**	
Kelp crab	**Pugettia producta**	
Bryzoan	**Dendrobeania lichenoides**	
Bryzoan	**Membranipora**	
Rose star	**Crossaster papposus**	

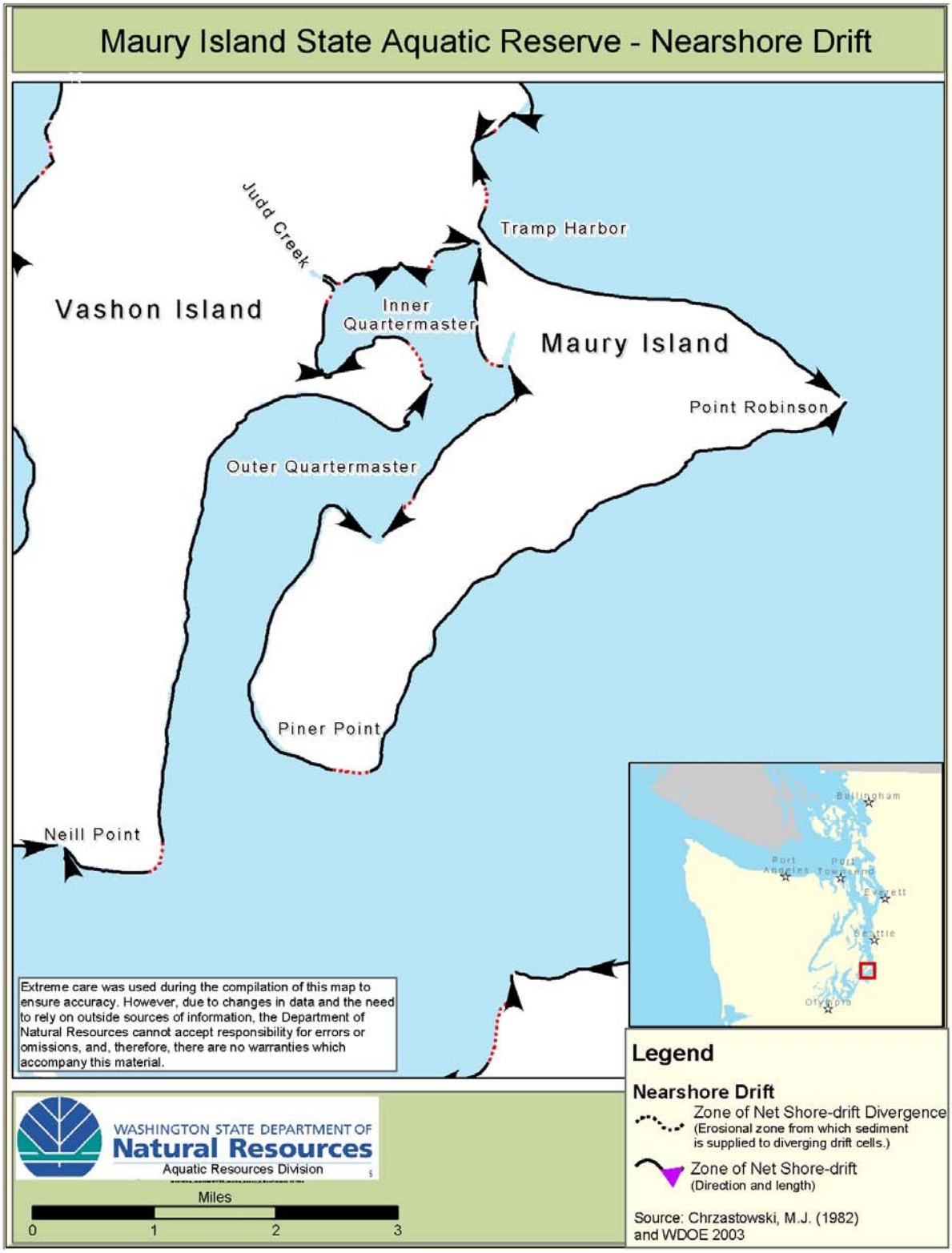
Leather star	**Dermasterias imbricata**	
Mottled star	**Evasterias troschelii**	
Blood star	**Henricia leviuscula**	
Vermillion star	**Mediaster aequalis**	
Pink starfish	**Pisaster brevispinus**	
Sunflower star	**Pycnopodia helianthoides**	
Sun star	**Solaster stimpsoni**	
Sand dollar	**Dendraster excentricus**	
Green sea urchin	**Strongylocentrotus droebachiensis**	
Sea cucumber	**Cucumaria miniata**	
Sea cucumber	**Eupentacta quinquesemita**	
California sea cucumber	**Parastichopus californicus**	
Ascidians	**Ascidia callosa**	
Ascidians	**Ascidia paratropa**	
Sea squirts	**Chelyosoma productum**	
Sea squirts	**Distaplia occidentalis**	
Sea squirts	**Styela gibbsii**	
Sea squirts	**Tunicate spp.**	

