NATURAL RESOURCES

Nisqually Reach Aquatic Reserve Management Plan

September 2011

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark - Commissioner of Public Lands

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Cover photo provided by Daniel Hull, Nisqually Reach Nature Center

Nisqually Reach Environmental, Scientific & Educational Aquatic Reserve Management Plan

September 2011

Washington State Department of Natural Resources
Aquatic Resources Division

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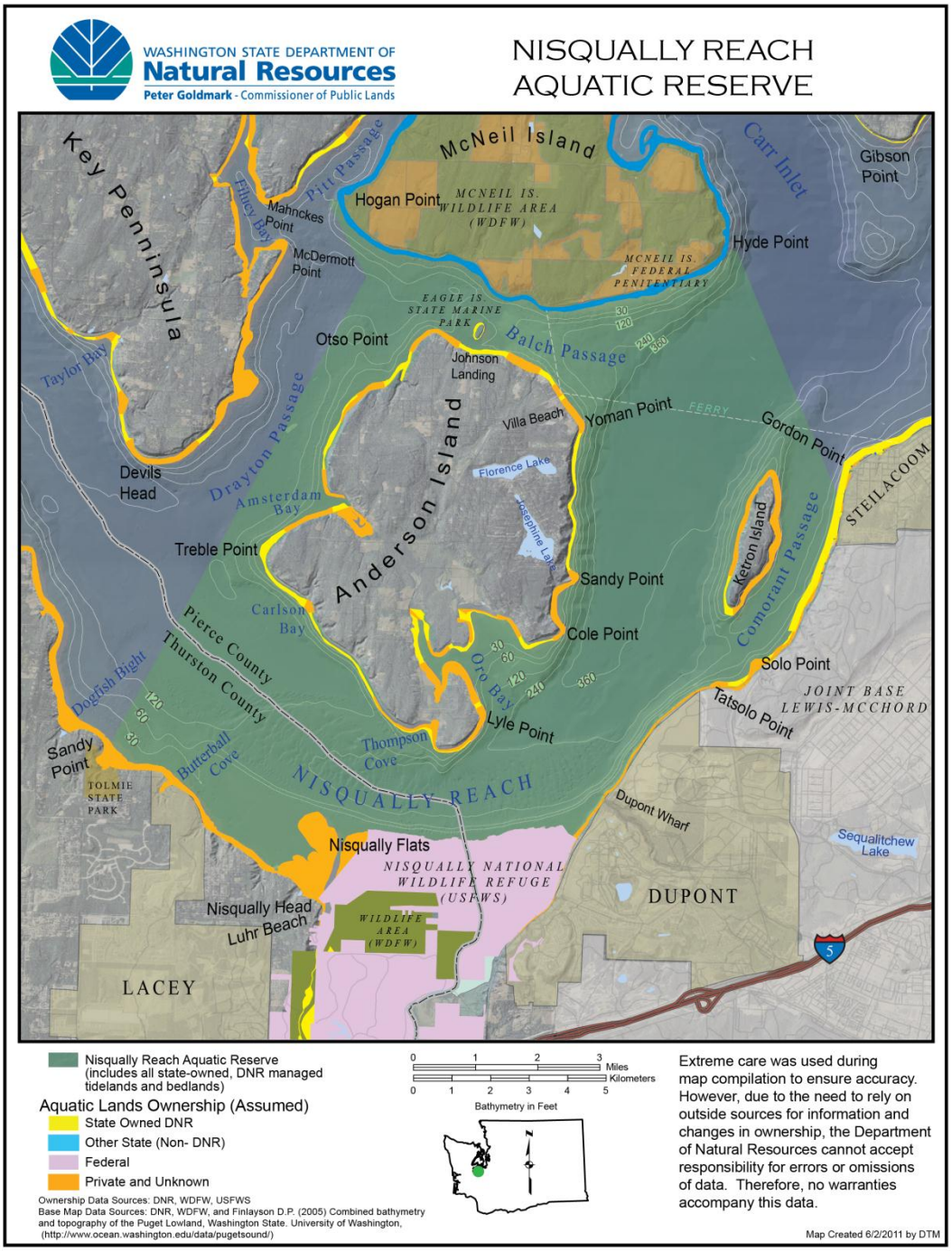
Acronyms

Corps	U.S. Army Corps of Engineers
DMMP	Dredged Material Management Program
DNR	Washington State Department of Natural Resources
DOE	Department of Ecology
DOH	Washington State Department of Health
EPA	Environmental Protection Agency
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
NOAA	National Oceanographic and Atmospheric Administration
PSAMP	Puget Sound Assessment and Monitoring Program
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SOAL	State owned aquatic lands
U&As	Usual and Accustomed areas
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Service
WAC	Washington Administrative Code
WDFW	Washington State Department of Fish and Wildlife
WSU	Washington State University

Figure 1: Nisqually Reach Aquatic Reserve and Vicinity



1. Executive Summary

The Nisqually Reach Aquatic Reserve is established as an environmental, scientific, and educational reserve to ensure protection of the unique habitats and species identified in the area and promote sustainable public stewardship of the region. This plan identifies the habitats and species in the reserve and the management actions that will be employed by the Department of Natural Resources (DNR) to conserve these resources with the management emphasis on environmental protection above all other management actions.

In general, within its statutory authority, DNR will approve new uses that have been demonstrated to be consistent with the reserve's goals, objectives, and management actions described in chapters 2, 4, and 5 respectively and support the desired future conditions. This management plan does not apply to private tideland or upland property owners. DNR management authority extends only to the state owned aquatic lands.

The following management goals have been established for the reserve:

1. Preserve, restore and enhance aquatic nearshore areas including intertidal and subtidal ecosystems with a special emphasis on native habitats for forage fish, salmonids, and marine birds.
2. Protect and restore the functions and natural processes of nearshore ecosystems in support of the natural resources of the reserve.
3. Promote stewardship of riparian and aquatic habitats and species by supporting and providing opportunities for outdoor education, scientific research including citizen science and interpretive studies.
4. Promote sustainable management of traditional recreational (e.g., boating, water skiing, fishing), commercial (e.g., marinas), and cultural uses in the aquatic reserve in a manner consistent with the other goals and objectives for the reserve.
5. Support the recovery and protection efforts for federal and state threatened, endangered and sensitive species, species of special concern and their habitats.

The management plan will be reviewed and updated as necessary every ten years throughout the 90-year term of the reserve designation. Changes in ecosystem condition and existing uses of state-owned aquatic lands will be included in the updates. Research and monitoring data will be used to guide DNR and the Implementation Committee in determining whether management actions are meeting the goals and objectives of the reserve. If management actions are not

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

2. Introduction

I. Washington's Department of Natural Resources

DNR manages about 2.6 million acres of state-owned aquatic lands. This includes 1,300 miles of tidelands, 6,700 acres of harbor areas (established in the state constitution), all of the bedlands in tidally influenced areas, and freshwater shorelands and bedlands of navigable water bodies. In addition there is an undetermined amount of freshwater shorelands and bedlands that may be navigable and fall under DNR management.

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 use and access, fostering water-dependent use, ensuring environmental protection, and utilizing renewable resources. DNR is directed to generate revenue from state-owned aquatic lands when it is consistent with the other public benefits. DNR manages the state's sensitive aquatic lands and, when necessary, removes them from conflicting uses. As part of this authority, under Washington Administrative Code (WAC) 332-30-151, DNR can establish environmental, scientific, and educational aquatic reserves. The Nisqually Reach Aquatic Reserve was confirmed as a reserve candidate in 2008 and established as an environmental, educational and scientific aquatic reserve in 2011 to conserve and enhance critical habitats and species and promote research, monitoring, and education in the area.

II. Aquatic Reserves Program

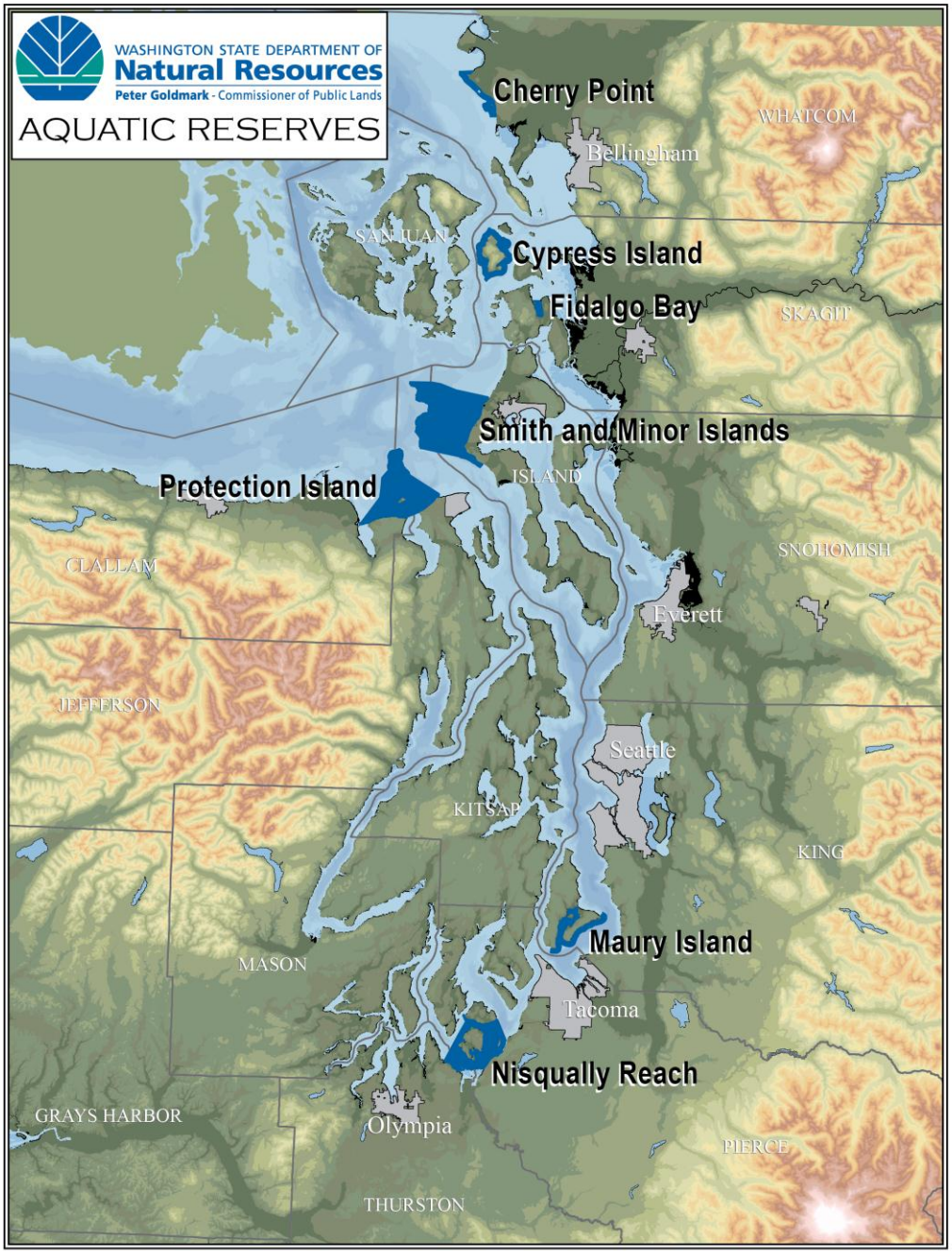
DNR established the Aquatic Reserves Program in an effort to promote preservation, restoration, and enhancement of state-owned aquatic lands that provide benefits to the health of native aquatic habitats and species in the state of Washington, and meet an increasing need for site-based conservation management of state-owned aquatic land. The program was created to establish aquatic reserves on selected state-owned lands to help protect important native aquatic ecosystems. Aquatic reserves are lands of special educational or scientific interest, or of special environmental importance (WAC 332-30-151). The Aquatic Reserves Program examines past successes in site-based conservation, to ensure that aquatic reserve status is applied when it is the most appropriate management tool (DNR 2005).

Three types of aquatic reserves may be established through the Aquatic Reserves Program: environmental, scientific, or educational. An aquatic reserve may be designated as one or any combination of the three types. The objectives for each

reserve category can be found in the *Aquatic Reserve Program Implementation and Designation Guidance*, on DNR's webpage www.dnr.wa.gov.

DNR and its partners will manage each reserve in a manner consistent with the goals, objectives, management actions, and desired future conditions in each site-specific management plan.

Figure 2: DNR Aquatic Reserves



Legal Authorities for Establishing State Aquatic Reserves

The constitutional authority for proprietary management of state-owned aquatic lands is derived from Articles XV and XVII of the Washington State Constitution. DNR is directed by state legislature in RCW 79.100 through 79.145 to manage the state-owned aquatic lands to provide a balance of public benefits that include encouraging public use and access, fostering water-dependent use, ensuring environmental protection, and utilizing renewable resources. In addition, DNR is directed to generate revenue from state-owned aquatic lands when consistent with the other legislatively directed public benefits.

RCW 79.105.030 identifies environmental protection, the overarching goal of the Aquatic Reserves Program, as one of the DNR's primary directives for the management of state-owned aquatic lands. RCW 79.10.210 further authorizes DNR, for the purpose of providing increased continuity in the management of public lands and of facilitating long-range planning by interested agencies, to identify and withdraw from all conflicting uses limited acreages of public lands. Withdrawn public lands are to be maintained for the benefit of the public as areas whose natural ecological systems can be observed studied, enjoyed, or otherwise utilized. 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(14) defines educational reserves as educationally important areas with aquatic lands typical of selected habitat types which are suitable for educational projects. WAC 332-30-106(64) defines scientific reserves as sites important for scientific research projects and/or areas of unusually rich plant and animal communities suitable for continuing scientific observation. 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.

III. Nisqually Reach Aquatic Reserve Boundary

The Nisqually Reach Aquatic Reserve encompasses approximately 14,826 acres of state-owned DNR managed tidelands and bedlands. The boundary of the reserve is delineated by a line running northeasterly from the northwestern shoreline boundary of Tolmie State Park to the outer boundary of the WDFW managed tidelands on the southwestern shoreline of McNeil Island. From this point the boundary follows a line eastward, connecting to a line running southeastward to the Fort Lewis shoreline south of the town of Steilacoom. The boundary then follows that shoreline southward (through Cormorant Passage) to the outer boundary of the Nisqually National Wildlife Refuge. The Reserve boundary parallels the Nisqually National Wildlife Refuge boundary westward, paralleling the Thurston County shoreline, and then back to the southeastern shoreline boundary of Tolmie State Park. The entire shorelines of both Anderson and Ketron Islands are encompassed within the boundaries of the Reserve (Figure 3).

Table 1: Miles of marine shoreline adjacent to the Reserve

Location	Shoreline Miles
Ketron Island	3.39
Eagle Is.	0.38
Anderson Island	18.03
South & east shore of Nisqually Reach	12.41
McNeil Island	4.74
Total	**38.95**

Legal Boundaries

For a complete legal description of the Nisqually Reach Aquatic Reserve boundaries please refer to Appendix C.

IV. Purpose of the Nisqually Reach Aquatic Reserve Management Plan

This plan describes the habitats, ecosystem features and associated species identified for conservation in the aquatic reserve and the actions that will be implemented to protect these resources. The plan also describes research goals for the aquatic reserve and identifies future research needs. In addition, the plan identifies the educational programs and practices that will be implemented within the Aquatic Reserve. The management emphasis will place protection of these resources, potential research and educational needs above other management actions.

The Nisqually Reach Aquatic Reserve Management Plan has been developed in accordance with the State Environmental Policy Act (SEPA). This plan will 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 will be reviewed and, if necessary, updated with current scientific, management, and site-specific information. During the development of each subsequent update, DNR will work with other jurisdictions, Tribes, interest groups, adjacent landowners, leaseholders, and local citizens to establish cooperative management for activities within and adjacent to the reserve—activities that promote conservation, research, education, enhancement and restoration of habitats and species within the reserve.

Decision making and planning regarding management of the aquatic reserve will be guided primarily by the following three sections of this plan, generally described here:

1. **Nisqually Reach Environmental, Scientific and Educational Aquatic Reserve:** This serves as an introduction to the site. Resource characteristics are identified and current ecological conditions are described for the site. Habitat and species conservation targets are identified and future impacts and data gaps are also identified in this section.

2. **Management Goals and Objectives**: This section identifies the desired future ecological conditions, research targets and educational needs. Goals and objectives are also identified that will aide in site management decision making.

3. **Management Actions**: This section describes various management actions to be taken that will allow the desired future ecological conditions, research and educational goals to be achieved.

   Opportunities for protection, enhancement, restoration, research and education will be identified. Monitoring of ecological conditions will be discussed. The conditions and considerations DNR will require in reviewing use authorizations for state-owned aquatic lands within and directly adjacent to the Aquatic Reserve will be established.

Adaptive Management

Adaptive management is a systematic process for continually improving site management by learning from the results of past management actions. To ensure that the future conditions of the aquatic reserve site are met and adaptive management is being implemented, the management plan will be reviewed and updated every 10 years throughout the 90-year term of the reserve designation. Adaptive management will help DNR integrate changes in scientific knowledge concerning the site, conditions of habitats and species, and existing uses of state-owned aquatic lands. Knowledge gained from research and monitoring activities also will 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. DNR will include new scientific findings in management plans, and new inclusions or adaptations will not be restricted to every 10 years.

V. Relationship to Federal, State, Local, and Tribal Management

This plan is promulgated under DNR's proprietary authority to manage state-owned aquatic lands. However, the successful management of the Nisqually Reach Aquatic Reserve will require coordination and collaboration with public and private entities as well as local, state, federal, and tribal governments, and non-government organizations. This section provides detail on proprietary, regulatory and management interests within or directly adjacent to the boundaries of the Nisqually Reach Aquatic Reserve.