Table 9: Aquatic Vegetation observed Near Aquatic Reserve

Common Name	Scientific name	status
Pickleweed	**Salicornia virginica**	
Eelgrass	**Zostera marina**	
Eelgrass	**Zostera japonica**	
Sea fern	**Bryopsis corticularis**	
Link confetti	**Enteromorpha intestinalis**	
Sea lettuce	**Ulva lactuca**	
Schizonema	**Navicula spp.**	
Diatom	**Pleurosigma fasciola**	
Red algae	**Agardhiella tenera**	
Red algae	**Callophyllis sp.**	
Red algae	**Ceramium sp.**	
Turkish towel	**Gigartina exasperata**	
Red algae	**Gracilariopsis sjoestedtii**	
Pink rock crust	**Lithothamnion sp.**	
Red algae	**Neodilsea amercana**	
Red algae	**Polysiphonia sp.**	
Red algae	**Pterosiphonia sp.**	
Red algae	**Rhodoptilum plumosum**	
Brown algae	**Colpomenia sinuosa**	
Brown algae	**Cystoseira germinata**	
Rockweed	**Fucus gardneri**	
Hairy rockweed	**Fucus spiralis**	
Sugar wrack	**Laminaria sacchirina**	
Bull kelp	**Nerocystis luetkeana**	
Brown algae	**Petalonia debilis**	
Japanese weed	**Sargassum muticum**	
Whip tube	**Scytosiphon lomentaria**	