Tribal Interests at Nisqually Reach

Tribes manage cultural and natural resources located on adjacent reservation lands, and those resources related to the right to fish and gather off-reservation at usual and accustomed places. DNR is obligated to conduct government-to-government consultations with all federally recognized Tribes, under the 1989 Centennial Accord, http://www.goia.wa.gov/Government-to-Government/Data/CentennialAccord.htm. In addition, pursuant to numerous court

rulings and Presidential Executive Orders, all federal agencies are required to consult with affected Indian Tribes in a government-to-government manner and ensure that impacts to tribal treaty rights are avoided and/or minimized and any unavoidable impacts are mitigated to the satisfaction of the affected tribal governments. DNR will continue to engage in a government-to-government dialog with the interested Tribes to help ensure this plan's conformance with treaty rights, and that tribal historical and cultural ties to the Nisqually Reach Aquatic Reserve area are maintained. DNR will work cooperatively with the Tribes to protect archaeological sites and allow access to cultural sites, access for treaty-protected fishing, hunting and gathering of resources in a manner that fosters the sustainability of those resources.

Conservation goals and management activities identified in this management plan are not intended to impair any reserved tribal treaty rights or be in conflict with tribal natural resource or cultural interests.

Tribes and the State of Washington have developed a cooperative framework which provides for fisheries management and habitat protection. This plan recognizes the policy statement developed by the Northwest Indian Fisheries Commission on behalf of member Northwest Tribes discussing the importance of considering the impacts conservation measures can have on tribal economics, subsistence and culture. Under this, Northwest Tribes highly recommend that the creation of any Marine Protected Area (local, state, federal or otherwise) such as an aquatic reserve not occur in the absence of any demonstrated need. In the face of such demonstrated need, Northwest Tribes do recognize that Marine Protected Areas may be useful tools for protecting or sustaining resources (Northwest Indian Fisheries Commission, 2011). In line with this policy, one of the primary goals of this management plan is to help demonstrate the need for protecting, sustaining, and restoring natural resources.

U.S. Coast Guard

The U.S. Coast Guard manages vessel activity to ensure the safety of vessels during transit and while in port, throughout Washington State's marine waters. The Coast Guard is also the lead response agency for spills in coastal waters and deepwater ports, responds to navigational hazards, other pollution, implements federal ballast water laws, and the discharge of onboard sewage in federal waters.

U.S. Army Corps of Engineers

Under Section 10 of the Rivers and Harbors Act, the U.S. Corps of Engineers (Corps) oversees any in-water construction in navigable waters. Additionally, the Corps has been delegated authority under the Clean Water Act for the issuance of Section 404 permits. The Corps supports navigation by maintaining and improving channels; develops projects to reduce flood damage, and regulates dredging and filling activities in wetlands and waterways including the construction of any structures such as bulkheads or piers. Like all federal agencies, the Corps must ensure that tribal trust resources are protected prior to taking any action that could potentially affect treaty-protected resources, including fishing and traditional cultural properties.

U.S. Environmental Protection Agency

The Environmental Protection Agency (EPA) is the lead federal response agency for oil spills occurring in inland waters, i.e. the Straits of Juan de Fuca and the Puget Sound, and jointly administers Section 404 of the Clean Water Act with the Corps of Engineers.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) is charged with protecting those species listed under the Endangered Species Act and the Migratory Bird Treaty Act and the habitats those species rely upon. The U.S. Fish and Wildlife Service also manage the National Refuge System, a federal program housed within the U.S. Department of the Interior. The Refuge System is charged with maintaining the biological integrity, diversity and environmental health of the natural resources under protection for the benefit of present and future generations of Americans. The Nisqually National Wildlife Refuge manages almost 3,000 acres of estuaries, tidal flats, freshwater marshes, riparian woodlands, forest lands and grasslands on the Nisqually Delta.

NOAA Fisheries

NOAA Fisheries is responsible for protection of marine and freshwater species under the Endangered Species Act and the Marine Mammal Protection Act. NOAA Fisheries also is responsible for consultation under the Magnuson-Stevens Fishery Conservation and Management Act.

Washington State Department of Health

The state Department of Health (DOH) regulates opening and closing of recreational and commercial shellfish zones and advises the public as to the healthy recreational harvest of shellfish.

Washington State Department of Ecology

The Washington State Department of Ecology (DOE) contributes to resource protection through the Spill Prevention, Preparedness and Response Program; Air Quality; Water Quality; Toxics Cleanup; Shorelands Assistance; Water Resources; Solid Waste (Industrial Section – permitting); Hazardous Waste and Toxic Reduction. DOE has a Spill Prevention, Preparedness and Response Program that focuses on prevention of oil spills to Washington waters and land, as well as planning for an effective response to any oil and hazardous substance spills that may occur. Vessel traffic in Washington State is tracked by DOE's spill program and published in Vessel Entries and Transits for Washington Reports. DOE reviews and must approve local Shoreline Master Programs and all plans for major substantial development permits involving construction in waters of the state.

DOE also works to maintain water and sediment quality standards, such that listing of waterbodies or segments as impaired under section 303(d) of the Clean Water Act is unnecessary. They are responsible for developing and approving National Pollutant Discharge Elimination System permits for industrial and municipal discharges. Nonpoint source pollution is managed through a variety of state and local programs; DOE has developed a nonpoint pollution plan that focuses on local land use activities. Finally, DOE issues water quality consistency certifications under Section 401 of the Clean Water Act, which help ensure compliance with the law's Anti-degradation Policy (DOE website, 2008).

Washington State Department of Fish and Wildlife

The Washington Department of Fish and Wildlife (WDFW) is responsible for preserving, protecting, and perpetuating all fish and shellfish resources of the State. To assist in achieving that goal, the State Legislature, in 1949 passed a state law now known as the "Hydraulic Code" (Chapter 77.55 RCW). The law requires that any person, organization, or government agency wishing to conduct any construction activity that will use, divert, obstruct, or change the bed or flow of State waters must do so under the terms of the Hydraulic Project Approval issued by WDFW. The purpose of the permit is to address any potential damage or loss of fish and shellfish habitat which is considered to result in direct loss of fish and shellfish production (WDFW website, 2008). WDFW also has authority over the management of commercial and recreational shellfish harvest and fisheries. Along with tribal governments, they co-manage commercial and recreational finfish and shellfish harvest, and with DNR and the Tribes, they co-manage the wild geoduck harvest. Additionally, WDFW plays an important role in oil spill response, ballast water monitoring, and Natural Resources Damage Assessments. Two units directly adjacent to the Aquatic Reserve are managed by WDFW, as part of the South Puget Sound Wildlife Area, a state program for acquiring key habitat areas for public ownership.

Washington State Parks and Recreation Commission

The State Parks and Recreation Commission plays a vital role in educating the public regarding appropriate recreation. According to its mission:

> "*The Washington State Parks and Recreation Commission acquire, operate, enhance and protect a diverse system of recreational, cultural, historical and natural sites. The Commission fosters outdoor recreation and education statewide to provide enjoyment and enrichment for all and a valued legacy to future generations.*"
> (Washington State Parks and Recreation, 2011).

The Washington State Park System includes over 100 developed parks including 20 marine parks.

Puget Sound Partnership

In 2007, the Legislature established the Puget Sound Partnership. The Partnership is charged with developing an action agenda to restore the environmental health of Puget Sound by the year 2020. In December 2008, the Partnership released the final Action Agenda. DNR is a member of the Ecosystem Coordination Board that advises the Partnership's Leadership Council. In 2011, the Puget Sound Partnership formally approved twenty "dashboard indicators", including twelve natural science measures. The natural science "dashboard indicators" for the long-term recovery of Puget Sound include; marine water quality, freshwater quality, water availability, salmon abundance, Pacific herring, birds, shoreline armoring, eelgrass, toxics in fish, toxics in sediment, and land use/land cover. The social science "dashboard indicators" include; commercial fisheries harvest, swimming beaches, shellfish beds re-opened and recreational permit sales. Many of these indicators are very applicable to South Puget Sound and the Reserve area.

Cities and Counties

Neighboring counties and municipalities are responsible for regulating upland and shoreline land uses, described in the previous section. The Comprehensive Land Use Management Plans and Shoreline Management Plans developed are key tools for managing land and shoreline use. Each municipality has valuable parks and recreational lands, Critical Areas, transportation networks, and other facilities. In addition, municipalities are responsible for the regulation of clearing, grading, and construction activities, identification and protection of Critical Areas, providing pollution control though their management of stormwater runoff and their regulation and inspection of onsite septic systems.

Local Land Use Designations

Shoreline Master Programs have been prepared as required by the Washington State Shoreline Management Act at various times by the two local county government jurisdictions fronting on greater Nisqually Reach: Thurston County most recently updated in 1990 and Pierce County most recently updated in 1988. All local governments in Pierce and Thurston Counties are required to update their Shoreline Master Programs by December 1st, 2011. As of the drafting of this document, the following shoreline environmental designations were being considered for various locations within or adjacent to the Nisqually Reach Aquatic Reserve boundary by local governments. This may not be the most current information available; the reader is encouraged to check with their local city/county.

From WAC 173-26-211 – Environmental Designation System:

Natural Environmental Designation - The purpose of the "natural" environment is to protect those shoreline areas that are relatively free of human influence or that include intact or minimally degraded shoreline functions intolerant of human use. These systems require that only very low intensity uses be allowed in order to maintain the ecological functions and ecosystem-wide processes.

Rural Conservancy Designation – The purpose of the "rural conservancy" environment is to protect ecological functions, conserve existing natural resources and valuable historic and cultural areas in order to provide for sustained resource use, achieve natural flood plain processes, and provide recreational opportunities.

Aquatic – The purpose of the “aquatic” environment is to protect, restore, and manage the unique characteristics and resources of the areas waterward of the ordinary high-water mark.

Urban Conservancy - The purpose of the "urban conservancy" environment is to protect and restore ecological functions of open space, flood plain and other sensitive lands where they exist in urban and developed settings, while allowing a variety of compatible uses.

High Intensity Environment –The purpose of the "high-intensity" environment is to provide for high-intensity water-oriented commercial, transportation, and industrial uses while protecting existing ecological functions and restoring ecological functions in areas that have been previously degraded.

Other classifications

Low Intensity Environment – Intent: The intent of the Low Intensity Environment is to accommodate residential development in areas that are already developed with or planned for residential uses. The Low Intensity Environment may also include water-oriented commercial and recreation uses.

Shoreline Residential Environment – The purpose of the shoreline residential environment is to accommodate residential development and appurtenant structures that are consistent with WAC 173-26-211. An additional purpose is to provide public access and recreational uses. This designation is currently not applied to any areas adjacent to or within the Aquatic Reserve boundaries, but is a possible designation for waterfront – based residential areas, and may be applied in the future. Compared to some of the listed classifications above, this designation may be more permissive with the use of private property.

Thurston County

Thurston County is in Phase 3 of their Shoreline Master Program update, and has preliminarily designated two classifications for the shorelines adjacent to the Nisqually Reach Aquatic Reserve in Thurston County: *Natural* or *Rural Conservancy*. The descriptions below include rationale for the preliminary designations of each designation adjacent to the reserve in Thurston County.

Thurston County includes those areas north of Butterball Cove, and to the south of the Beachcrest mini-marina, including the Beachcrest subdivision and the rest of the area south extending into the Nisqually Wildlife Refuge. A small cove just south of Sandy Point at Tolmie State Park, Hogum Bay, the area south of Luhr Beach east to the Thurston–Pierce County line bisecting the Nisqually River, are proposed for the designation *Natural* – these are all government lands administered by the WDFW or the Nisqually National Wildlife Refuge. The remaining shoreline surrounding the Aquatic Reserve boundary (see Figure B-21 in Appendix B, Maps) is proposed for the designation *Rural Conservancy*. Aquatic lands falling within the boundaries of the Nisqually Reserve are proposed as *Aquatic* (Thurston County, pers. comm. 2011).

City of Lacey

The City of Lacey is also updating its Shoreline Master Program which is currently under review by the DOE (City of Lacey, 2010). The marine habitat in Lacey runs from the Butterball Cove area to Mallard Cove. Much of this area is designated as critical saltwater habitat, consisting of embayment habitat, eelgrass beds, fish spawning habitat and feeder bluffs, Appendix B). Excepting out the existing marina, on Mallard Cove, area landward of the Ordinary High Water Mark, associated wetlands, and embayment habitats have been designated as *Natural*. The site immediately surrounding the marina is designated *Conservancy*. Area water ward of the ordinary high water mark is designated as *Aquatic*.

Butterball Cove and Jubilee Beach area are targeted for the *Natural Designation*. This area contains shoreline of state wide significance, a low level of alteration, and several key habitats. Only the upland area is zoned for *residential use*. The riparian areas and embayment habitat area remain intact.

Mallard Cove, Beachcrest marina and Beachcrest Community are targeted for the Urban Conservancy designation. This area has experienced a moderate level of

alteration but retains several key substrate types and habitat areas. It contains a shoreline of state-wide significance and is currently zoned for *Low Density Residential Development*. The pocket estuary has been partially modified and the shoreline at the base of a steep slope is altered (Thurston County Regional Planning Council, 2009).

Portions of the Beachcrest Marina fall outside of the City of Lacey's jurisdiction into Thurston County and are managed under the County's Shoreline Management Program, (Burns, D. personal communication 3-Feb-11). See Thurston County (above). The City of Lacey's Shoreline Master Program has a policy that requires restoration of degraded shoreline areas as new development or re-development occurs (Burns, D., Principal Planner, City of Lacey, pers. comm. 2011).

Pierce County

Pierce County is also updating its Shoreline Master Program and is in the process of conducting inventories of current shoreline uses, locations of critical areas and public participation information that will determine new shoreline environment designations. The Pierce County Shoreline Master Program applies to unincorporated lands and small cities throughout the county, including Anderson, Ketron and McNeil Islands.

The shoreline environmental designations proposed for the islands involves a mix of Natural and Conservancy, with focused areas for Low Intensity and selected sites targeted for High Intensity Maritime.

On the mainland (not including any islands) from University Place to the Nisqually Wildlife refuge, the portions of shoreline within unincorporated Pierce County are relatively small, as the vast majority of Pierce County shorelines are managed by University Place, Steilacoom, Joint Base Lewis-McChord, and DuPont municipalities.

Within unincorporated Pierce County, there is a small section located within the Nisqually delta (and includes a portion of the Nisqually Wildlife Refuge) which has been proposed for a Conservancy Shoreline Environment designation.

Anderson Island

Anderson Island is the largest island encompassed by the aquatic reserve, at 7.75 sq. miles and 4,960 acres in size. The shorelines exhibit relatively low density residential development with the exception of a few focused areas. Private tidelands are prevalent along the shores of Amsterdam Bay, Thompson Cove and Oro Bay. North of Oro Bay, on either side of Sandy Point, several large privately owned shoreline parcels are protected from development, (including shoreline armoring) by conservation easements. Continuing northward along the eastern shoreline, much of the high bluff backshore area is included in a greenbelt easement that is adjacent to publicly owned tidelands. Additionally, on the west side of the island, a fairly long stretch of public tidelands extends northwestward from Thompson Cove to Treble Point. Carlson Bay is within this shoreline reach and is almost completely contained within Andrew Anderson Marine Park (Andy's Marine Park). Andy's Marine Park and St. Anne's Park, to the southeast along the same reach, are owned and operated by Anderson Island Park District. St. Anne's Park features 1200 feet of pristine high-bluff waterfront. The Anderson Island Park District and local citizen groups continue to identify critical parcels of shoreline that protect unique habitat areas, maintain

connectivity to essential upland habitat areas, and allow public access to the Aquatic Reserve. Recently, in 2011, the Park District was awarded two Grants to purchase Jacob's Point, on a peninsula in Oro Bay; this property includes over 4,900 feet of pristine beach frontage.

City of DuPont

The City of DuPont encompasses approximately 3.54 miles of shoreline and maintains a greenbelt along the entire length of their jurisdiction (City of DuPont, 2011). As part of the process of updating its Shoreline Management Plan, the City is assigning all areas water ward of the ordinary high water mark as *Aquatic*, with the exception of those subtidal lands included in the Tatsolo Point Special Management Unit. The *Conservancy* designation is assigned to all upland areas of the City's shoreline outside of the Tatsolo Point Special Management Unit environment. The Tatsolo Point Special Management Unit designation is assigned to a 750-foot length of shoreline with the purpose of ensuring that shoreline resources and the Shoreline of Statewide Significance, (associated with the Nisqually Delta) are protected. The purpose of this area is also to provide secure access to Puget Sound for appropriate water-dependent uses and water-related passive recreational uses and activities. The City of DuPont SMP's policies for this designation state that water dependent uses should be limited to those uses associated with public transportation or with sand and gravel barge transshipment. In general, the policies for the Tatsolo Point Special Management Unit are compatible with the Aquatic Reserve's goals and objectives, and address issues such as, limiting water-dependent uses to public transportation and sand and gravel transshipment, minimization of impact to the natural and human environment, no net loss of ecological functions, alteration of natural hydrographic conditions, and water quality (Section 4.2.3 TPSU, City of DuPont SMP, Draft, March 2011).

Adjacent land uses include the Burlington Northern Sante Fe Railway (BNSF), a former DuPont industrial munitions facility (now a golf course), the Fort Lewis landfill, and a gravel mine. The gravel mine is inland from the bluffs extending several hundred feet parallel to but out-of-sight from the shoreline. An associated barge loading facility to transport materials from the upland mine was constructed after the designation of the Tatsolo Point Special Management Unit.

Sequlitchew Creek is located just upstream of the BNSF Railway berm that parallels the Puget Sound shoreline south of the current gravel pit loading facility. An estuarine wetland known as Brackish Marsh is on the downstream end, and managed as part of the marine shoreline by the City of DuPont. This wetland is connected to the Sound by a culvert under the railroad track, enabling occasional inundation of marine waters at OHT. Adult salmon have been observed in the creek, but the culvert is considered a fish barrier. The City of DuPont is working to preserve and enhance these habitat features (City of DuPont Draft SMP, January 2011).

The BNSF Railway main line railroad runs along an embankment from the mouth of Red Salmon Creek, located on the eastern edge of the Nisqually delta, to Solo Point. Portions of the City of DuPont and adjacent areas to the south drain into Red Salmon Creek through two culverts (Nisqually River Basin Plan, Pierce County Public Works and Utilities 2008; City of DuPont Comprehensive Plan, 2001).

Fort Lewis Military Reservation

Fort Lewis shorelines are similarly undeveloped with the exception of a small recreational access site at Solo Point and a sewage treatment plant outfall (Figure B-16, Appendix B). Tidelands are publicly owned along Fort Lewis shorelines but access to the public is restricted or requires permission to prevent interruption of military training exercises.

Ketron Island

Ketron Island lies between the mainland near the city of Steilacoom and Anderson Island near the extreme south end of Puget Sound. The island has a land area of 220.67 acres and had a population of 24 persons as of the 2000 census. Approximately one third of the shoreline of Ketron Island consists of tidelands owned by Pierce County (most of the western shore) with the remaining shorelines in private ownership.

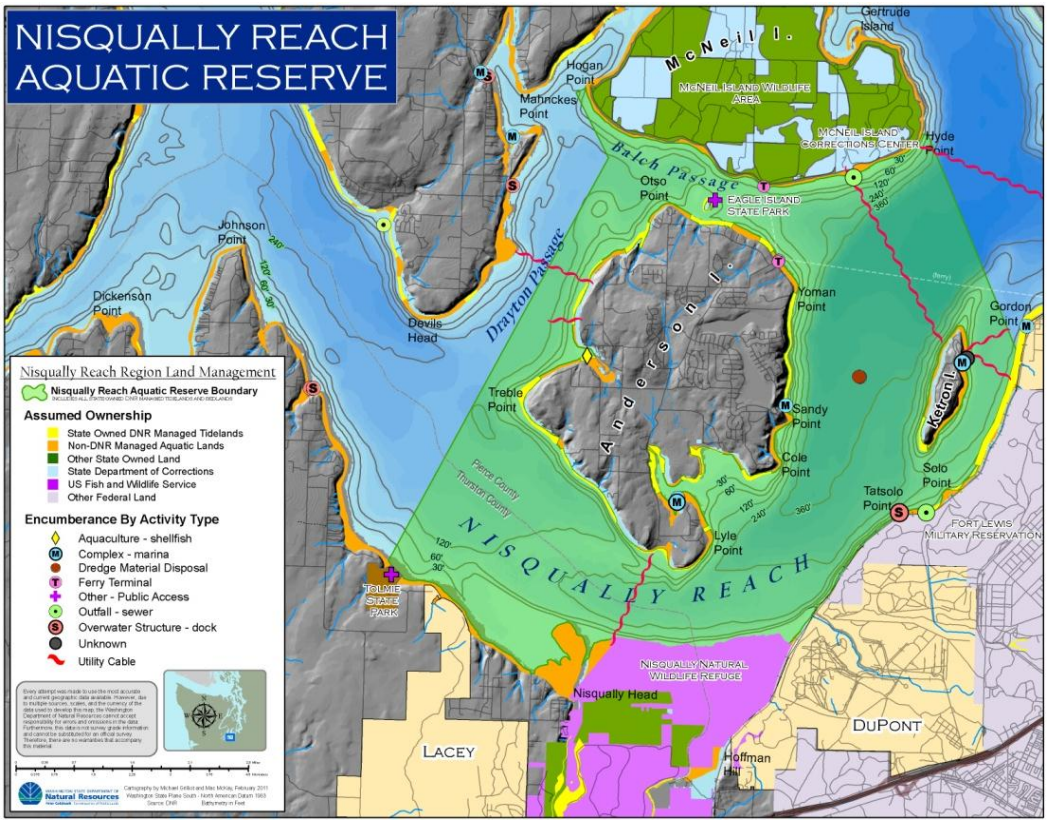
VI. Nisqually Reach Area Ownership

While all lands within the aquatic reserve are managed by DNR, adjacent public and private lands will interact with the species and habitats found within the aquatic reserves. This section identifies ownership of lands adjacent to the aquatic reserve.

Summary of Ownership

Numerous private tideland parcels exist adjacent to the aquatic reserve. The private tideland parcels are interspersed with publicly owned tidelands creating a patchwork of tideland ownership throughout the reserve area (Figure 3). The total acreage of private and public tideland parcels adjacent to the reserve is approximately 2496 acres. WDFW manages the majority of the public tidelands along the southern shoreline of McNeil Island and manages a tideland parcels adjoining to the Nisqually National Wildlife Refuge. Washington State Parks manages the tidelands at Tolmie State Park and Eagle Island State Park. The Department of Corrections currently manages several tideland parcels directly adjacent to the southeastern most McNeil Island Correctional Facility parcel. Federal tideland ownerships makes up the largest portion of the non-DNR managed tidelands adjacent to the reserve. The Nisqually National Wildlife Refuge manages the majority of the tidelands directly abutting the southernmost boundary of the Nisqually Reach Aquatic Reserve. The largest private tideland parcel includes Nisqually Tribal lands on the eastern side of the Nisqually River delta and the Nisqually River.

Figure 3: Nisqually Reach General Ownership and Encumbrance Type



The Nisqually National Wildlife Refuge

The Nisqually National Wildlife Refuge is located at the confluence of the Nisqually River and the Nisqually Reach of Puget Sound, creating the Nisqually River Delta. Because of its regional and national significance, the Nisqually Delta has been designated as a National Natural Landmark.

The Refuge supports more than 275 bird species that use the refuge for migration, resting and foraging, wintering-over, or breeding. The refuge provides rearing and migratory habitat for Chinook, steelhead trout and several salmon species, as well as habitat for a variety of threatened and endangered species (U.S. Fish and Wildlife Service Website, Nisqually National Wildlife Refuge, 2010).

The Nisqually National Wildlife Refuge is working to restore the Nisqually estuary, the largest estuary restoration project of its kind in the Pacific Northwest. The Refuge has been assisted by two key partners, the Nisqually Indian Tribe and Ducks Unlimited, to restore much of the historic estuary and reconnect it with the tides of Puget Sound. In 2009, the Refuge and its key partners completed tidal restoration of more than 762 acres of estuarine habitat on the west side of the Nisqually River, fulfilling a priority goal in the recently completed USFWS Comprehensive Conservation Plan for restoration of Puget Sound estuarine habitat. This tidal restoration complements the conversion of approximately 140 acres of previously diked pasture on the east side of the river undertaken by the Nisqually Tribe in 2002 (Nisqually Delta Restoration Partnership Website, 2010).

Joint Base Lewis-McChord

Joint Base Lewis-McChord is one of the largest and most modern military reservations in the United States. The base has more than 44,000 soldiers, airmen and civilian workers. The post supports 120,000(+) retirees and more than 47,000 family members living both on and off post. Joint Base Lewis-McChord consists of 86,000 acres of varied terrain and habitat areas that includes approximately 19,000 feet of marine shoreline adjacent to the Nisqually Reach Aquatic Reserve, (Joint Base Lewis-McChord Air Force Base website, 2010).

Washington State Parks and Recreation Commission

Washington State Parks manages two state parks adjacent to the aquatic reserve, Tolmie State Park, which delineates the westernmost boundary of the reserve, and Eagle Island State Park, in Balch passage, near the northern boundary of the reserve. Tolmie State Park is a 105-acre marine day-use park with 1,800 feet of saltwater shoreline. This shore side park is on the southwest boundary of the Aquatic Reserve. The park offers a variety of beachside and aquatic activities including an underwater park built by scuba divers. Eagle Island is a 10-acre marine park with 2,600 feet of saltwater shoreline. The island is located in Balch Passage between McNeil Island and Anderson Island in South Puget Sound.

The island shoals and tidal flats of these parks provide marine mammal haul-out areas, preserve ecologically healthy shorelands, conserve ecosystem connectivity, and provide public access for recreational uses and environmental education.

Washington State Department of Fish and Wildlife

Two adjacent properties are Wildlife Area Units managed by WDFW, as part of the South Puget Sound Wildlife Area (WDFW 2006). The South Puget Sound Wildlife Area Complex is made up of multiple parcels of land owned and maintained by WDFW, including properties on McNeil Island and surrounding the Nisqually National Wildlife Refuge. Management goals for the South Puget Sound Wildlife Areas are to preserve habitat and species diversity for both fish and wildlife resources, maintain healthy populations of game and non-game species, protect and restore native plant communities, and provide diverse opportunities for the public to encounter, utilize, and appreciate wildlife and wild areas.

McNeil Island Unit

The McNeil Island Unit includes McNeil, Gertrude and Pitt Islands (3,119 acres), acquired in 1984 through a USA transfer, and is adjacent to the “moth-balled” state correctional center and the Department of Social and Health Services Civil Commitment Center, which is slated to close down. Along with the other prescribed goals of the South Puget Sound Wildlife Area Complex, the focus of Gertrude and Pitt Islands are to conserve habitat for the largest harbor seal rookery in South Puget Sound. Only McNeil Island is directly shoreward of the aquatic reserve.
The remoteness of this Unit provides a safe haven for many species due to limited access. These islands also provide habitat for a Great Blue Heron rookery, Bald Eagle nests and haul-out sites for marine mammals, especially harbor seals, all federally protected species (WDFW 2006).

Nisqually Unit

The Nisqually Unit consists of multiple parcels totaling 648 acres near the confluence of the Nisqually River, McAllister Creek and Puget Sound and adjacent to the Nisqually National Wildlife Refuge. The property was purchased for outdoor recreation including public hunting, fishing, sightseeing, photography, nature study and boating. Habitat areas include sandy tidal flats, emergent salt marsh, riparian vegetated areas, open fields, and forested areas (WDFW 2011) (See Figure 3).

Marine Protected Areas

Aquatic Reserves are recognized marine protected areas. The Nisqually Reach Aquatic Reserve is surrounded by other types of state and federal designated Marine Protected Areas (Personal Communication, LeClair, L. WDFW 2011). According to the 2009 inventory by WDFW (Van Cleve et. al. 2009) for Marine Protected Areas in Washington State, the following locations are designated Marine Protected Areas adjacent to or near the Reserve:

Table 2: State/Federal Marine Protected Areas Near or Within the Reserve

Agency	**United States Fish and Wildlife Service**	**Washington State Parks and Recreation Commission**	
Marine Protected Area	Nisqually National Wildlife Refuge	Tolmie State Park/Underwater Park	McNeil Island Wildlife Area
Description/ Date designation	58,161 feet of shoreline designated in 1974	25.02 acres and 1,800 ft of shoreline designated in 1962	56, 341 feet of shoreline designated in 1984

Source: Van Cleve et. al. 2009. Washington Department of Fish and Wildlife, Marine Protected Areas in Washington, December 2009. Recommendations of the Marine Protected Areas Work Group to the Washington State Legislature.

3. Nisqually Reach Aquatic Reserve

I. Site Characterization

The following section provides an overview of the environmental and natural resource characteristics for the Nisqually Reach Aquatic Reserve and the adjacent areas. Physical and biological characteristics within or adjacent to the reserve, including physical processes, habitat, species, water and sediment quality are summarized in the following section. Understanding the processes, functions, and components of the biological communities present in the Nisqually Reach region will help guide decisions regarding aquatic land management that influence the reserve and its associated ecological relationships.

Influenced by the substantial tidal exchange of South Puget Sound waters, the Nisqually Reach and River dominate the morphology, processes, and habitat types found in the southern region of the aquatic reserve. The Nisqually River and smaller drainages support acres of tidally influenced salt and brackish marsh areas, with adjacent riparian habitats that provide refuge and nesting areas for migratory marine birds, shorebirds, waterfowl, and raptors. The extensive marsh lands and tidal flats common throughout the Reach adjoin to productive open water habitat area that includes deep water passages, bordered by long reaches of gravelly beaches, and shallow embayment areas. Wave energy is not the primary shaping force in this southerly region of the reserve, however significant tidal currents exist in some nearshore and deep water areas of the Reach. These currents often expose hard substrates, produce unique sediment dynamics and formations, and enable distinctive habitat features and biological assemblages to develop.

Adjacent human land uses include residential, recreational, agricultural, transportation and limited commercial uses. Natural resource extraction, including gravel mining, shellfish cultivation and harvest, commercial and recreational fishing, hunting, limited upland forestry, and most importantly to this effort, conservation lands, all exists within or directly adjacent to the aquatic reserve area.

The Nisqually Reach Aquatic Reserve is surrounded by land managed by local, state and federal agencies, private companies and organizations, and Tribal governments, many of whom are interested in explicitly managing properties for resource protection, or conservation.

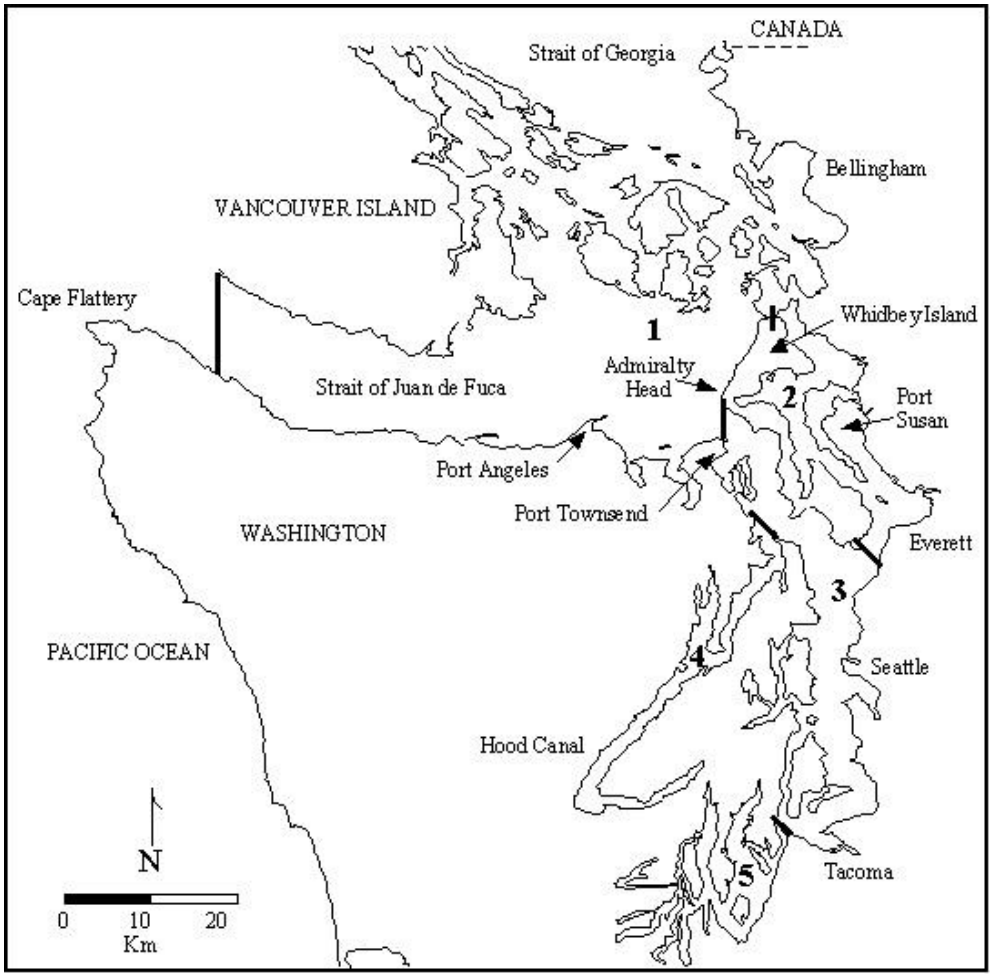
Geographic Description

The Nisqually Reach Aquatic Reserve is part of the Puget Trough section of the Willamette Valley-Puget Trough Ecoregion. The Puget Trough is a depression formed by the uplifting of the Cascade and Coast Range mountains, then further scoured by

repeated glaciation. During these glacial episodes of advance and retreat, the characteristic glacial “drift” plain made of gravels, sand, silt, clays, (“wash”) and tills were created filling most of the Puget Sound lowlands (White 1997). The last glacier receded about 14,000 years ago, leaving valleys flooded with melting sea water, putting the finishing touches on Puget Sound’s major basins and smaller inlets (Burg 1984). McNeil, Anderson, Ketron and numerous other islands were shaped by this event, molding the surrounding terrain into a convoluted environment that promotes dynamic oceanographic processes.

The Reserve is located within the Southern Puget Sound basin (Figure 64). This basin includes all waterways south of the Tacoma Narrows and is characterized by numerous islands, peninsulas and shallow inlets (under 20 meters deep). The tidelands along the relatively pristine southern shore of McNeil Island form the northern boundary of the Aquatic Reserve. Balch Passage, Drayton Passage and the Nisqually Reach surround the forested shores and pristine bluffs of Anderson, Ketron, and Eagle Islands. Although the islands are within the bounds of the Reserve, only the adjacent state-owned Aquatic Lands (no uplands) are included in the Nisqually Reach Aquatic Reserve. Southward, along the eastern shore of the Reach, almost five miles of armored shoreline from BNSF Railway, has cut-off the physical connection between the uplands and the Sound. The wide delta at the mouth of the Nisqually River expands the shoreline to the west across an extensive complex estuary formed by both the River and outlet of McAllister Creek. These varied tidal flats and marsh lands are part of the Nisqually National Wildlife Refuge, and the adjoining wetlands of the Nisqually Tribe and WDFW refuge lands. The northern extent of these intertidal flats at extreme low water (approximately - 4.5 MLLW) is the boundary of the bedlands of the Aquatic Reserve. Continuing westward, the broad Nisqually Flats contain areas of commercial aquaculture and public access sites. Along the length of the shoreline, natural unperturbed beaches and bluffs are intermittently disrupted by residential bulkheads persisting with this contrasting pattern up to Tolmie State Park. The total acreage of the Aquatic Reserve incorporates 14,736.5 acres.