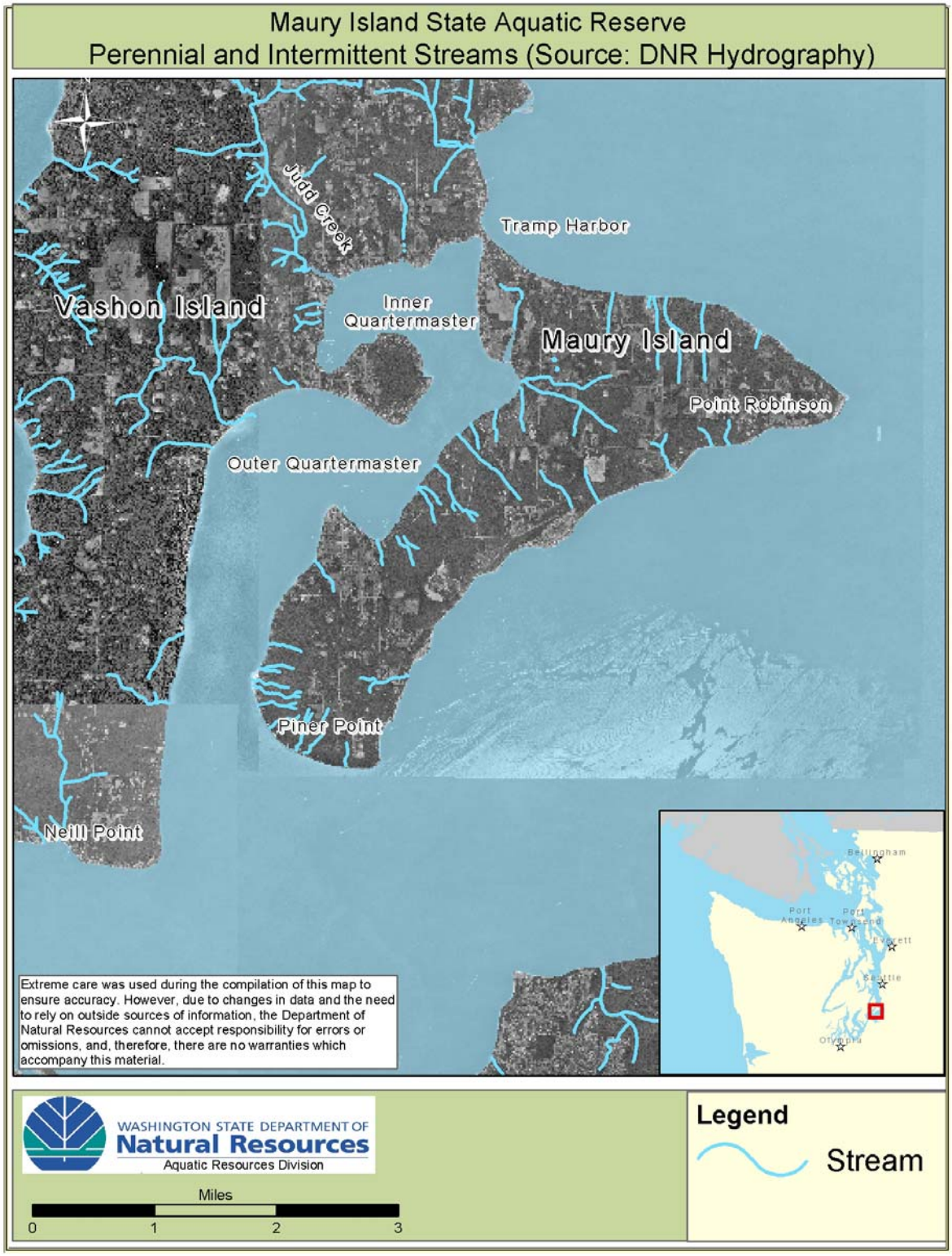
Appendix D– Drift Cells

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm



Appendix E – Tributary Streams

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm

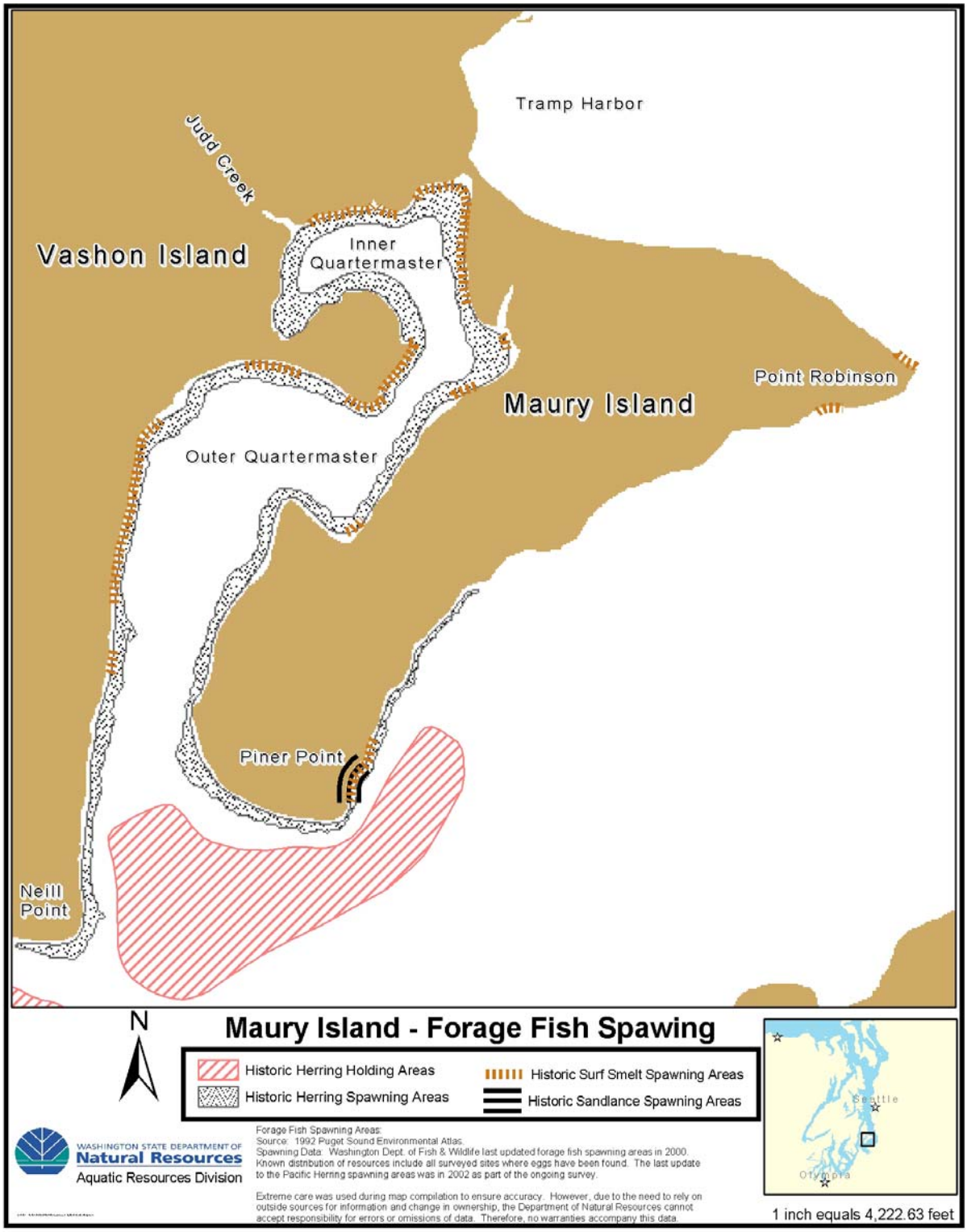


Appendix F – Aquatic Vegetation

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm

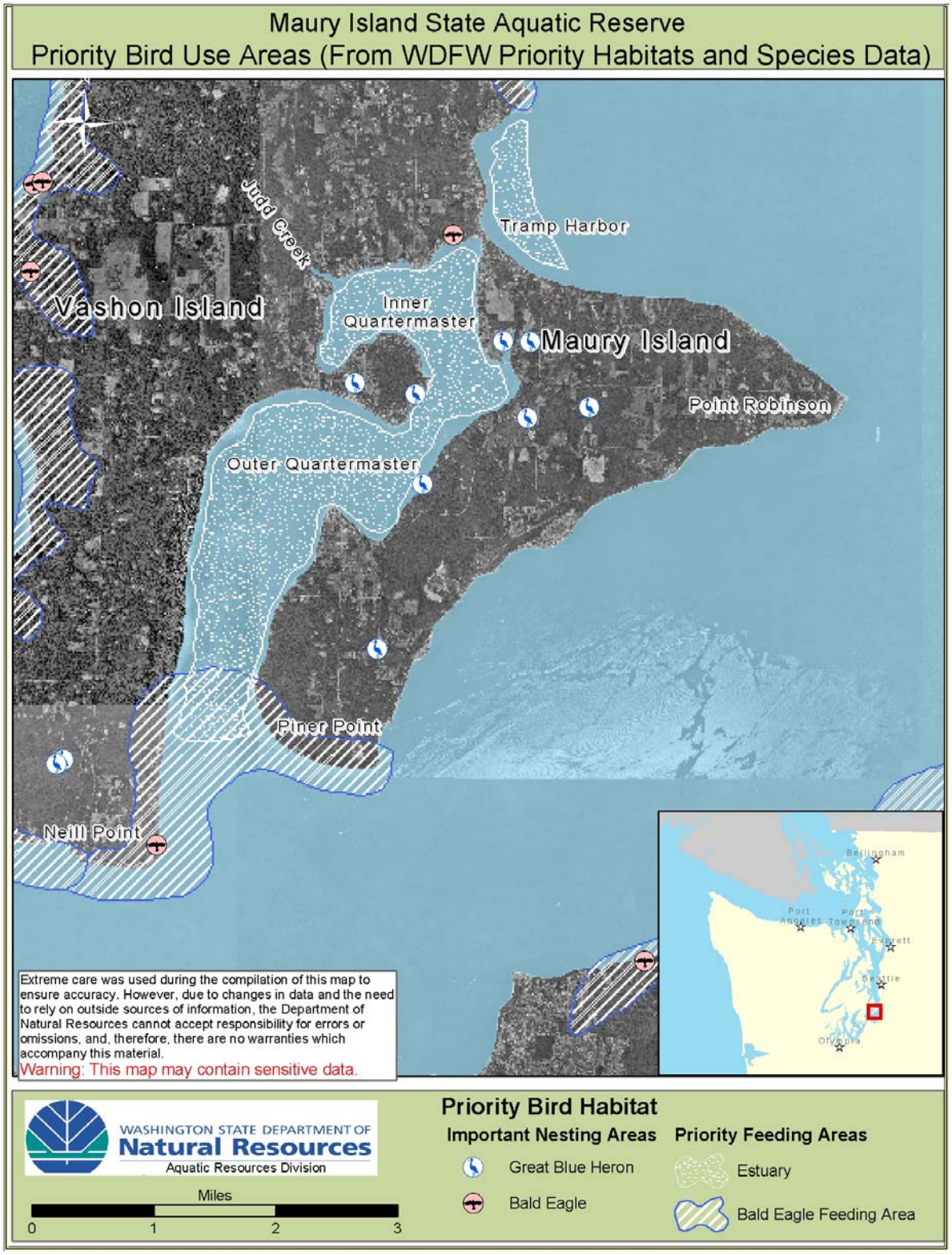
Appendix G – Forage Fish Spawning

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm



Appendix H – Priority Bird Use Areas

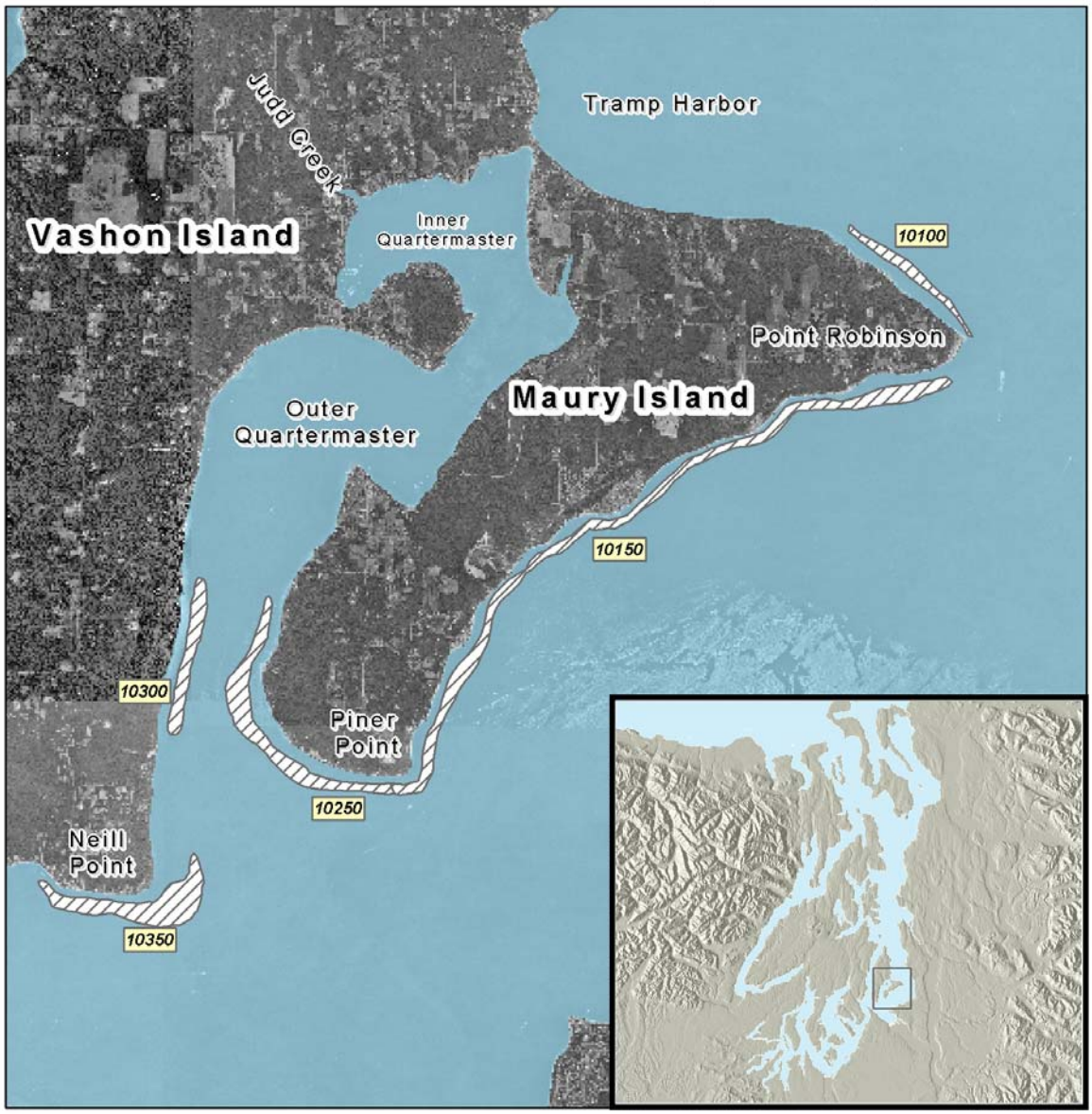
For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm



Appendix I – Geoduck Tracts

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm

Commercial Geoduck Tracts Within The Maury Island Aquatic Reserve



Extreme care was used during the compilation of this map to ensure accuracy. However, due to changes in data and the need to rely on outside sources of information, the Department of Natural Resources cannot accept responsibility for errors or omissions, and, therefore, there are no warranties which accompany this material.

0 0.4 0.8 1.6 2.4 3.2 Miles

Legend

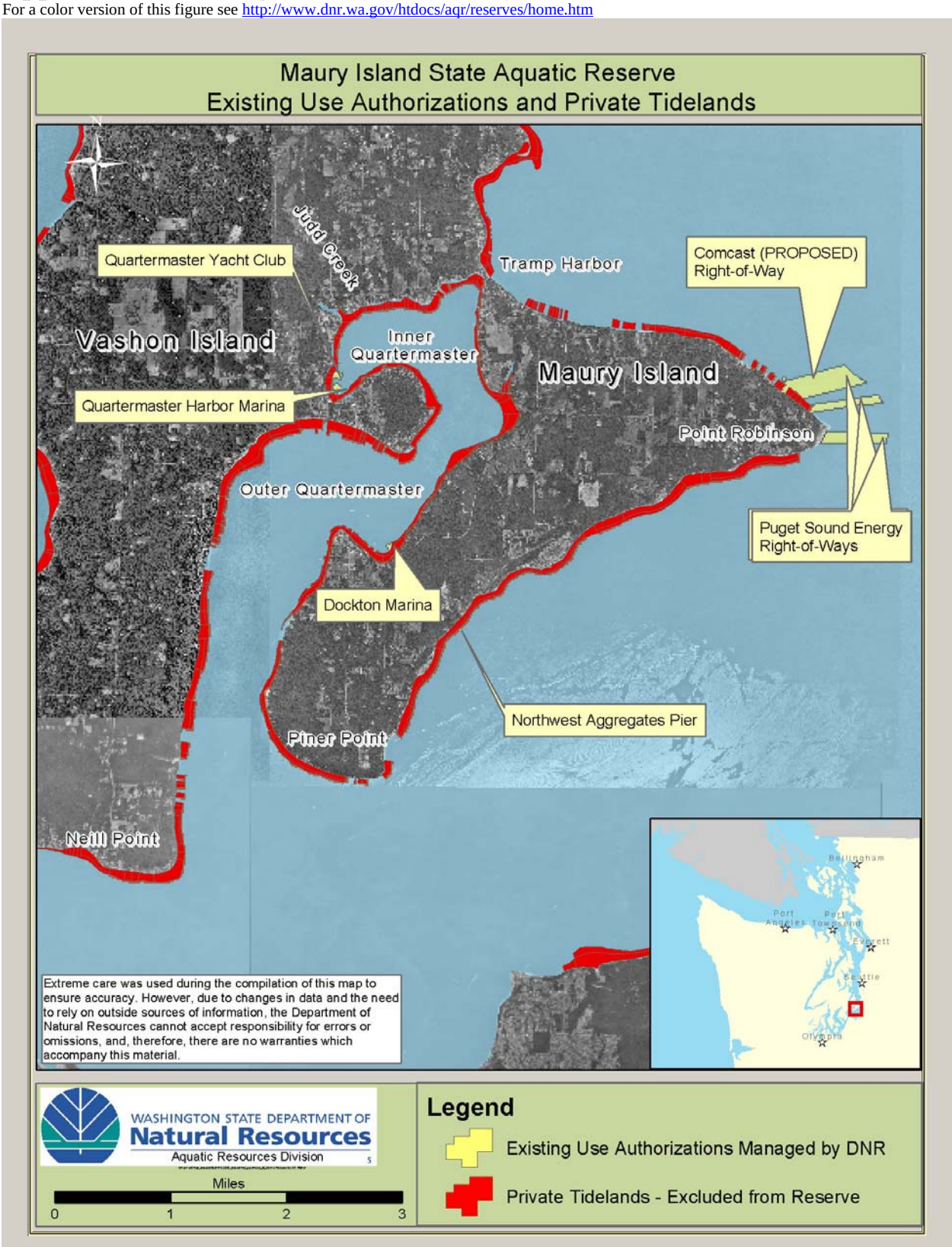
Geoduck Tracts

10300 Geoduck Tract Number

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands

Appendix J – Existing Use Authorizations

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm

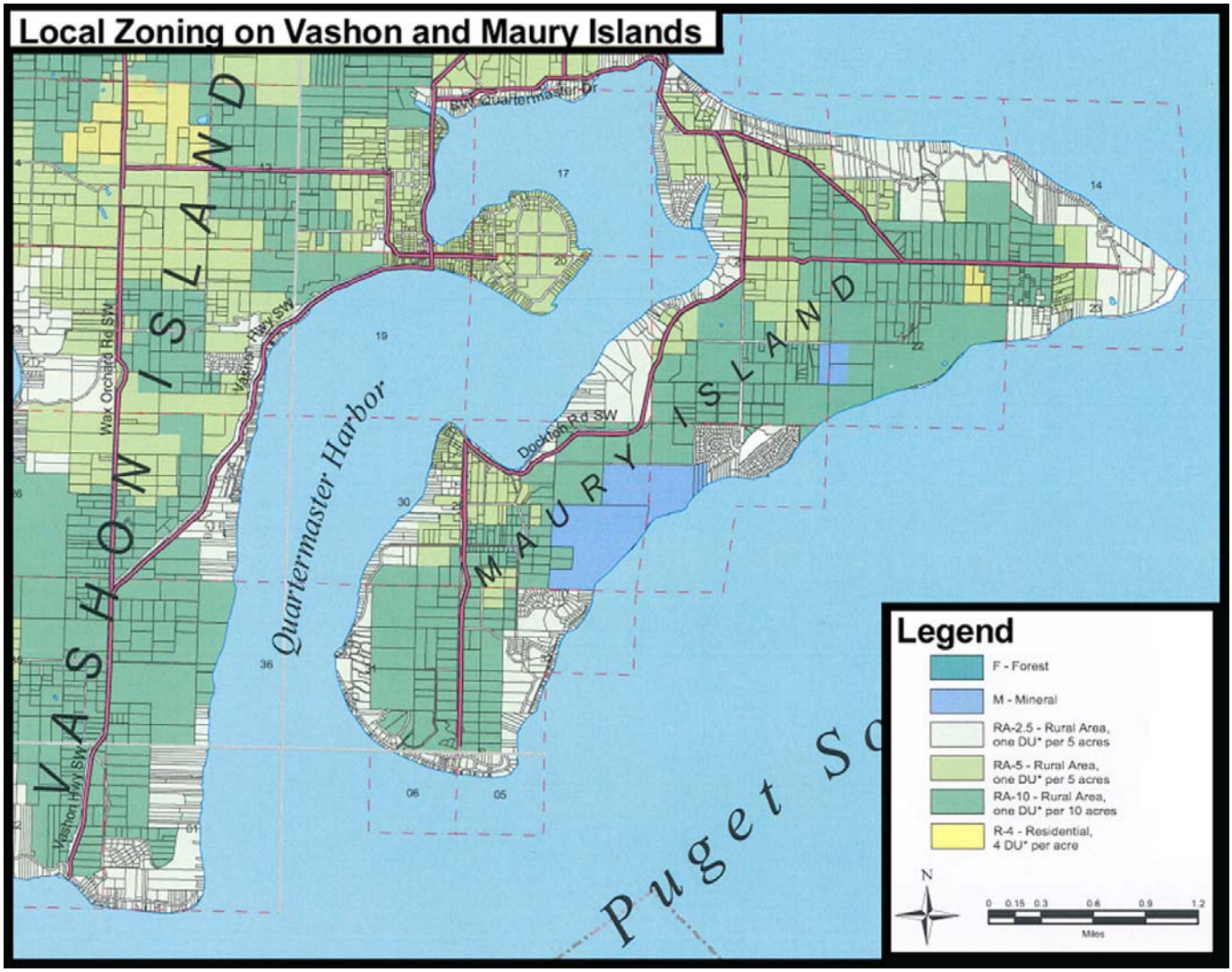


Appendix K – Shoreline Zoning

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm

Appendix L – Land Use Designations

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm



Appendix M: Shoreline Modifications

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm

Appendix N– Programmatic Management Matrix

LOCATION	MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS	GOAL
Reserve-Wide	Cooperative Management	Identify local, state, federal, and tribal stakeholders Collaborate on a project-specific basis with stakeholders	Improve interagency communication Coordinate aquatic resource and shoreline management strategies
	Management Plan Updates	Review & update every 10 years based on budget and staffing Establish long-term quantifiable resource goals Implement adaptive management	Ensure management plan success
	Research	Identify historical research conducted for site Identify ongoing research conducted at site Compile database of historical research Identify outstanding research needs for the site Identify research partners Develop long-term research plan Establish reserve-wide baseline conditions Establish resource specific goals	Establish Baseline Conditions Improve understanding of reserve resources Establish long-term resource goals
	Monitoring	Establish long-term monitoring plan Identify monitoring partners Implement assessments of dissolved oxygen, nitrates, fecal coliform, suspended solids, and water column transparency Conduct surveys of eelgrass, kelp, forage fish spawning, shoreline development, and beach substrate	Ensure management plan success Establish Long-term resource goals Better understand resources within the reserve