Figure 4: Regional water masses and subareas of Puget Sound: 1) Northern Puget Sound, 2) Whidbey Basin, 3) Main Basin, 4) Hood Canal, and 5) Southern Puget Sound. From Gustafson, et al (2000)



Ecosystem Description

The Nisqually Reach Aquatic Reserve delta region is an estuarine area that exhibits a wide-range of unique physical features, processes, habitats and associated biodiversity. The abundant and productive waters, especially between the Nisqually Flats and Anderson Island, are primary habitat for breeding, foraging and winter refuge for a diverse suite of species. The beaches, tidal flats, and marshes of the Nisqually Reach and delta provide a food source for a plethora of organisms from invertebrates to fishes, marine mammal species and numerous birds. Vegetated nearshore areas are dominated by extensive emergent salt marsh, as well as, eelgrass beds, kelp and other macroalgae. These areas provide critical refuge, spawning, nursery and foraging habitat for juvenile salmonids, rockfish, crabs, and various other marine oriented species. Juvenile Chinook and chum salmon develop in the estuarine waters near the delta and migrate along the shorelines of Anderson Island and the Reach utilizing the small “embayments” (pocket estuaries) (Figure B-4, Appendix B) still common in the region (Ellings 2007). Deepwater habitats support staging, refuge and feeding grounds for forage fish, as well as, providing these

functions for many other marine fishes while supporting numerous invertebrates and birds.

Nisqually Reach, McNeil, Anderson and Ketron Islands and adjacent marine habitat was identified as a high priority biological diversity area by the Nature Conservancy Puget Trough/Georgia Basin Ecoregional Plan (Floberg et. al. 2004). These conservation areas are featured to direct strategies to conserve the biological integrity of the site. This designation is underscored in the DNR Marine Priority Habitats approach that promotes preservation of state-owned aquatic lands that provide significant benefits to native aquatic ecosystems. The Nisqually region is particularly identified as having high habitat value and features including the prominent fluvial influences on vegetated estuarine, intertidal and shallow subtidal areas with high biological diversity, important biological and physiochemical processes, and vulnerable habitats and life stages for populations and species of special concern.

The following sections describe the ecosystem processes, habitats, and species that are found within the Aquatic Reserve boundaries, creating the Nisqually Aquatic Reserve.

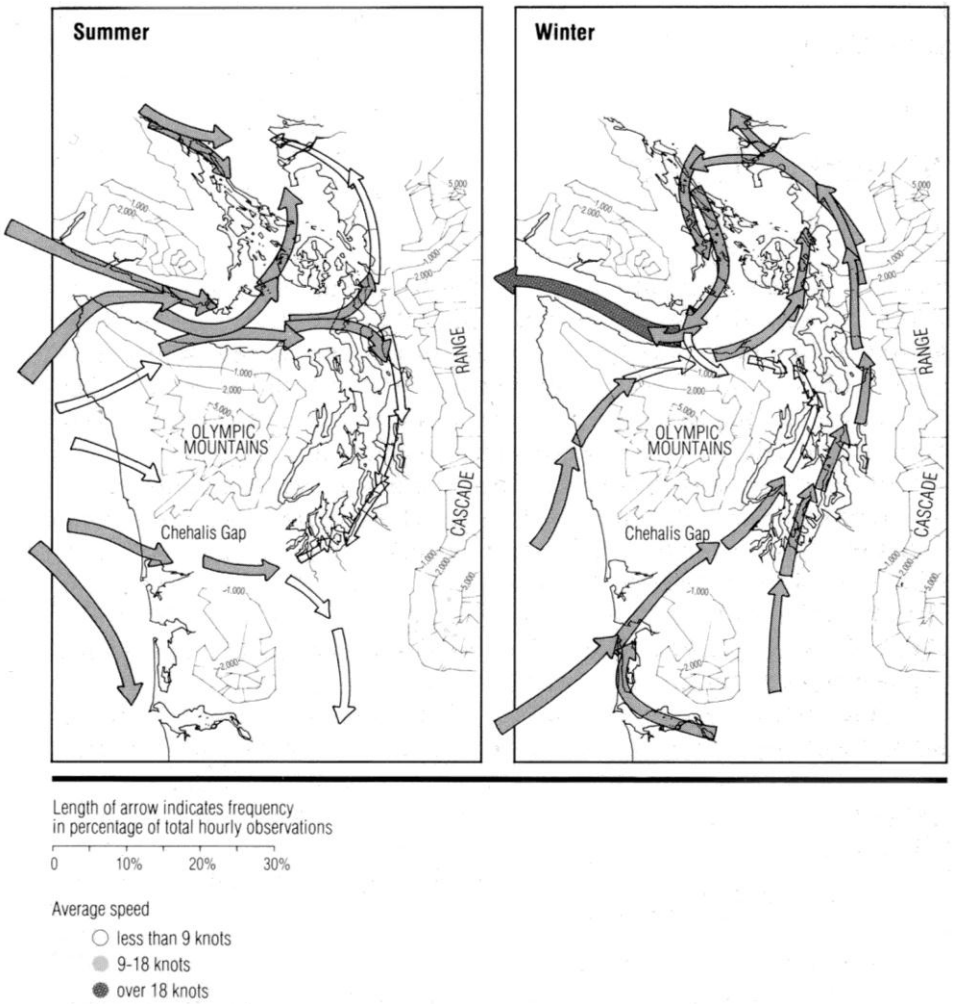
Physical Processes

Physical processes most relevant to the region, and in particular, to the Nisqually Reach Aquatic Reserve include broad scale processes such as, geological, glacial, climatic, and oceanographic; plus more local processes include wave, tidal and current forces, fluvial and deltaic processes, and sediment dynamics (movement, erosion, and deposition).

Located in the southern portion of the Puget Sound ("South Sound", Figure 5), the aquatic reserve area experiences a mid-latitude maritime west coast or modified Mediterranean climate, characterized by cool, wet winters and warm, dry summers (Downing, 1983). The Pacific Ocean acts as a temperature moderator while changing pressure systems determine the overall wind direction (Figure 6). Air temperatures rarely reach into the 90° (^{o}F) or fall into the teens in the region. The maritime areas of Pierce and Thurston counties experience similar marine-type South Puget Sound climates, with typical late summer afternoon temperatures between the low 70°s to low 80°F, and average winter temperatures in the mid 40°s. This region also experiences relatively wet winters with rainfall spread out over a large number of days, providing an average of 52 clear days out of every 365 (Thurston County Planning Commission, November 2010; Pierce County, 2010).

The Olympic Mountains intercept large amounts of wind coming off the Pacific Ocean and deflecting them north through the Straits of Juan de Fuca and south through the Chahalis Gap. The proximity of the Nisqually Reach Aquatic Reserves places it in the path of regularly occurring southwesterly winds and storms throughout the winter months. The summer seasonal pattern for this area is generally lighter winds with infrequent storms from the South and the occasional influence of winds coming down the Puget Sound trough from the north. Seasonal wind patterns can be viewed in Figure 5.

Figure 5: Seasonal Patterns of winds over western Washington. From



Repeated glaciations, the last retreating about 12,000 years ago, have shaped the Puget Sound lowlands. Glacial and meltwater scouring has sculpted Puget Sound and created a number of basins connected by sills and ridges constricting water flow from one basin to the next. Southern Puget Sound basin is constricted by the sill at the Tacoma Narrows and is characterized by numerous islands, peninsulas, a few deeper water passages leading south to the Nisqually Reach and shallower inlets. The islands are glacial till deposits with overlying outwash gravels deposited and then scoured along with the entire surrounding region, creating a complex environment that promotes vigorous oceanographic processes (Burns, 1990).

Oceanographic Processes

Tides and Currents

The region experiences a semi-diurnal tidal cycle. Based upon tidal cycles at the river delta mouth, the mean higher high water (MHHW) level in the Nisqually Reach is 13.5 feet, with the maximum yearly tide at 18.7 feet. Tidal influence extends upstream of the Nisqually River to about river mile 3.3. The more extreme tidal cycles occur twice monthly, with the most extreme lowest tides happening during the spring and summer months (-3.5 feet MLLW) (USFWS, 2005) and an infrequent

occurrence of extreme low water, estimated at -4.5 MLLW, over a 19-year tidal cycle.

In most of the South Sound, the tides are the strongest force, due largely to the shallowness of the region. Currents tend to be stronger in narrow channels (Burns 1985). For example, tidal currents increase significantly between the Reach and Anderson Island, as it narrows in configuration. The river delta and Reach function as the primary portal to the shallower waters of southern Puget Sound. This function also diminishes egress from the area, as a result the Nisqually Reach water is replaced every 8 days and this is considered well flushed for this basin (ENSR 1999).

Salinity, Dissolved Oxygen, Temperature

Monthly seasonal patterns are measured using temperature, salinity, and water density. In South Puget Sound water temperatures are generally warmest in September and coolest in February. Salinity and water density are most strongly influenced by the freshwater inflow from the Nisqually River during winter and spring from precipitation and snowmelt. Variations in salinity are greatest in the surface waters and at stations closest to river mouth (Moore et al. 2008). The freshwater is less dense and resistant to mixing, often resulting in vertical stratification of the water column. The degree of stratification is site specific and seasonally dependent.

In the South Sound area, salinities generally range from 22-29 practical salinity units, and, although surface temperatures reach 14-15°C in summer, the temperatures of subsurface waters generally range from 10-13°C in summer and 8-10°C in winter (WDOE 1999).

Marine water quality data is collected through the Puget Sound Ambient Monitoring Program. The Puget Sound Ambient Monitoring Program has established monitoring stations off of Key Peninsula South and along the Anderson Island-Steilacoom ferry line. Long term monitoring data from 2008 is consistent with these ranges (PSAMP Marine Water Quality Data, 2008).

Nearshore Physical Processes

The physical processes within and adjacent to the reserve include but are not limited to:

- Fluvial energy including freshwater input, and movement of material and nutrients
- tidal fluctuations (energy) and currents
- wave and wind energy
- feeder bluffs (eroding bluffs), and other sediment inputs
- littoral and net shore drift

Most of these processes are dynamic and fluctuate throughout the seasons. Shorelines throughout the reserve have variable levels of modification which may disrupt some of natural processes, such as sediment input and movement, freshwater seepage patterns, and wave energy. These processes are critical for maintaining nearshore morphology, function and health.

Littoral Transport/Drift Cells and Feeder Bluffs

The general pattern of littoral transport in the region largely reflects the shore orientation relative to the predominant wind and wave conditions. Shores exposed to the south typically have northward net shore-drift, due to predominant southerly winds. Generally, no appreciable net shore-drift occurs in enclosed shorelines such as the inner shores of lagoons and small embayments (Shipman 2007). The prevailing southwest winds hit the southwest side of Anderson Island and Ketron Islands and make most of the drift cells move northward. While on the northeast side of the islands, which are exposed to more fetch and wave energy during northerly winter storms, the net-shore drift is to the south. The locations around the Islands (Anderson, Ketron, and McNeil), with undeveloped backshore and bluffs, allow drift cells to function naturally – moving sediment and detritus from a source and allowing sediment input to continue along the zone of transport, and end up in deposition (terminus) (Johannessen and MacLennan 2007). Littoral drift functions appear uninterrupted along Hogum Bay, to the River Delta (See Figure B-3, See Appendix B).

These littoral drift cells have been located and mapped throughout the Puget Sound. The reserve area map is included as Figure B-3 Appendix B.

Deltaic Processes

As with most of the larger river systems in the Puget Sound area, the most prominent component of the Nisqually River delta is the large, relatively flat deltaic plain. Fluvial sediments deposited at the coastline continue to contribute to the broad, low-lying, marine extension of the alluvial floodplain. The River provides the majority of the freshwater to the estuary with loads of fluvial sediment washed around by the intermingling tidal flows. Two daily high and low tides distribute the turbid river waters to backshore, foreshore and alongshore areas forming the prominent deltaic lobe and flats that exist today. The delta is also associated with several streams, including multiple distributary channels and a variety of tidal channels and sloughs within the upper portions of the delta plain. This delta complex has subsumed the waters, rich nutrients, and sediment flow of Red Salmon Creek and McAllister Creek forming more extensive sand and mudflats and allowing for broad areas of healthy emergent salt marsh habitat.

Salinity profiles were sampled in 1977 in the Nisqually Reach during low slack water and flood tide (ENSR 1999). Freshwater in this area flows over the marine water in a very thin layer, estimated at 3 to 5 cm (centimeters). Salinity measurements varied from 0 to 30 parts per thousand, with the most stratified conditions occurring near the Nisqually mudflats. Saltwater tidal influence has been observed from the mouth of Nisqually River to the bridge on old US Hwy 99 (at river miles 0.0-3.3).

The construction of two dams on the Nisqually River near Elbe reduced the amount of sediment carried to the delta, which may have altered the equilibrium between erosion and deposition toward erosion and recession. The river discharges about 105,000 tons of sediment annually, nearly all of which is currently deposited in Alder Lake (Nelson 1974; USFWS 2005). However, a well-defined 20- to 40-m-thick deposit of delta sediment (some historic sediment) has accumulated on the bottom along the southern (outside) portion of a narrow (1.5 km) bend in Nisqually Reach that experiences strong (>2 knots) ebb and flood diurnal tides. The surface of the deposit

has been molded into large sinuous-crested, asymmetrical bedforms (50 to 100 m wavelengths; 3 to 6 m wave heights) (USGS 2001).

Habitat Elements

The habitat characteristics and associated communities in the reserve area are influenced by the complex suite of physical, chemical and biological interactions with the structure of shorelines, intertidal areas, and benthic substratum. The unique tidal and fluvial regime processes, and resources, along with areas of minimal development, provide the sustenance for productive habitat areas. The Reserve area provides varied and complex habitat areas, supporting a high level of biodiversity and species richness.

High habitat value includes:

- Nursery and feeding areas for migrating, breeding, nesting, and foraging birds, fish and marine mammals, including essential habitat types for juvenile salmon, such as, small embayment habitat areas.
- Nutrient rich and diverse shallow, deep, and open water habitat.
- Stretches of minimally disturbed beaches, and bluffs with intact riparian vegetation.
- Unique oceanographic, tectonic and geomorphic conditions, *e.g.*, high current energy in a complex deltaic regime with an active fault zone creating dynamic features, such as, 15m tall benthic sand waves and exposed deep-water hard bottom habitat areas.

The dominant influence in the southern portion of the aquatic reserve is the Nisqually River estuary which is one of the most extensive and productive estuaries in Puget Sound, (Armstrong and Copping 1990). The estuary includes extensive flats, unconsolidated beaches, vegetated intertidal areas, submerged aquatic beds, and open water habitat. The diverse emergent marsh lands of the Nisqually National Wildlife Refuge sustain an abundance of migratory and resident waterbird, shorebirds, raptors, and many other plants and animals that depend on the adjacent waters and habitat areas for specific different life.

Monitoring key indicators of nearshore marine habitat include but are not limited to:

- eelgrass
- abundance of other marine vegetation, including macroalgae and emergent salt marsh vegetation
- invertebrates, such as, shellfish
- different groups of fish, including forage fish spawning habitat
- seabirds, marine mammals
- unique substrate types and geomorphic conditions

Indicators provide information and documentation of ecosystem health. The Puget Sound Partnership has adopted eelgrass and the reopening of shellfish beds as the first two “dashboard indicators” of nearshore health. The approved target for eelgrass recovery in Puget Sound is a 20% increase in eelgrass over baseline by 2020. For shellfish beds, the approved target is a net increase from 2007 to 2020 of 10,800

harvestable shellfish acres, including 7,000 acres where harvest is currently prohibited (PSP 2011).

DNR will support the first target through its Submerged Vegetation Monitoring Program, which tracks status and trends in eelgrass throughout Puget Sound. The Submerged Vegetation Monitoring Program reports that eelgrass grows in intertidal and shallow subtidal areas and in the South Sound Region eelgrass is more sparsely distributed than eelgrass beds in other parts of the Sound (Jeff Gaeckle, pers. comm. DNR 2010).

Intertidal Habitats

The general shore types found throughout this region include bluff-backed beaches, depositional beaches, deltaic shores, and spits associated with protected lagoons and salt marshes. The most prevalent of these shore types are bluff-backed beaches: fronted by narrow mixed sand and gravel beaches. However, excluding spits and other types of depositional beaches, most of south Puget Sound beaches have only a thin veneer of sediment atop a relatively flat erosional platform (Shipman 1995). This type of depositional beach configuration is particularly vulnerable to erosion when conditions are altered due to human-induced change (Johannessen 2007).

More specifically, the substrates in the aquatic reserve area (because of its glacial origins), consist of unconsolidated mud, sand, gravel, and less frequent mixed cobble substrates, with occasional larger boulders or erratics. Intertidal and subtidal substrates within the aquatic reserve also include the spectrum of mixed fine sediment types with muds and silts settling in the more enclosed embayments. Sand, silt and mud sediment are also disseminated throughout the large tidal expanse of the Nisqually Flats and along the southern reserve boundary. In areas with a steeper foreshore zone and higher wave and current energy, the coarser and more compacted sediments prevail, particularly the underlying compacted till with embedded mixed coarse gravels are uncovered and persistent.

The beaches throughout the Reserve area are representative of the typical mixed sand and pebble substrates described above. Anderson Island is rimmed by these unconsolidated sand and mixed gravel beaches representative of the common foreshore components of the high-tide beach and low tide terrace (Downing 1983, Johannessen 1993). The high-tide beach consists of a steeper sloped beach face with coarser material, while poorly sorted finer sediment is deposited seaward of the high-tide beach in a gently sloping terrace. Among the five basins of Puget Sound, the Southern Basin has the least amount of vegetation in its intertidal area (12.7 ± 15.5% coverage), with salt marsh (9.7 ± 14.7% coverage) and green algae (2.1 ± 1.9% coverage) being the most common types (Bailey et al. 1998). However, other types of hardy macroalgae, such as, *Fucus* spp. (rockweed) and *Mastocarpus* spp. (a widely distributed red algae) are common throughout the intertidal zone where the substrate allows. Green algae, including *Ulva* spp. are seasonally prevalent on the beaches throughout the reserve and where freshwater drainages or seepages enter the intertidal and *Enteromorpha* spp. are common.