Use Authorizations On State-owned Aquatic Lands	Existing Uses of State-owned Aquatic Lands	Existing terms & conditions honored May conduct maintenance and construction Identify baseline conditions of habitats & species Work to decrease existing impacts May be re-assigned May be processed for re-authorization	Maintain site-specific baseline conditions Improve site-specific baseline conditions where necessary

LOCATION	MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS	GOAL
	Re-authorization of Existing Uses and Authorization of New Uses	Must primarily serve objective of reserve Identify baseline conditions of habitats & species Create no additional impacts Show success on compensatory mitigation Reduce impacts over time (plan) Monitor impacts (plan) Implement adaptive management (plan)	Maintain site-specific baseline conditions Improve site-specific baseline conditions where necessary
DNR Led Activities Within Reserve	Derelict Vessels	Inventory existing derelict or abandoned vessels Identify new derelict or abandoned vessels Remove as per derelict vessel program guidelines	Maintain or improve reserve-wide baseline conditions
	Land Acquisition for Habitat	Establish priorities Identify acquisition opportunities Seek funding for purchase	Maintain or improve reserve-wide baseline conditions
	Aquatic Nuisance Species Eradication	Manage in cooperation with other entities	Improve site-specific baseline conditions
	Unauthorized & Trespass Structures	Inventory Determine ownership Assess impacts Improve installation, maintenance, & location Authorize Remove if derelict or abandoned	Improve site-specific baseline conditions
	Public Use & Access	Promote & encourage use consistent with the reserve objectives Determine if additional public access is needed	Promote appropriate use of reserve

LOCATION	MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS	GOAL
	Transient Public Recreational Use	Encourage appropriate, legal recreational activities Inventory types, magnitude, and location of recreational uses Determine if such uses contribute to impacts to the resources of the reserve Collaborate with user groups on voluntary basis Implement voluntary actions to reduce impacts	Promote use of reserve Maintain or improve reserve-wide baseline conditions
	Outreach & Education	Place signs & boundary markers Disseminate BMPs to local residents, user groups, and lessees Implement educational activities Seek funding sources & projects for adjacent lands Collaborate with stakeholders to minimize offsite impacts	Design outreach that can best involve the public as well as meeting the goals of the reserve designation
On Adjacent Lands	Shoreline Modification	Rely on existing regulatory activities Identify voluntary landowners Collaborate with stakeholders to foster participation in meeting the goals of the reserve and the community Identify funding sources and projects Implement projects	Improve area-wide baseline conditions
	Non-point Source Pollution	Review past and present non-point source pollution programs Identify sources of non-point pollution in area Prioritize areas of concern Collaborate with other entities to formulate and implement projects Seek funding sources to assist in projects	Improve area-wide baseline conditions
	Private Docks, Floats, and Mooring Buoys	Rely on existing regulatory activities Disseminate BMPs to local residents Identify voluntary landowners Identify funding sources and projects Improve installation, maintenance, & location	Improve area-wide baseline conditions

Appendix O – DNR Use Management Guidance Matrix

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
Stormwater Outfalls	No direct discharge to reserve area. Upland treatment and infiltration to groundwater, streams, or wetlands to be re-introduced to marine waters through natural hydrologic processes.		No direct discharge to reserve area. Upland treatment and infiltration to groundwater, streams, or wetlands to be re-introduced to marine waters through natural hydrologic processes - OR - might consider discharge area of impact to extend beyond the boundary of influence or habitat of concern (eelgrass, herring holding area, salmon migratory habitat, near shore zone).	Water quality, nutrient input, toxics, sediment input, flow rate, mixing, temperature, dissolved oxygen, salinity.	No shellfish closures due to water quality concerns. Meet Clean Water Act standards. Maintain sediment quality.
Sewage Outfalls	No direct discharge to reserve area. Upland treatment and infiltration to groundwater, streams, or wetlands to be re-introduced to marine waters through natural hydrologic processes.		No direct discharge to reserve area. Upland treatment and infiltration to groundwater, streams, or wetlands to be re-introduced to marine waters through natural hydrologic processes - OR - might consider discharge area of impact to extend beyond the boundary of influence or habitat of concern (eelgrass, herring holding area, salmon migratory habitat, near shore zone).	Water quality, nutrient input, toxics, sediment input, flow rate, mixing, temperature, dissolved oxygen, salinity.	No shellfish closures due to water quality concerns. Meet Clean Water Act standards. Maintain sediment quality.

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
Water Intakes	No intakes near fish spawning, migratory, or rearing areas. Intakes should generally be placed deeper than -30 ft. MLLW. All intakes must adhere to WDFW screening criteria.			Removal or destruction of habitat and disruption of fish larval dispersal. Direct entrainment of marine species.	No loss of juvenile fish or adult crustaceans related to intakes. No destruction of aquatic habitat related to intakes.
Desalinization Facilities	Same as "intake" above. No discharge of desalination wastewater or concentrated minerals to marine waters.		Same as "intake" above. No discharge of concentrated minerals to marine waters. Prefer no direct discharge of wastewater to reserve area - OR - might consider discharge area of impact to extend beyond the boundary of influence or habitat of concern (eelgrass, herring holding area, salmon migratory habitat, near shore zone).	Water quality, habitat disruption, direct entrainment of marine organisms.	No loss of juvenile fish or adult crustaceans related to desalinization intakes or outfalls. No destruction of aquatic habitat related to desalinization intakes or outfalls. Maintain existing ambient salinity levels.
Cable Crossings	Permissible. Required to route cable around or drilling below critical habitat. Must avoid all surface and sub-surface impacts to critical aquatic habitat and species. Proponents must survey and video seabed to show proposed installation site is free of vegetation. Installation period must comply with WDFW in-water work periods. Prefer that shore-ends use directional drilling or rock-pinning/split-pipe remedial protection if the shore-end is either rocky or an erosion area. When burial is an acceptable installation method, plowing is the preferred method over water-jetting remote operated vehicle.			Aquatic vegetation, other aquatic rearing and migratory habitat, disruption of near shore drift, localized habitat degradation.	No disturbance of vegetated areas during construction. No post construction project footprint on surface within euphotic zone.