Varying sizes and types of protected embayments (discussed below) are also common along the Anderson Island shoreline, distributing the finer sands, silts and muds in these lower energy bays and lagoons (i.e., Oro and Amsterdam Bays).

A couple of shore areas more exposed and affected by currents reveal the underlying glacial till or hardpan (Lyle Point, and Balch Passage between Anderson and Eagle Islands) during minus tides. This compacted hard clay with embedded gravels provides structure for lower intertidal seaweeds such as, large bladed kelps, and benthic organisms like *Zirfea pilsbryii*, the burrowing clam (Mumford 2010).

The south side of the reach is dominated by the broad intertidal area of Nisqually Flats associated with the transport of deltaic sediment westward alongshore. This gently sloping low-tide terrace, exhibits a distinct and typical transition between the finer grained terrace and the steeper gravelly-sand beach face prevalent on this shore, (Shipman 2008). As on Anderson Island, sheltered embayment habitats are intermittently tucked amid backshore areas of the shorezone and add habitat value and complexity.

Embayment Habitat

The Aquatic Reserve contains embayment habitats at intervals along the marine shoreline (Figure B-4, Appendix B). An embayment is a small, protected, partially enclosed marine body of water, with varying amounts of freshwater input, and where there is too little wave action to form beaches (Shipman 2008). Embayment habitat supports salt marsh, tidal flats, submerged vegetated communities, and provides shelter for juvenile Chinook and other fish. Studies of fish use and embayment habitat (also called “pocket estuaries”) began in 2002 with a focus on Chinook salmon. Expanded research found other species, such as sand lance and chum, also use this habitat (Beamer 2006, 2007). According to Fresh (2009), densities of migrant Chinook fry in these habitats in winter and early spring are typically greater than adjacent nearshore habitats, suggesting that these habitats are important.

Numerous embayments are distributed throughout the Reserve and are significant features along Anderson Island and the Thurston County shorelines, with one embayment noted on Ketron Island (Figure B-17, Appendix B). Embayments often produce habitat conditions that are favorable for the growth and survival of juvenile salmon. The distribution of embayment habitat has diminished significantly from historical times in this area, therefore reducing the availability of this important refuge and feeding areas during critical life phases of several species. These embayments also often provide suitable upper intertidal habitat area for establishing fringing emergent marsh communities, while mud and mixed fine sediments can support intertidal and shallow subtidal eelgrass colonization. Green algae and other smaller brown and red algae are also present in these embayments.

Locally, embayment habitats vary from intact to slightly modified; recently, tidal influence was restored to an embayment along the Beachcrest subdivision. Several historic embayments along the Pierce County mainland shoreline have been filled or are disconnected from the eastern portion of Nisqually Reach by the railroad grade and associated culverts (Figure B-4, Appendix B). This is also the case on Anderson Island where several historic estuaries have been diked or filled. Mumford (2010) determined that eighteen historical embayments existed within the reserve boundaries as opposed to the current twelve functional embayment habitat areas.

River Delta Habitat

The Nisqually River is the only watershed in the contiguous United States with its headwaters in a National Park (Mount Rainier) and its delta in a National Wildlife Refuge. Although the Nisqually Delta has been heavily modified for agricultural use, it is the most intact delta of its kind in the Pacific Northwest. The Nisqually River Delta fits Shipman's (2008) "delta" descriptor for the area, by being a large river that drains the Cascade Mountains. The delta was built from fluvial sediments deposited at the coastline intermingling with tidal flows, creating the broad and low-lying, marine extension of the alluvial floodplains. The delta is associated with a myriad of tidal sloughs, and various sizes of streams and their associated deltas, all conjoined and subsumed within the larger deltaic system – McAllister and Red Salmon Creeks deltas with the Nisqually River delta (Shipman 2008). In 1985, Thom et al, determined that the extensive mixed habitat areas of the greater Nisqually delta, with exposed mudflats and emergent salt marsh communities, has the highest productivity rates recorded for salt marshes in the Pacific Northwest.

The recent removal of the outer dike at the Nisqually National Wildlife Refuge (2010) is dramatically transforming the regime and structure of the delta by altering water and nutrient flow dynamics and changing the distribution of vegetated marsh lands and tidal flats throughout the region. In many areas of the delta, healthy, well-established salt marsh communities continue to thrive throughout the intertidal zone. While in other areas, large portions of saltwater and freshwater emergent vegetation is breaking away, being transported and re-deposited throughout the estuary. The expansion and dispersal of greater amounts of sediment and nutrients also encourages the growth of plankton in the local waters. These dynamic changes, along with the renewed inundation of nutrient rich estuarine waters throughout the flats, will continue to develop intertidal habitat areas for foraging and propagation. Additionally, the on-going reclamation of tidal lands at the Refuge will further enrich the significance of the entire area as transition areas and nursery grounds for juvenile marine fish, all juvenile salmonids, and resident and migratory birds.

Shallow Subtidal Habitat

Characteristically, within the energy regime of the reserve, many of the same physical substrate characteristics and submerged vegetation types of lower intertidal areas extend into shallow subtidal areas. This zone encompasses from ELW to the limits of the photic zone, which is usually down to sixty feet below MLLW, (although maybe shallower in this region). The substrates in this zone, are not often exposed to wind-driven energy and typically grade into finer sediment, with the exception of areas influenced by strong currents. This provides a more stable habitat for rooted vascular plants, such as *Zostera marina* (eelgrass).

Eelgrass has been detected at 5 of the 9 Submerged Vegetation Monitoring Project segments within the reserve area. Research suggests that South Puget Sound supports the least amount of eelgrass in all of Puget Sound (Thom and Hallum 1990). The Nisqually River delta is known as the southernmost extent of eelgrass in Puget Sound (T. Mumford, pers. comm., 2010). Investigations by DNR scientists on eelgrass distribution suggests that the tidal regime further west of Nisqually Flats may limit the permanent establishment of eelgrass in that portion of the South Sound (T. Mumford, pers. comm., 2010) (Figure B-7, Appendix B).

Other types of submerged marine vegetation are prevalent in the area, consisting of mixed large bladed understory kelp, and other brown, red and green seaweeds (macroalgae). These non-floating macroalgae communities provide many of the same habitat functions as eelgrass and floating kelp beds. The availability of large quantities of nutrients, resulting rapid growth rates, and relative tolerance of pollutants are hypothesized as contributing factors to the growth and spread of kelp in this area (Thom and Hallum, 1990) (Figure B-8, Appendix B).

Substrate consisting of coarse gravels and gravels compacted in hard clay-hardpan, is a primary factor in determining distribution of large species of algae. Current swept subtidal hardpan substrate, often forms into ledges and platforms, and can support holdfasts for large bladed seaweeds. Larger, perennial seaweeds, such as sugar kelp, are commonly found in areas throughout the Reserve, prominent examples of this are the reef west of Eagle Island, along the north and eastern more protuberant shoreline areas of Anderson Island, north Ketron Island, and intermittently along the mainland shorezone of Pierce County (Figure B-5, Appendix B). Other lower shallow subtidal areas around the Reserve reveal the presence of coarse sediment that can support kelp habitat, but no longer does. Although this type of substrate is not markedly plentiful in the area, *Nereocystis* (bull kelp) beds were once common in many locations throughout the Reserve. As noted by Mumford (2010), bull kelp is conspicuously absent from nearshore areas around Anderson Island. Thom and Hallum (1990) mapped the occurrence of bull kelp from a variety of historical sources, particularly occurring in Balch Passage and off Lyle Point. Doty, in 1992, noted the presence of bull kelp in several areas in the reserve, such as the north end of Ketron Island. In 1877-78 on US Coast and Geodetic Survey t-sheets show even more extensive bull kelp beds. Specifically, a continuous bed of bull kelp was mapped along the southwest shore of Anderson Island, from just north of Pt. Treble southward to Lyle Point. Research has shown the contribution and significance of bull kelp and other common kelp species to ecosystem goods and services in Puget Sound; it is considered a highly valued habitat type and natural resource in the area. The cause of the disappearance of this major part of the biological structure and community is unknown and there is little information on how to determine the cause of this type of loss.

Deepwater Marine Habitat Area

The deepwater marine habitat consists of substrates and associated habitats deeper than and water ward of the nearshore zone. Deepwater marine habitat includes open water areas within the Nisqually Reach Aquatic Reserve. Deepwater marine habitat within the Nisqually Reach Aquatic Reserve boundaries are currently being explored (USGS). The deepest location within the Aquatic Reserve boundary, just east of McNeil Island and south of the sill, has been measured at 190 meters (Gustafson 2000; USGS, 2010; E. Grossman, pers. comm., 2011) compared to the mean depth of southern Puget Sound basin at 37 meters.

Bathymetric surveys are being conducted by the United States Geological Service (USGS) in the Nisqually Reach (USGS website, 2011; USGS 2009). USGS preliminary survey results from March 2009 show the complex geomorphology as the result of active sediment transport processes near the delta edge. Variable substrate features have been mapped, including muddy or soft bottom substrates and sandy to hard

bottom substrate. Cross-section profiling in the Reach revealed sand waves up to 15 meters in height that are fed by sediment bypassing the delta and tide flats. The USGS will resurvey during 2011 to research changes in sediment transport processes likely to have changed with the dike removal.

The Nisqually Reach Nature Center and the University of Puget Sound (UPS) has used Remote Operated Vehicles to map and research the deeper water habitats of the Nisqually Reach. Early research revealed diverse sessile and epibenthic invertebrate communities attached to a variety of different substrates, including regions of shifting sands uncovering a hardpan base scattered with coarse gravels and cobble. Also observed were large quantities of spotted prawns and spiny dogfish off the south side of Anderson Island. These prawns have not been harvested commercially in South Sound for decades. These invertebrates appear to be subsisting on a constant deposition of marine detritus from surface waters while swift tidal currents prevent the settling of these fine sediments and detritus on the gravel and cobble substrates below. Videos can be viewed at http://projects.ups.edu/jkelliott/NWACC/South_Puget_Sound2/index.htm

Open Water Habitat

Open water is the largest habitat type in Puget Sound and correspondingly in the Nisqually Reach Aquatic Reserve. In addition to being the main zone for surface water exiting the South Sound, the open water expanse serves as a major migratory corridor for marine mammals and fish species, supporting feeding and propagation, and acting as a sink for nutrients, as well as a thermal buffer for nearshore waters.

Generally, some key physical properties open water provides are, more constant temperatures, reduced salinity variation, and floatation for a wide variety of animals and plants. These organisms spend part or all of their life cycle, floating or swimming in the open water. Many species arrive as plankton, and drift for time in the open water feeding on other abundant plankton before they settle to the bottom as adults. The vast numbers of planktonic plants and animals offer an abundant food source and are the foundation for a complex and very productive food web for a myriad of other species. Many of these open water animals are regularly observed feeding, resting, or migrating through the Nisqually Reach, including a variety of jellyfish (Fried Egg, Lion's Mane), forage fish, squid, Common Loons, harbor seals, Northern (Stellar) sea lions, and killer whales.

Fish and Wildlife Resources

As discussed in the preceding section, much of the aquatic lands within the reserve and the associated waters support spawning, rearing, and foraging habitat for numerous migratory and resident birds, fish, and marine mammals and marine invertebrate species. The variety of aquatic vegetation types, diverse substrates, and areas of unperturbed physical and ecological processes within the upland-marine interface provide for productive and well utilized habitat areas.

Birds

The Nisqually Reach Aquatic Reserve is located adjacent to one of Audubon's "Best Places to Bird" in the South Sound, with the Nisqually National Wildlife Refuge recording over 175 species with approximately 75 species within the Nisqually Delta

(Audubon 2011). Many of these species are marine dependent, and use intertidal and subtidal habitats within the reserve boundary (See Bird spp. list, Appendix A).

Waterbirds migrating in the Pacific flyway begin arriving on the Nisqually delta in late September, with many remaining through the winter. While some birds may use the area only for short periods of time during migration, they are dependent upon this vicinity for its safe resting areas and rich foraging and food sources. The Audubon Society also reports that the extensive Nisqually estuary as well as the locally scattered pocket estuaries are resting and feeding habitats for shorebirds and other waterbirds. The area within the aquatic reserve boundaries appears to be particularly important to several species of conservation concern. The significant amount of high bluffs provides prime nesting habitat for Pigeon Guillemots (*Cepphus columba*) (Figure B-9, Appendix B). Surf Scoters (*Melanitta perspicillata*) are common to the area, perhaps due to the abundant food sources such as Pacific herring (*Clupea pallasi)*. Marbled Murrelets (*Brachyramphus marmoratus*) have been documented in parts of the area, assumedly using the Nisqually River as a corridor between potential nesting grounds at Mount Rainer National Park and foraging waters of southern Puget Sound. Other seabirds that have been sighted within the Reserve boundaries include Long-tailed Duck (*Clangula hyemalis)*, Rhinocerous Auklets (*Cerorhinca monocerata)*, and Common Murre (*Uria aalge)* (Figure B-10, B-11, Appendix B) (Audubon 2011).

According to WDFW surveys (Nysewander and Evenson 1998), once abundant seabirds and seaducks, including scoters and scaups, have declined in Puget Sound; diminishing resource quality and availability most likely play a part in this trend. Diets of scoter primarily consist of mollusks but can include decapods (crabs, shrimp), amphipods, barnacles, insects, fish, and plants (Klotz et al. 1978).

Common and Red-throated Loons are observed in the waters of Nisqually Reach in the winter months but not with great frequency. The Common Loon is considered a Washington State candidate threatened species; WDFW has stated that the protection of the forage base and water quality is essential for the Common Loon's recovery as it is a species that requires a healthy fish population on which to feed. Other than fish, loons occasionally take other foods including crustaceans, mollusks, and insects (WDFW 2004). The Yellow-billed Loon, listed as a Birds of Conservation Concern, is an accidental migrant to this area (USFWS 2008).

Marine birds sighted during winter from Tolmie State Park include the White Winged Scoter (*Melanitta deglandi*), Surf Scoter, and Rhinoceros Auklet as well as a variety of shorebirds, wading birds and other waterbirds.

Fish

Salmonids are abundant in the Nisqually River Basin with six species of Pacific salmon present, listed in order of abundance from top to bottom:

- Chum salmon (*Onchorynchus keta*)
- Coho salmon (*O. kisutch*)
- Pink salmon (*O. gorbuscha*)
- Steelhead (*O. nerka*)
- Chinook (*O. tshawytscha*)
- Cutthroat (*O. clarki clarki)*

According to the 2000 stock profiles for Nisqually, winter steelhead, pink salmon and the coastal cutthroat, are not significantly influenced by hatchery-originated genes and are classified as native, sustained by wild production (WDFW, 2000; 2011).

These salmonids and other nearshore species migrate along the shallow water fringe of the reserve shorelines. Numerous intact feeder bluffs provide a cool, shallow micro-climate for the migrating juvenile salmon, while riparian vegetation contributes to food production. Further support for juvenile salmonid survival comes from the shallow embayments disbursed along the shoreline throughout the reserve area. Fyke net surveys conducted by the Nisqually Tribe in tidal channels of the delta from 2002-2004 found large numbers of Chinook, chum, pink and coho salmon as well as coastal cutthroat trout, shiner perch, sand lance, herring, smelt, sculpins and starry flounders. Other nearshore species commonly caught in student beach seines at Nisqually Reach Nature Center include crescent gunnel, rock prickleback, high cockscomb, arrow goby, buffalo sculpin, pile perch, three-spined sticklebacks as well as, juvenile individuals of several flatfish species (Figure B-13, Appendix B).

Several beach localities within the reserve area provide the habitat elements necessary for forage fish spawning. Zones of documented upper intertidal surf smelt and sand lance spawning beaches are common along the Nisqually Reach and on Anderson Island. Juvenile sand lance remain in nearshore areas in the region through their first summer (Penttila, 2007). A broad array of marine birds, fish and mammal species are known to feed on sand lance. Pacific herring are also a significant part of the prey base of finfish, marine mammals, and sea birds of Puget Sound (Lemberg et al. 1997; Stewart 1977). The herring found utilizing the Nisqually Reach are the Squaxin Pass stock, the southernmost stock in Puget Sound (Figure B-12, Appendix B).

WDFW surveys suggest a number of fish species in the vicinity of the Aquatic Reserve are experiencing declining numbers. Two Nisqually salmon stocks (Nisqually Chinook, Nisqually Winter Steelhead) are listed as “depressed” and one is listed as “unknown” (Nisqually Pink). Pink salmon experienced a marked decline in the latter part of the 1990s in the Nisqually and its tributaries (WDFW SaSI reports, 2011). However, in more recent years, since 2007 there have been significant numbers of juvenile pink outmigrants and higher numbers (50,000 -100,000) for estimated returns (Ellings, pers. comm., Feb. 2011). Creel surveys by WDFW summarized over a thirty year period by the Nisqually Reach Nature Center suggest at least another 5 to 10 species were present in the Nisqually Reach area up until the late 1980s and have not been caught recently, these include copper, canary, and black rockfish, cabezone, lingcod, blue shark, red Irish lord, kelp greenling and halibut (Figure B-13, Appendix B).

Mammals

Small Islands within the Nisqually Reach Aquatic Reserve provide important haul-out locations for seals and sea lions. Eagle Island is the most important haul-out and breeding site for harbor seals in south Puget Sound. As the most abundant marine mammal observed in the Nisqually Reach, harbor seals are often seen swimming along the Reach and using the extensive mudflats of the delta as a haul-out. Male California sea lions forage throughout the reserve area in winter months and also

haul-out on the tidal flats, floating buoys and undisturbed beaches. Concentrated in the deeper water areas of the reserve east of Anderson Island, are the highest concentrations of Dall's and harbor porpoise sightings in the reserve area. Other dolphins and whales using this area include gray whales, minke whales, and orcas, most often sighted during the spring, fall, and winter months in "the Reach". During their migration, gray whales venture into southern Puget Sound for short periods of time, particularly in the spring, and occasionally feed on the outer slope of the Nisqually Delta.

Orcas from the Eastern North Pacific Southern Resident stock (Southern Resident Orcas, or Southern Resident Killer Whales), are normally sighted in late fall/early winter following fall chum salmon runs into South Sound from the Tacoma Narrows (Figure B-15, Appendix B). NOAA Fisheries reports that between 1990 and 2005, orca sightings south of McNeil Island have been less than 25. Historically, reports in the 1960s and 1970s documented orcas visiting the South Sound annually, traveling through Colvos Passage and surrounding McNeil Island to feed on salmon and herring (Palo 1972). The National Marine Fisheries Service, NOAA, is in the process of determining historical population size as part of the Recovery Program for the orca (NOAA 2008).

According to the most recent stock assessment for the killer whales, the live-capture fishery from 1967 to 1973 removed an estimated 47 killer whales from the Southern Resident stock, mostly immature (Ford et. al. 1994). Between 1974 and 1993 the Southern Resident stock increased approximately 35%, from 71 to 96 individuals (Ford et al. 1994), an annual growth rate of 1.8% during those years. Since 1995, the population declined by 79 whales before increasing to 91 whales between 2002-2005. The population has declined for the past two years to 86 whales (Ford et al. 2010; Center for Whale Research, unpubl. data). During September 2009, over a two-week period, regular sightings of transient orcas were documented in the South Sound. Transients move in smaller groups over larger ranges, and have different diets, compared to resident orcas (NOAA 2008). In late September, two boats from Cascadia Research were in the southern part of Puget Sound searching for this group, and finally encountered the group east of Anderson Island. They photo-identified all five individuals present (T137, T137A, T137B, T36A, and T36A1), and deployed a satellite tag on one individual (T36A). According to the Orca Recovery Plan, transients represent a small portion of the overall orca population (NOAA 2008).

Bats of various species (see mammal species list, Appendix A) rely on the high representation of insect diversity (see insect species list, Appendix A) on and above the waters of the Aquatic Reserve. Bat species identified include the Townsend's Big Eared Bat (*Corynorhinus townsendii*), a species of Federal Concern and a State Candidate. The last maternal colony of Puget Sound Lowland Townsend's big eared bats is located just south of Fort Lewis.

Invertebrates

Early investigations of invertebrate diversity by the Nisqually Reach Nature Center, University of Puget Sound and others suggest an extremely high representation of invertebrate species (see Appendix A, species list) between the upper intertidal areas and deeper waters within the Reserve boundaries. Nisqually Research Nature

Center beach seine and intertidal surveys have often caught abundant amounts of mysid shrimp, mud shrimp, shore crabs, blue mussels, ivory barnacles, shaggy mouse nudibranchs, worms, bentnose clams, moon snails, periwinkles and various limpet species. The most common marine invertebrates include Olympia and Pacific oysters, blue mussels, Dungeness and red rock crabs, geoduck, littleneck, Manila, and butter clams which are all harvested recreationally and commercially and support a robust crab and shellfish industry.

Non-native or invasive marine fauna and flora

There has not been a comprehensive survey for non-native and invasive species in this area; limited information is available about the distribution of non-native marine species for the region and the aquatic reserve area. Although, several invasive marine species are monitored and controlled throughout the inland marine waters of Washington State, only a few have reported within the South Sound region. Some regional based programs focus on invasive species, such as the Puget Sound *Spartina* Program. To date, *Spartina anglica* has not been documented farther south than Squally Beach in Commencement Bay (Heimer, WDFW, 2011).

Other monitoring efforts have documented non-native species in the area, such as, the presence of the brown macroalgae *Sargassum muticum* (Nearshore Habitat Program, 2001). *Sargassum* is considered an invasive brown alga, which competes for space with non-floating kelp and other large brown algae, and can have a negative impact on their abundance (Britton-Simmons, 2004). A small bed of *Zostera japonica* has been documented at Tolmie State Park and has been persistent for many years, albeit spotty, elsewhere in the area. In 2010, *Z. japonica* was nominated, but not listed as a noxious weed in Washington State (Heimer, WDFW 2011).

WDFW currently lists seven species of non-native, invasive tunicates for priority and secondary invasive management (WDFW, 2011). Dive groups throughout the Sound are engaged in noting occurrences and removal of some of these species where possible. It is unknown if any of these species are present in the Nisqually Reach aquatic reserve area.

Conservation Targets

The following conservation targets were identified through the designation process. Primary sources of target identification were the original site proposal application, recommendations made by the 2009 Aquatic Reserves Program Technical Advisory Committee, and the Nisqually Planning Advisory Committee. These priority species and habitats will benefit from additional conservation measures implemented through this management plan. By identifying conservation targets, management actions can be developed and implemented that are consistent with the protection needs of the conservation targets. By focusing management efforts on priority species and habitats it is possible to develop management strategies with realistic goals that will inherently include other species and habitats in protective management decisions. (Refer to Appendix A for a comprehensive listing of species).

1) Unique ecosystem characteristics

a) Geological and oceanographic conditions have created an unusual co-occurrence of marine habitats including deepwater sand waves, shallow banks, deepwater trenches, and sand, mud and rocky habitats.

b) Relatively intact shoreline and shoreline processes on Anderson Island with sandy beaches, spits, and "feeder bluff" shorelines – maintaining these substrates, features and functions in its relatively undisturbed condition will continue to support nesting sea birds such as Pigeon Guillemots, as well as maintaining healthy conditions for forage fish spawning habitat. Forage fish provide a food source for many sea birds, salmon, and marine mammals in the area.

c) Submarine delta has unique properties as a dynamic sandy feature with almost unexplored biodiversity. Benthic and open water habitats, including areas of high tidal, current , and mixing activity - support high biological diversity, and food production for birds, fish and marine mammals within the reserve.

2) Aquatic vegetation and habitat

a) The complexity of physical and biological conditions found in the estuarine and freshwater habitats near Nisqually Reach create a high diversity of substrates and habitats.

b) Numerous intact embayment habitats support nursery and refuge habitat for many juvenile species including juvenile Pacific salmonids.

c) Area is conducive to restoration opportunities of the native Olympia oyster (*Ostreola conchaphila*).

d) Historically, *Nereocystis* (floating kelp) beds were common in the area.

e) Contains pre-spawn holding area for Pacific herring, and documented sand lance, and surf smelt spawning beaches.

Species: Brown algae species including kelp - *Nereocystis* – bull kelp, *Saccharina latissima* - sugar kelp, and other non-canopy forming kelp, such as *Desmerestia* spp. Red and green algae spp. are present, and seagrasses, including *Zostera marina* – eelgrass.

3) Bird populations

a) Many marine migratory and resident sea birds are supported by the proximity of estuary to strong benthic and pelagic habitats within the aquatic reserve.

b) Up to seventy four (74) species of birds are regularly seen within the reserve and adjacent shorelines.

Species: Pigeon Guillemots, Marbled Murrelets, Harlequin Duck, Common Loon, Brown Pelican, Bald Eagle, Brants, Surf Scoters, Horned Grebes, Pelagic Cormorant, Double-crested Cormorant, Great Blue Herons, Common Murres.

4) Mammal populations

a) Islets and kelp beds provide refuge, breeding and foraging areas for harbor seals and sea lions.

Species: Harbor seal, California sea lion, Stellar sea lions, Southern Resident Orcas, Dall's porpoise, Harbor porpoise, Gray whales, *Chiropterans*

5) Fish and Shellfish populations

a) Estuarine area used extensively by juvenile salmonids from the Nisqually River and a few rivers outside the region.

b) Freshwater and marine sediment and nutrient inputs from the Nisqually River and Tacoma Narrows supports high fish species biodiversity and transition habitat areas for salmonids.

Fish Species: Six species of salmonids, Surf smelt, Pacific sand lance, Pacific herring, Pacific cod, Ling cod, Rockfish, Rock sole.

Shellfish Species: Olympia oyster, Dungeness crabs, Red rock crab, Geoduck, Butter clams, and Native littlenecks.

II. Current Conditions

The current ecological conditions of the Nisqually Reach Aquatic Reserve are represented by unique physical features, such as unusual deep water substrate, structure, and bathymetry, extreme tidal flows and high currents in some submerged portions of the outer delta, lower levels of altered bluffs and beaches on the adjacent islands, and habitat types that both support high primary productivity and provide critical structural habitat for juvenile salmon and other marine species. Connectivity to the Nisqually River Delta and the Nisqually National Wildlife Refuge, provide seamless protected foraging and refuge habitat for numerous migratory species. The Nisqually National Wildlife Refuge site is notably one of the largest river deltaic environs in the Pacific Northwest, a biologically-rich and diverse area that supports a variety of habitats. Additionally, it is one of the most ecologically intact estuarine deltas, containing large tracts of healthy emergent salt marsh areas. As previously mentioned, Anderson, Ketron, and McNeil Islands also provide reaches of well-preserved shoreline with intact processes and shore forms particularly intermittent embaymernt habitat areas that provide refuge, feeding, and nursery areas for juvenile salmonids and other marine species. Likewise, along the western shore of the aquatic reserve, a number of these small intact embayments are prominent features. Presently, with the removal of the historical dike, significant ecological changes are likely to occur throughout the area. Conceptual models of re-establishment suggest significant shifts in size, location and dominant substrate of the intertidal habitats over the next 10-30 years.

The Nisqually Reach Aquatic Reserve is generally characterized by, mud, sand and gravel substrates, with varying exposures to wave and current energy. In higher current areas, underlying compacted till is exposed with coarser embedded gravels and cobble; this substrate provides the structure for a distinctively more diverse, assemblage of flora and fauna. Generally, subtidal habitat areas within the aquatic reserve represent a similar assortment of substrate types to the intertidal areas, although further research is needed to better characterize the distribution and status of the area. Presentations by the USGS of bathymetric studies (2001-2009),

suggest the submarine delta of the Nisqually River displays dynamic patterns of shifting underwater sand dunes up to 15 meters high contrasting with deep-water exposed cobble and hardpan substrate. The exposed cobble areas were further viewed with an underwater rover and revealed a viable and unique benthic community with anemones, corals and sponges (D. Meyers, pers. comm., 2010).

In addition, the current ecological conditions of the site include varying degrees of human-caused alteration. Current conditions take in a number of uses that particularly, have modified shorezone areas within the aquatic reserve. These uses include but are not limited to, diking for agricultural purposes, filling and cutting-off small embayments, cable crossings, outfalls, pipelines, overwater structures, shoreline armoring, train and shipping traffic, marinas, and aquaculture. Although, compared to other parts of the South Sound region, this area is known to have a higher representation of unique, functional habitat areas, greater biological diversity, and less prolific residential shoreline hardening and development. However, the resulting local consequences of the existing uses and alterations within the reserve area have not been quantified and the status of the resources needs to be better documented and understood.

Cable Crossings

There are currently several cable use authorizations crossing the tidelands adjacent to Anderson Island. Most of these have been operating for some time. An easement was recently approved for Tanner Electric to lay a new power cable adjacent to an older damaged cable to provide adequate electrical service to Anderson Island. For other cable authorizations see Appendix D.

Olympic Pipeline

Crossing the Nisqually River at approximately river mile 18.5 near Yelm, the Olympic Pipeline carries gasoline, diesel, and jet fuel at pressures ranging from 600-800 lb psi. Manual block valves are located on both sides of the river crossing, with a total drainout capacity of approximately 29,000 gallons between these valves. DOE, Olympic Pipeline Company and incident response agencies conduct simulated responses to stress cracks in this 14-inch pipeline as part of the state's oil spill response plan.

Joint Base Lewis McCord Training Areas

The Nisqually River borders and runs through Joint Base Lewis-McChord for approximately 16.5 miles. It separates the Rainier Training Area and southwest Joint Base Lewis-McChord from the rest of the reservation between river miles 11 and 12. To reach the Rainier Training Area, military units must cross the river either at the Nisqually River Bridge or ford the river at the Tank Crossing Site.

Traffic

Train Traffic

The BNSF Railway main line runs along the shoreline of the Aquatic Reserve in Thurston and Pierce counties, crossing the Nisqually River at approximately river mile 19 and river mile 3.5 and paralleling the reserve along a majority of the eastern boundary, from the River Delta to the northeastern boundary point. In Washington

State, the Washington Utilities and Transportation Commission oversees railroad crossing safety, train speeds in incorporated cities and regulates where cross bucks are placed or changed. All other authorities lie with the Federal Railroad Administration (Brady, P., 2011; Hunter, K. WUTC, pers. comm., 2011).

Vessel traffic

Many vessels, including tugs, barges and cargo vessels transit through the Nisqually Reach Aquatic Reserve to reach the DuPont gravel loading dock, Port of Olympia'smarine terminal or Shelton's Oakland Bay. The Port of Olympia is the southernmost deep draft port of Puget Sound, and has become the transshipment center for Canadian timber destined for mills in Oregon and Northern California. Other imports and exports include paper, iron, steel, aluminum, pulp, machinery, vehicles, plastics, food, and cement. The Port of Olympia manages a sixty acre terminal, with three modern, deepwater berths, on-dock rail and a complete container yard. The Port also has a marina and boathouse (www.vesseltracker.com/en/home.html).

Other vehicle traffic

The Reserve is surrounded by commercial truck traffic on I-5, State Route 507, and local roads. Container and log ships, tugs, and other vessel traffic transit to and from Shelton and Olympia. Recreational vessel traffic is associated with public marinas, docks, residential docks or recreational use.

Outfalls

A large number of municipal outfalls are located within the reserve boundaries, including a combined sewer outfall, a Department of Transportation managed outfall, and outfalls managed by Fort Lewis at Solo Point (Figure B-3, Appendix B).

Shoreline Modification

Nearshore processes within and adjacent to the reserve appear intact with the exception of a few areas of significant human modification. An estimated 26% of the total adjacent shoreline of the Reserve is modified, which is 10% less than the average for south Puget Sound region (Tables 2 and 3, DNR 2010). The majority of the reserve area is adjacent to undeveloped beaches, unaffected by human alterations and in excellent condition. However, on mainland Pierce County alone 94% of the shoreline within the reserve boundary has been modified, resulting in approximately 26% of the total shoreline adjacent to the reserve having modifications.

Shoreline modification disrupts natural sedimentation and freshwater seepage patterns important for maintaining habitat formation and function. As previously mentioned, along the main land shores of Pierce County there is 25,000 feet of shoreline armoring and associated fill and build out, from the BNSF rail line. This extends along the entire eastern boundary of the Aquatic Reserve. The railroad also separates Sequalitchew Creek in DuPont from Puget Sound and the associated culvert represents a potential fish passage barrier.

In Thurston County, minor shoreline modification occurs at the Beachcrest community, just west of Luhr Beach. Further west, along the southwestern reach between the Jubilee neighborhood and Tolmie State Park, shoreline armoring from

residential areas has impaired natural shoreline processes. Several small barrier estuaries and lagoons have been hydrologically altered by tidegates that reduce the internal tidal prism and sediment export to the main Puget Sound shoreline.

Tables 2 and 3 below show that approximately 189,132 feet or 35.82 miles of shoreline hardening creates a barrier, severing the connection of the uplands to the Sound, stifling sediment input, water seepage and potentially compromising the overall sediment budget in this area. Although there have not been any studies to quantify the loss of nearshore processes within the Nisqually Reserve, there is clearly an ecological disturbance, as has been shown through numerous studies related to shoreline hardening in Puget Sound.

Table 3: Nisqually Total Shoreline - Percent Modification within Reserve Boundaries (feet)[1]

Nisqually Total Shoreline	0%	5 – 35%	36 – 65%	66 – 95%	>95%	Total	Shoreline modified (feet)
Anderson Island	94079.3	3544.6	4378.4	4184.4	1340	107527	13%
Ketron Island	15835.7	0	0	872.1	0	16707.7	5%
McNeil Island	16791.9	1232.2	0	0	1948	19972.1	16%
Eagle Island	1981.6	0	0	0	0	1981.6	0%
Pierce County	1508.8	0	3170.6	2059.3	19983.7	26722.4	94%
Thurston County	10306.7	0	2497.6	999	2417.7	16221	36%
Total	140504	4776.8	10046.6	8114.8	25689.3	189131.5	26%

Table 4: Nisqually Total Shoreline - Percent Modification within Reserve Boundaries (miles)

Nisqually Total Shoreline	0%	5 – 35%	36 – 65%	66 – 95%	>95%	Total	Shoreline modified
Anderson Island	17.8	0.67	0.83	0.79	0.25	20.36	13%
Ketron Island	3.00	0	0	0.17	0	3.17	5%
McNeil Island	3.18	0.23	0.23	0	0.37	3.78	16%
Eagle Island	0.38	0	0	0	0	0.38	0%
Pierce County	0.29	0	0	0.39	3.78	5.06	94%
Thurston County	1.95	0	0	0.19	0.46	3.07	36%
Total	26.61	0.90	1.90	1.54	4.87	35.82	26%

[1]Nisqually total shoreline in feet: 188512.50; Nisqually total shoreline in miles: 35.70. Numbers shown have been rounded up one decimal place. Created using the DNR ShoreZone Inventory, 2001.. Percent modification was developed by taking the total amount of modification and dividing it by the amount of coastline/shoreline in the reach, then converting to a percent.