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
Oil, gas, water, and other pipelines	Same as cable crossings. Additionally, pipelines must be directionally drilled below the reserve to depths of minus 70 feet at MLLW or 1/2 mile from the MHW line. The project proponent must demonstrate the ability to detect leaks of less than 0.1% of total flow for each segment.			Aquatic vegetation, other aquatic rearing and migratory habitat, disruption of near shore drift, localized habitat degradation.	No disturbance of vegetated areas during construction. No post construction project footprint on surface within euphotic zone. Protect reserve resources from leaks of toxic chemicals.
Fish Pens	Not permissible.	Conditional - Herring holding in pens is not permitted during periods of herring spawning (Jan. through mid-April). In addition, pens being utilized to hold herring may only be sited in areas of adequate flushing to ensure there are no water quality impacts. No floating aquaculture facility may be located over aquatic vegetation or documented spawning habitat and shall not be located in the intertidal zone.		Aquatic vegetation, other rearing and migratory habitat, water quality, euphotic zone, herring spawning habitat.	Herring disease levels consistent with pre-project baseline conditions. No disturbance to aquatic vegetation or euphotic zone.
State Commercial Geoduck Harvest	Only on commercial tracts and performed with no impacts to aquatic habitat and species identified in the management plan. Harvest must be consistent with the guidance established in the FSEIS for the state commercial geoduck fishery and associated management plan.			Aquatic vegetation, migration, spawning and rearing habitat, intertidal substrate.	No disturbance of aquatic vegetation. No long-term turbidity increases. No disruption of fish spawning or rearing.
Shellfish Aquaculture	Permissible with no impacts to conservation features of aquatic habitat and species identified in the management plan. Use of herbicides and pesticides, cutting, tilling, or otherwise disturbing native aquatic vegetation is not permissible.			Aquatic vegetation, migration, spawning and rearing habitat, intertidal substrate.	No disturbance of aquatic vegetation. No long-term turbidity increases. No disruption of fish spawning or rearing.
Marinas and Public Docks	Existing marinas permissible with long-term management plan that outlines time frames for upgrades to reduce impacts. New Marinas - Contingent on siting study to be conducted for the reserve in coordination with local user groups and		Contingent on siting study to be conducted for the reserve in coordination with local user groups and applicable local, state, and	Euphotic Zone, aquatic vegetation, water quality, sediment contamination, hydrologic alterations,	No disturbance of aquatic vegetation. Meet Clean Water Act standards. Maintain sediment

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
	applicable local, state, and federal government agencies.		federal government agencies.	and fish predation.	quality. No disruption of fish spawning or rearing.
Breakwaters on State Land	Conditional - Limited to only floating breakwaters and specific uses that can show the immediate need for facility, structural, or private property protection to alleviate risk of eminent damage. Must be designed to promote circulation and minimize barriers, limit shading, and use environmentally neutral materials.			Hydrologic alterations, drift cells, aquatic vegetation, and fish predation.	No disturbance of aquatic vegetation. Promote natural hydrologic regime. Avoid drift cell disruptions. No disruption of fish spawning, rearing, or migration.
Boat repair facilities on state land	Not permissible.			Water quality and contaminated sediment.	Meet Clean Water Act standards. Maintain sediment quality.
Industrial Wharves and Piers	Conditional- only if new structure creates no net additional impacts (no net loss) to the habitat and species identified for conservation at the site, and implements actions to primarily serve the purpose of the reserve.		Limited to area adjacent to upland mineral zoning in King County Comprehensive Plan. Conditional only if new structure creates no net additional impacts (no net loss) to the habitat and species identified for conservation at the site, and implements actions to primarily serve the purpose of the reserve. Existing facilities must upgrade their facility to reduce impacts over time.	Water quality, hydrologic alterations, drift cells, aquatic vegetation, and adverse species interactions.	No disturbance of aquatic vegetation. Promote natural hydrologic regime. Avoid drift cell disruptions. No disruption of fish spawning, rearing, or migration.

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
Mooring Areas, Recreational Mooring Buoys, and Private Recreational Docks on State-Owned Aquatic Lands	DNR will inventory existing buoys and establish ownership; cooperate with owners to identify appropriate installation methods, locations, and maintenance practices; and authorize buoys on state-owned aquatic lands (adjacent landowners may install and maintain a recreational dock or mooring buoy at no fee). Until the inventory actions are completed, existing mooring areas will be allowed to remain. In the future, DNR would remove abandoned buoys, ensure proper installation, and promote public awareness of location of eelgrass and forage fish spawning locations.			Aquatic vegetation, forage fish spawning and rearing habitat, water quality.	No disturbance of aquatic vegetation. Meet Clean Water Act standards. Maintain sediment quality. No disruption of fish spawning, rearing, or migration.
Residential Use (Live Aboards)	Limited to existing marinas and according to the limitations of DNR regulations in WAC 332-30-171 and King County Shoreline Master Program.	Reference marinas and public docks section above.		Water quality, hydrologic alterations, drift cells, aquatic vegetation, and adverse species interactions.	No disturbance of aquatic vegetation. Meet Clean Water Act standards. Maintain sediment quality. No disruption of fish spawning, rearing, or migration.
Log Storage/Booming	Not permissible.			Euphotic zone, substrate, aquatic vegetation, sediment quality.	No disturbance of aquatic vegetation. Meet Clean Water Act standards. Maintain sediment quality.
Dredging	Not permissible unless for federal transportation projects.			Substrate, water quality, aquatic vegetation, fish spawning, rearing, and migration.	No disturbance of aquatic vegetation. Meet Clean Water Act standards. Maintain sediment quality. No disruption of fish spawning, rearing, or migration.

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
MTCA/CERCLA Sites	Support reserve conservation goals and manages uses within the reserve to prevent future sediment contamination.			Sediment quality, water quality.	Meet Clean Water Act standards. Maintain sediment. quality.
Voluntary Restoration and Enhancement	Encouraged throughout the reserve based on recognized priorities. DNR will review existing inventories of potential restoration activities and in voluntary cooperation with interested parties will develop a site specific prioritization; secure funding for habitat improvement projects; and implement projects within the reserve.			Euphotic zone, aquatic vegetation, water quality, sediment quality, hydrologic alterations, drift cells, fish populations and habitat.	Maintain and improve aquatic habitat conditions within the reserve.
Mitigation	Projects within reserve must be fully mitigated and compensatory mitigation must be installed prior to project-related impacts occurring. Mitigation activities for projects outside of the reserve must improve aquatic habitat conditions within the reserve.			Euphotic zone, aquatic vegetation, water quality, sediment quality, hydrologic alterations, drift cells, fish populations and habitat.	Maintain and improve aquatic habitat conditions within the reserve.