Overwater Structures

Overwater structures present potential negative environmental impacts. Overwater structures currently exist along the western shore of Anderson Island with a long reach of unarmored bluffs and beaches. DNR Scientists conducted site visits to this area in 2010. The shorezone appears to be intact with little indication that net shore drift and other associated processes have been compromised.

Overwater structures are present in a few locations on the northeastern (the ferry dock) and eastern sides of the Island. Oro Bay, the large double embayment in the southeast portion of the island, has the highest concentration of overwater structures and shoreline alteration with two marinas and several private docks and overwater structures (Figures B-20, B-20a and B-20b in Appendix B). Additionally overwater structures occur on Ketron Island including a Pierce County ferry dock, and the DuPont gravel loading dock is located at Tatsolo Point adjacent to DuPont.

Marinas and Public Docks

There are six marinas within or adjacent to the Reserve; one at Ketron, one at Mallard Cove (Beachcrest in Lacey) and four on state-owned aquatic lands on Anderson Island. 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.

Recreational Use

The reserve is situated adjacent to the mouth of the Nisqually River Delta, in which boat access is available at a WDFW boat launch at Luhr Beach, next to the Nisqually Reach Nature Center. In the Nisqually National Wildlife Refuge, personal watercraft speed restrictions exist. Personal watercraft is limited to a five (5) mph speed restriction due to wildlife and habitat disturbance. There is also a permanent closure to any watercraft in the “restoration” area of the Refuge. This does not include McAllister Creek which is managed by WDFW. Fort Lewis personnel and their families use Solo Point as a recreational access area for launching small boats. The Nisqually Reach Nature Center has been providing educational activities for Fort Lewis family events at Solo Point and will continue to work on developing an on-base volunteer program to continue educational offerings and citizen science opportunities.

The Reserve area is used extensively for boating, including movement back and forth between Anderson, Eagle, McNeil, Ketron Islands and the mainland. There is also a ferry that runs from Steilacoom to Anderson and McNeil Island.

Recreational Docks and Mooring Buoys

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 21 overwater structures within and adjacent to the reserve are in Figures B-20, B-20a, and B-20b, Appendix B. Six of these structures appear to be associated with single-family residences and many are located partially on private tidelands. The exact number of mooring buoys is unknown at this time.

Anderson-Ketron Disposal Site/Dredged Material Management

This site was established in 1989 under the Dredged Material Management Program (DMMP) which represents an interagency approach to the management of dredged material in the State of Washington. The DMMP interagency approach began in 1985 after studies raised concerns about environmentally degraded sediment and water quality in Puget Sound. The program has provided publically acceptable and environmentally safe management plans for regulation of unconfined open-water dredged material disposal. A number of measures and procedures inherent in the DMMP act in combination to minimize the potential for impacts to listed species in Puget Sound: consolidation of the number of sites to minimize impacts; siting disposal locations in areas of relatively low habitat value or low use by biota (distance offshore, depth, areas with low known resource value); timing of dredging and disposal events to avoid overlap with sensitive migration or life history periods of listed species; using dredged material testing protocols to ensure the suitability of materials for discharge; conducting monitoring events (physical, chemical and biological) to determine if unacceptable impacts are occurring at disposal sites; performing annual review of monitoring results; and adaptively managing sites in light of the above. Disposal fees, determined by the Legislature, are used to pay for the cost of environmental monitoring of the disposal site.

In addition to the scientific monitoring of the disposal site, all dredging actions that generate material for open water disposal require the issuance of a Section 10 and Section 404 Permit (Clean Water Act) which triggers an ESA Section 7 consultation. The material to be dredged receives scientific analysis for chemicals of concern and must meet strict standards to be eligible for disposal at this site. Beneficial use (such as beach nourishment or habitat restoration) of clean dredged material is the preferred use. If not used for beneficial use or disposed of at an approved uplands location, site use authorizations are issued for disposal of clean, approved dredge material at the designated disposal site per RCW 79.105.500.

The site is situated in about 130 m (425 ft) of water (Figure B-17, Appendix B). The disposal site was designated for fifty years beginning in 1989 and will be periodically reviewed. The site has been designated for a capacity of 1.02 million m^3 (1.33 million yd^3) over the lifespan of the site. The following list presents the historical use of the dredge material disposal site:

Table 5: Volumes of Dredged Material Disposal at Anderson/Ketron Openwater Disposal Site

Date	Source	Volume Disposed (yd^3)
1993	LOTT	3,600
1993	Day Island Yacht Club	6,597
1995	Indian Cove	8,677
2004	Olympia Yacht Club, Pickering Passage	5,772
2005	Dept of Transportation, Tacoma Narrows Bridge	8,180
2007	Port of Anderson Island, Olympia Yacht Club	10,507
2008	Dept of Transportation, Tacoma Narrows Bridge	97,310
1993-2008	Total Volume Disposed:	140,543

Wildstock Geoduck Harvest

The Washington State wildstock Geoduck harvest is managed cooperatively by the treaty Tribes of Washington and DNR. Harvest of wild geoduck is currently taking place within the reserve (Figure B-14, Appendix B).

Aquaculture

A very small part of the tidelands within the Reserve area can be considered, currently or historically, as managed for aquaculture use. Certain practices associated with aquaculture have the potential to modify natural benthic and epibenthic communities. Shifts in these communities resulting from various aquaculture practices and the possible results are discussed further in Simenstad and Fresh (1995).

Aquaculture uses are found on the west side of Nisqually Reach, adjacent to the Reserve, and in limited areas of Anderson Island. One aquaculture operation, National Fish and Oyster Company, cultures about 300 acres of Pacific oysters, Manila clams and geoducks on the west side of the reserve in between McCallister Creek and Tolmie Park. Two other companies, Seattle Shellfish and Allen Shellfish, are also growing geoducks and other types of shellfish in that area, adjacent to the Reserve. National Fish and Oyster, which has been doing business in the area since 1939, also operates an oyster seed floating upwelling system (FLUPSY) in Oro Bay on Anderson Island.

Education and Research

Current conditions of the Nisqually Reach Aquatic Reserve also provide an existing infrastructure for environmental education, scientific research and monitoring opportunities. Proximity to the Nisqually estuary restoration allows unique opportunities for monitoring the effects of a large-scale estuary restoration project on adjacent intertidal and subtidal habitats. The area includes sufficient habitat to support healthy populations of marine and terrestrial species that use the region. A large portion of the shoreline within the reserve boundary is currently protected because of adjacency to existing State, city and Federal protected areas; and little additional disturbance has occurred and nearshore processes appear to be properly functioning.

III. Potential Future Impacts

This section identifies and discusses potential threats to aquatic resources within the reserve, including future land use scenarios, spill scenarios, energy projects, non-essential pipeline or transmission line rights of ways, increased recreational use and mooring buoys, invasive species, shoreline modification, and climate change.

The Nisqually Reach Aquatic Reserve is susceptible to a number of potential future impacts stemming from expanding upland development to increasing recreational and commercial overwater use. While DNR only has the authority to manage state-owned tidelands and bedlands, other potential uses adjacent or near the reserve may have indirect impacts on the reserve and must be identified and acknowledged if a comprehensive management plan is to be developed.

It is difficult to predict all potential future activities that might pose a threat to the site. The fact that the site is not relatively isolated from urban shoreline development could make it vulnerable to activities or land uses whose siting criteria prefer locations near urban development, such as residential developers, energy utilities, resorts and marinas. Activities within the reserve that could increase risks of major disturbance or entrapment of birds or marine mammals, negatively affect water quality, or food web interactions on state-owned aquatic lands are of major concern. Management actions taken within the reserve and during the reserves designation will ensure they are consistent with the Goals and Objectives of this Management Plan.

Future Land Use Scenarios

Increased population growth in Pierce and Thurston Counties is expected to place pressure on ground water withdrawal, stormwater runoff, and sewage treatment. The level of impact these uses have on the Aquatic Reserve is highly dependent upon coordination between the municipal authorities and regulatory agencies, in this case, DOE. City and county shorelines are regulated under the Shoreline Management Act while land/water use and protection use is regulated under the Comprehensive Growth Management Act. Ground water withdrawals, stormwater, and sewage treatment are all regulated under various sections of DOE's water use and water quality laws.

The potential for future growth along the eastern shore of Anderson Island is moderate because most of the Anderson Island shoreline adjacent to the reserve is not highly developed and is designated primarily as natural. The remainder of shoreline is classified as a mix of natural and low intensity under the draft Pierce County SMP (Pierce County, 2011). Tolmie State Park, McNeil Island, Eagle Island State Park and several shoreline parks around Anderson Island will not allow development on large portion of their shorelines adjacent to the reserve.

Energy

Hydrokinetic energy

There has been an increasing interest in tidal, wave, and in-stream river (hydrokinetic) electricity generation in Puget Sound, the Columbia and Snohomish Rivers, and off the coast of Washington. There are active proposals on the coast and in the Columbia River and Puget Sound. Hydrokinetic energy proposals have not

been considered for the South Sound region with the exception of the Tacoma Narrows area.

Pipelines, Utility and Transmission Lines

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 to marine outfalls. Impacts associated with such discharges are discussed in the outfall section.

Transmission, fiber optic and other utility lines carry power and communication services to urban and rural areas. The lines can be buried or laid above ground and on tidelands and bedlands. Lines are typically buried in the nearshore and laid on the bedlands when running to islands. In the past, when lines required replacement, older lines were simply abandoned because removal was considered either too disturbing or financially not feasible.

The operational impacts of a pipeline increase as the size and capacity of a pipeline increase, and are dependent on the type of material being transported in the pipeline. Additionally, larger pipelines typically convey larger quantities of materials and therefore may discharge larger quantities of materials if the line fails. The type of material being transported also dictates the potential severity of impacts from a spill as a result of a failure.

Abandoned cables, pipelines, and utility lines are an encumbrance on state-owned aquatic lands. Non-essential cable or pipeline rights of ways, easements, or leases may pose a serious threat to the sub-tidal habitats in the Aquatic Reserve.

Water Quality and Spill Scenarios

Outfalls

Outfalls are locations where storm and treated sewage water are discharged, generally into other hydrologic systems away from their source. Urban sewage is collected at a central location for treatment while septic systems collect and dispose of rural household waste. Pierce County is currently updating its Phase I Municipal Stormwater Permit and Thurston County is currently implementing its Phase II Municipal Stormwater Permit. Stormwater outfalls are covered under the previous Municipal permit requirements while permits are updated.

Future residential upland development is likely to occur along the Nisqually Reach shoreline which may result in additional permitted outfalls. Outfalls may pose a threat to the Nisqually Reach Aquatic Reserves nearshore environment and water quality. DNR should monitor new outfalls closely as they are built, and older ones as they are re-permitted, working with municipalities, DOE, Joint Base Lewis-McChord and the Department of Transportation.

Spill scenarios

The South Puget Sound Geographic Response Plan and Nisqually Geographic Response Plan Scenario planning has identified the following potential risks in South Puget Sound (DOE Spills Program, 2007). The identified risks may or may not actually occur and are defined as an identified probability of spill hazard to the Nisqually

River, Nisqually Reach and waters within the Reserve Boundaries. DNR should remain aware of these risks, coordinating through the DOE Spill Response and Prevention Program as needed:

Joint Base Lewis-McChord

The U.S. Army conducts field training on Joint Base Lewis-McChord throughout the year. This training routinely involves transportation and field storage of fuel (predominately JP-8) and field refueling of vehicles and aircraft. A worst-case scenario spill would involve an accident on the bridge or at the tank crossing site involving a 7,500 gallon military tanker truck with JP-8 overturning and spilling the majority of its fuel into the river. The probability of such a spill is considered small, and no spills into the river from Army training have been recorded. However, the risk remains as long as Army training activities continue.

The Solo Point area and nearby offshore waters are used periodically for amphibious assault training. The spill risk associated with amphibious assault training is unknown.

Train Traffic Spill Risk

Hazardous materials are transported on the BNSF Railway lines however, railroad transportation of hazardous materials is far safer than transporting material on highways, which has a 16x higher likelihood of an incident (P. Brady, BNSF pers. comm., 2011). Some level of risk remains when transporting hazardous materials on any railroad. Another risk associated with train traffic is an accident that impacts the locomotive fuel tank, which is capable of containing between 2000 and 6000 gallons of diesel fuel (Ecology, Post, 2011). BNSF Railway has instituted many types of operational, engineering, and maintenance procedures to minimize the risk of releases to the environment. As required by the Federal Railroad Administration, BNSF Railway conducts routine track and bridge inspections to maintain rail line safety and other operational controls, and to minimize the potential for accidents or derailments (Brady, P. BNSF, pers. comm. 2011).

BNSF Railway also has a release notification and emergency response process coordinated through its Service Interruption Desk and maintains a System Emergency Response Plan with a trained internal and external response network. BNSF Railway also periodically conducts training or offers training opportunities to local community responders (through TRANSCAER) (P. Brady, pers. comm., BNSF, 2011).

Since 2003, there have been 213 documented rail incidents resulting in spills throughout Washington State. Of those, two were in the Nisqually region and two were in Steilacoom. On February 8 1996, a landslide near Steilacoom caused a derailment at Solo Point. One of the locomotives fell into Puget Sound, where its fuel tank ruptured, leaking approximately 3,200 gallons of diesel into the water. On May 16, 2007, two trains collided head-on near the Nisqually Valley in Thurston County. Environmental engineers estimated between 230 and 630 gallons of diesel fuel spilled from one locomotive (Post, R. Ecology, Personal Communication 2011). This collision led to a minor sheening on a nearby wetland. On October 18, 2007, a derailment spilled cargo (wheat, soybeans) on the shoreline in Steilacoom (DOE Response Tracking System # 601460; R. Post, DOE, pers. comm., 2011).

Train traffic increases the risk of large scale derailments and collisions risking hazardous cargo and fuel tank ruptures. Information provided on the safety procedures and practices taken by BNSF Railway and the number, dates and types of incidents statewide and within the boundaries of the Nisqually Reach Aquatic Reserve places has resulted in the listing of this risk in the management plan.

Vessel Traffic Risk

Maritime shipping increases the risk of invasion by non-native species in Puget Sound and the Strait of Georgia. Un-exchanged ballast water discharges from commercial ships can be a vector for introducing non-indigenous species. Nonnative aquatic plant and animal species can displace, disturb, consume, and compete with native species (CRS 2007, 2010). Non-native organisms may also be attached to the hulls of commercial vessels.

The department of Ecology and the U.S. Coast Guard currently require ballast water exchange to occur 200 nautical miles from any shoreline in water that is 2,000 feet deep. Current regulations require a mandatory 300 percent exchange of ballast water. Additionally department of Ecology inspectors routinely board vessels to ensure compliance.

Marine vessel traffic in the area may increase the risk of spills, discharges, and increase the possibility of “strike” to wildlife in the vicinity of the vessel. This may include fish, diving birds, seals, dolphins, but the most commonly followed example is that of ships or vessels striking whales. Whale strikes by vessels are not known to occur commonly in the Nisqually Reach area (R. Post, pers. comm., 2011)

The Coast Guard, Department of Ecology and the maritime industry have necessary procedures and technologies in place to significantly reduce the likelihood of oils spills and minimize spill volume. However, the possibility exists for future spills, which could have a particularly catastrophic impact on the recently restored Nisqually Estuary, and the habitats and species found within the Aquatic Reserve.

Recreational Vessels

The Nisqually Reach area is a popular recreation boating and fishing destination and includes approximately six marinas within or adjacent to the Reserve. Recreational vessel traffic represents a medium to high risk of impacts such as litter, physical and chemical impacts to nearshore environments (including prop scour, chronic lubricant and fuel leakage, and shading of aquatic vegetation) as well as increased damage to submerged aquatic vegetation and macro algae from anchoring and gear loss.

Shoreline Modification

Shoreline modification includes bulkheads and armoring. Areas of the South Puget Sound have extensive shoreline armoring. The Thurston County Regional Council reported an estimated 30% - 35% of the county shoreline is armored. The report states that shorelines with armoring, particularly bulkheads, differ significantly from unarmored shorelines with regards to the following characteristics:

1. Reduced beach area and thereby reduced forage fish spawning habitat in the upper tidal zone.
    a. Reduced local sediment recruitment potential

b. Lowered elevation profile of beaches
c. Reduced area of sand & small gravel, in relation to beach width
d. Lack of wood debris from either adjacent riparian areas or lack of large woody debris (LWD) from offshore recruitment and retention
e. Reduced shade/cover along upper beach from removal of riparian vegetation

2. The loss of upper beach habitat is more pronounced as the percentage of shoreline armoring increases.
3. Preservation of unarmored shorelines will minimize further impacts to upper beach habitat.
4. Landslides and larger rivers both provide a potentially significant source of sediment.
5. Shoreline armoring, in certain scenarios has the effect of stopping landslides and reducing upland inputs of sediments over years or decades.

Additional shoreline modification within the aquatic reserve poses potential threats to nearshore processes.

Marinas and Public Docks

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 Washington Department of Health, as mandated by the National Shellfish Sanitation Program, establishes shellfish closure zones around marinas. 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. 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 (EPA CZMA Reauthorization website).

Recreational Use

Increased boating traffic increases the likelihood of impacts of litter, and physical and chemical impacts to nearshore environment (including prop scour, chronic lubricant and fuel leakage, and shading of aquatic vegetation) as well as, increased damage to submerged aquatic vegetation from anchoring, and gear loss.

Other recreational uses within the Aquatic Reserve boundary include salmon fishing, crabbing, shellfish digging, birding, nature and wildlife photography, kayaking, diving, and environmental education. While DNR promotes public use through proprietary authorizations and providing access to state-owned aquatic lands, DNR does not have regulatory authority to manage public recreational activities such as boating, fishing, recreational shellfish digging, swimming, and beach walking. DNR

does have the ability to close areas to public access in order to protect sensitive habitats and species. DNR will promote and encourage appropriate, legal transient public recreational activities within the reserve (such as boating, water skiing, fishing, recreational shellfish digging, swimming, and beach walking) conducted in a manner that preserves the habitats and species of the reserve.

DNR does not regulate commercial or recreational fisheries, but has authority over activities that require leases on state-owned aquatic lands (bedlands and tidelands). Review of the scope of these activities and potential target strategies will be explored during implementation of the management actions. DNR recognizes that the WDFW and Washington's Treaty Tribe co-manage the state's fisheries, therefore fisheries management is outside the scope of the Aquatic Reserves Program.

Recreational Docks and Mooring Buoys

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 vessel. 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 to enhance opportunities for predation.

Recreational mooring buoys and docks may be authorized for abutting residential owners if the proposal meets the requirements of RCW 79.105.430. The permission granted by RCW 79.105.430 may be revoked or altered if DNR makes a finding of public necessity to protect waterward access, ingress rights of other landowners, public health or safety, or public resources. Examples of uses not qualifying include mooring fields, commercial buoys, and public access buoys.

Dredging and Dredge Material Disposal

Concerns were raised during the Aquatic Reserve Planning process that reserve designation would interfere with ongoing use of the Anderson/Ketron DMMP site. Representatives from the agencies involved in DMMP site management met to share current use restrictions and data on background levels of dioxin. Sediment analysis following the last disposal event at the site (2008) showed a decrease in dioxin levels from the 2005 levels . Planning committee members expressed interest in observing the next disposal cycle to verify that the site is non-dispersive and does not bury identified hard bottom communities in the deeper areas of the reserve.

The Anderson/Ketron deepwater disposal site is an approved use within the Reserve contingent on the scientific oversight of the Dredged Material Management Program (DMMP) agencies consisting of the Army Corps of Engineers, Environmental Protection Agency, State Department of Ecology and State Department of Natural Resources. Additional scientific review with reasonable and prudent measures and terms and conditions for this use is provided in the Endangered Species Act (ESA) section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH)

Consultation dated December 10, 2010 for yelloweye rockfish, canary rockfish and bocaccio. Other guiding documents that apply are the Informal Consultations for ESA listed salmonids and marine mammals (1999/01195, 1999/01261, 2000/00696, 2005/00484, 2007/03507)); the Updated Environmental Monitoring Plan for Unconfined, Open-water Dredged Material Disposal Sites, non-Dispersive PSDDA Sites in Puget Sound(January 2007); and the Environmental Impact Statement (1989). The DMMP solicits input and review through a transparent public process with an annual review, issues discussion, clarification papers, disposal site monitoring results, and other publications.

Climate Change Scenarios

Global climate change is likely to impact the Nisqually Reach Aquatic Reserve area if future predictions of sea-level rise and increased storm events and flooding occur. Rates of sea-level rise are calculated using differences between local sea level and local land level. Differences in sea level rise from one place to another can be substantial. Trends in vertical land movement or changes in local tectonic or soil movement, must be taken into account, and is measured by satellite. Calculations agree that vertical land movement is higher in the north and northwestern part of the Olympic Peninsula, with only small movement in central and southern Puget Sound, and some uplift at the outer coast. Sea level is expected to increase in the Puget Sound Region at an annual increase of .04 - .1 inches (1 - 2.5 mm) per year. A University of Washington Climate Impacts Group study places 2050 sea-level rise values for Puget Sound at 3.1 inches (8 cm), 5.9 inches (15 cm), and 21.7 inches (55 cm) for low, moderate, and high scenarios respectively. 2100 values are 6.3 inches (16 cm), 13.4 inches (34 cm), and 50.4 inches (128 cm) for low, moderate, and high scenarios respectively (Mote, Petersen, Reeder, Shipman, & Binder, 2008). A rise in sea-level will result in increased coastal erosion, and potential disappearance of the connectivity of islands at low tides, as well as an appreciable reduction of the already diminishing land mass of these exposed islands. Changes in the tidal prism, current regime, and permanent inundation of salt marsh areas and vegetated spit/berm will significantly reduce the available nursery and transitional habitat for salmonids, foraging and nesting seabirds, as well as diminishing the availability of suitable haul-out and pupping areas for seals.

Finfish Aquaculture

Finfish aquaculture (net pens) has the potential for significant impacts to water and sediment quality, physical effects to the seabed, as well as the opportunity to introduce harmful organisms, diseases and the potential of genetic alteration to local salmon stocks. Floating net 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). Net 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.

IV. Archeological, Cultural and Historic Resources

According to the Washington Information System for Architectural and Archaeological Record Data, available on the Department of Architectural and Historical Preservation website, there are two notable upland sites adjacent to the reserve boundaries; none of these sites are located on state-owned aquatic lands (DAHP 2011).

Several culturally and historically important sites have been identified in the region and within the reserve boundaries. The Nisqually Reserve is marked by a number of historic events involving the development of water transportation and trading into the Puget Sound. The largest is the arrival of the Hudson Bay Trading Company's ship, the Beaver, in 1836. Hudson Bay established a trading post at Fort Nisqually and Anderson Island is named after the chief trader, Alexander Caufield Anderson. Lt. Charles Wilkes named the island after Anderson because of his warm greeting to the 1841 U.S. Exploring Expedition.

The U.S. Exploring Expedition opened up major transportation corridors for steamships. Soon, thousands of steamships swarmed Puget Sound waters, resembling a mosquito swarm and dubbed "The Mosquito Fleet". The Mosquito Fleet was critical to earlier access and further development of the South Sound region. Competition from superior forms of transportation (rail, diesel engines) and the major highway system led to the demise of Mosquito Fleet in the 1930's (AIHS, 2011; Galentine, E. 2006).

The Nisqually Reach and the surrounding area are currently and historically occupied by the Nisqually Tribe and the Squaxin Island Tribe. The territories of the aboriginal Nisqually and Squaxin Island Tribes included lands on Anderson and Ketron Islands and historic shellfish and fishing grounds around Nisqually Reach a Drayton Passage. In 1854, these Tribes participated in the signing of the historic Treaty of Medicine Creek, and together with the Puyallup tribe ceded over two million acres of homelands in western Washington. The signing took place along McCallister (then Medicine) Creek. The treaty was translated into Chinook Jargon a native language with such limitations to be considered inadequate for describing the concepts. While attempting to preserve fishing rights the treaty removed prime land. The circumstances surrounding the signing, and details of the treaty are considered to have been the catalyst for the Puget Sound War, a one year armed conflict between the United States Military, members of the Native American Tribes, and local militia (Carpenter, C.S. et al. 2008).

Another important historic event directly tied to the Medicine Creek Treaty is the Bolt Decision of 1974. This judgment reinforced Section II of the Medicine Creek Treaty – and all other tribal treaties developed since that time - which stated that "The right of taking fish, at all usual and accustomed grounds and stations is further secured to said Indians, in common with all citizens of the Territory" In 2002 and 2004 ,the federal courts (Judge Rafeedie) applied Tribal U&A rights to shellfish, reflecting the historical region in which finfish, shellfish and other natural resources were collected. This decision clarified the Treaty right to mean, the right to fish for fifty percent of the sustainable harvest biomass of any shellfish species within the

usual and accustomed areas for that Tribe. The Nisqually Reach Aquatic Reserve has usual and accustomed areas for the Nisqually and Squaxin Tribes (Carpenter, C.S. et al. 2008).

The Great Fire of Seattle (1889) burned down most of the central district, and a new building ordinance required rebuilding materials to be of brick or stone, not wood. Small brickyards sprung up around the Sound where good clay and a place to dock boats for transporting the bricks were found. This was the first and only – to this day – industry on Anderson Island (AIHS, 2011; Anderson, R. personal communication, 2011; Wikipedia – Great Seattle Fire, 2011).

Figure 6: Anderson Island Brickmakers[1]

[1]Image of Anderson Island Brickmaking Facility courtesy of Anderson Island Historical Society (http://www.anderonislandhs.org/).

All that remains are remnants of the crudely refined clay bricks, littering the shoreline near the facility – this area which separates Oro Bay from East Oro Bay has become known as "Brickyard Point." (Anderson R. 2011) The Anderson Island Park and Recreation District has acquired ALEA and Conservation Future Grants to purchase this property.

Anderson Island is accessible only by ferry from Steilacoom or by private watercraft, and its remoteness allows the island to remain a desirable summer vacation spot (AIHS, 2011).

4. Management Goals and Objectives

The primary focus in managing the Nisqually Reach Aquatic Reserve is to protect and restore the regions natural biological communities, habitats and ecosystems and process, and the ecological services, uses and values they provide to current and future generations. In addition, the management of the Reserve will focus on providing opportunities for environmental education, and research. This section of the plan identifies the desired future conditions of the site and provides goals and objectives to help ensure that these desired future conditions can be met.

The Nisqually Reach Aquatic Reserve contains aquatic lands of special educational, scientific and environmental importance. Leases for activities in conflict with reserve status will not be issued (WAC 332-30-151). The reserve will not conflict with current uses of this area. If the designation of this reserve presents a conflict with potential future uses, the Commissioner will make a determination as to which use best serves the public benefit (WAC 332-30-151(4b)).

DNR's management program includes preventing conflicting land use activities on state-owned aquatic lands in or near the reserve through actions on new use authorizations and on reauthorizations of existing uses. The extent of the management will consist of a critical review of lease activities to insure proposed activities or structures will not conflict with the basis for reserve designation (WAC 332-30-151 (6)). In addition, DNR will seek collaboration with partners to help implement management actions, and ensure desired future conditions of the reserve are met.

I. Desired Future Conditions

Desired future conditions describe the overall vision for a landscape, providing guidance for developing management goals and objectives. The following describes the future environmental, scientific and educational conditions expected at the Nisqually Reach Aquatic Reserve when the management goals and objectives in the plan are achieved.

The Nisqually Reach Aquatic Reserve Management Plan ensures strong protection of the state-owned aquatic lands in an effort to prevent further habitat degradation. For the first five years, management of the Nisqually Reach Aquatic Reserve will be more focused on education, research, access, and protection than on other aspects of the action plan. This is necessary as much of the reserve is comprised of habitat and substrate that has not been studied to the degree necessary to adequately manage the Reserve. A baseline study of the Reserve should be developed, including identifying/addressing data gaps in bathymetry, deepwater marine habitat, forage fish species, migratory and non-migratory waterbird use, and submerged aquatic

vegetation. Existing data will be used; surveys will only be performed if data is out-dated, of poor quality or non-existent. Management actions should be re-visited in accordance with an adaptive management approach to ensure that all actions support the Nisqually Reach Aquatic Reserves vision.

The Nisqually Reach Aquatic Reserve Management Plan also supports re-establishment and rehabilitation in order to reduce current habitat degradation and restore natural processes that support a healthy nearshore environment. DNR should support shoreline and embayment habitat restoration efforts that will lead to improved spawning and rearing habitat for important fish species such as salmon, herring, surf smelt and sand lance. Restoration of areas degraded by hard shoreline armoring should be supported to help restore shoreline sediment transport processes that create and sustain habitats, including forage fish spawning and juvenile salmon migration corridors. Improved ecological conditions may also increase foraging opportunities for resident and migratory birds and waterbirds. DNR should support an inventory for marine debris and any subsequent removal that may decrease the potential mortality of species that use the region.

DNR should emphasize and cooperatively work toward building partnerships with adjacent land owners, land managers and local stakeholder organizations and projects, like the Nisqually Reach Nature Center, the Important Bird Area Project by the National Audubon Society, and the South Puget Sound Salmon Enhancement Group. Cooperative partnerships should support current scientific, educational and environmental activities and potentially address negative effects from adjacent property conditions. DNR should work with identified parties to reduce water quality impacts to the aquatic reserve and adjacent nearshore areas.

The Nisqually Reach Aquatic Reserve is designated as an Educational reserve and DNR will support the state law to provide education at all grade levels (RCW 28A.230.020). DNR should identify and use existing natural laboratories for observational inquiry, such as those provided by Nisqually Reach Nature Center and the USFWS. DNR should support educational opportunities for all agencies, consider habitats that are underrepresented, and support outreach identifying any unique species, micro-habitats or communities. DNR should support safe and ready public access, including paths or boardwalks, or other measures (Final Aquatic Reserve Guidance 2005).

DNR encourages public access to the Reserve, and will partner with groups and adjacent landowners interested in providing access to state-owned aquatic lands; for example, the Nisqually Reach Nature Center provides onsite accessibility to state-owned tidelands within the Reserve boundaries. The Reserve should have multiple public access sites on islands and the mainland to a diversity of identified aquatic resources, from diving sites to eelgrass beds and migratory bird habitat.

As a Scientific Reserve, the interests of the scientific community should be supported by allowing current or future research projects provided no irreparable harm to the ecosystem, conservation targets or goods and services including the physical structure of a site occurs. DNR favors sites that have a history of ongoing monitoring efforts, and DNR should partner and support the Nisqually Reach Nature Center, NOAA-Fisheries, USGS, Audubon Society, USFWS and other interested parties in these efforts.

To achieve these desired future conditions, the following goals and objectives have been adopted. The objectives are a product of the outreach, analysis, advisory committee meetings, and public input during the Nisqually Reach Aquatic Reserve management planning process. These objectives were developed for the exclusive management of the Nisqually Reach Aquatic Reserve.

Goal One: Preserve, restore and enhance the aquatic nearshore and subtidal ecosystems with a special emphasis on native habitats for forage fish, salmonids, and waterbirds.

Objectives

1.1 *Protect fish spawning and rearing habitat and movement corridors.* Protect documented spawning and rearing areas from negative impacts associated with new developments on SOAL. Over time, minimize and eventually eliminate the negative impacts associated with existing uses on SOALs that are shown to demonstrate an adverse effect to the ecological functions that support spawning, feeding and rearing habitat.

1.2 *Identify and minimize 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.

1.3 *Maintain Clean Water Act standards for water and sediment quality.* Maintain water and sediment quality such that listing of water bodies or segments within the reserve as impaired under the Clean Water Act is unnecessary.

1.4 *Sustain or increase the documented extent and species composition of native aquatic vegetation.* Eelgrass and kelp beds should not decrease due to anthropogenic impacts from the baseline level that reflect the area and density at reserve establishment.

1.5 *Protect and restore intertidal sand and mudflat habitats.* Document total area of sandy intertidal and mudflat habitats and specify any unique habitat features (e.g., USGS surveys) or waterbird “hot spots” which may require priority protection.

1.6 *Promote and support research on species-habitat associations.* Support research on the habitat requirements and behaviors of deepwater fish and invertebrates within the reserve

1.7 *Prevent aquatic nuisance species from invading or disrupting the ecosystem.* Prevent aquatic nuisance species not already found within the reserve from establishing populations within the reserve. For those established aquatic nuisance species that have the capacity to disrupt the ecosystem, undertake appropriate management actions to reduce the abundance and threat to the ecosystem posed by these aquatic nuisance plant or organisms.

1.8 *Protect nearshore waterbird habitat.* Maintain undisturbed shoreline habitats where birds can rest and feed, breed, and over-winter for migratory and non-migratory species.

1.9 *Protect marine mammal haul-out areas.* Maintain and protect haul-out sites documented within the Reserve. Examples include the haul-out locations on Eagle Island and the adjacent Wildlife Area on McNeil Island which is part of the South Puget Sound Wildlife Area.

1.10 *Support efforts to restore habitat and conditions for Olympia oyster propagation.* Support restoration and protection activities that will result in potential habitat for the Olympia oyster.

Goal Two: Protect and restore the functions and natural processes of nearshore, deepwater, and open water ecosystems within and adjacent to the reserve.

Objectives

2.1 *Maintain the integrity and function of nearshore drift cell processes.* Support efforts to reduce impacts of shoreline modification on nearshore drift cell processes. Survey the amount of shoreline modification throughout the Reserve and identify areas where modification is negatively impacting drift cell processes. Support restoration projects that reduce the impact of armoring and modification on the shoreline.

2.2 *Protect and restore hydrologic functions and water quality at stream mouth estuaries.* Support efforts to maintain natural flow regimes in streams and seeps entering the reserve.

2.3 *Work cooperatively to identify and minimize existing and potential future impacts and restore degraded functions on the nearshore environment resulting from outfalls and runoff discharging into 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.

2.4 *Pursue eelgrass and bull kelp restoration and protection opportunities where viable.* Native eelgrass is a an important ecosystem component in the Aquatic Reserve and opportunities for protection and restoration will be pursued as well as research and monitoring to determine if eelgrass can successfully be used to track ecosystem stressors. Bull kelp was historically an important ecosystem component in the Aquatic Reserve and opportunities for delineation and protection of remaining stocks and restoration will be pursued.

2.5 *Support actions that protect deep-water processes.* Support activities that explore and research the unique deep-water benthic sand waves and exposed hard bottom habitat areas to better understand the functions of deep-water sediment transport and habitat within the Reserve.

2.6 *Support research to identify, classify and map the biological and physical environment to locate unique habitats and habitats characteristic of special status species.* Partner with stakeholders to characterize unique habitats and special status species.

Goal Three: Promote stewardship of riparian and aquatic habitats and species by supporting and providing opportunities for outdoor education, scientific research including Citizen Science and interpretive studies.

Objectives

3.1 *Promote 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.

3.2 *Create 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 DNR through the Nisqually Reach Nature Center from interested parties and the public regarding the Nisqually Reach Aquatic Reserve.

3.3 *Support scientific research related to management of the Reserve through identification and prioritization of 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.

3.4 *Support educational opportunities in coordination with other entities, adjacent landowners, and treaty Tribes that will provide information and access to a wide audience.* The reserve will enhance environmental protection through public awareness and education opportunities and ensure leasing activities are consistent with the objectives of education, allowing for some manipulation in order to support the benefit of research, education and public access.

3.5 *Create opportunities for the public and adjacent homeowners to express preferences on the appropriate level, places and types of public access within the aquatic reserve*. The reserve will ensure public access exists within and surrounding the boundaries, while respecting the public's right to privacy. DNR will help provide web-based opportunities to provide feedback on preferred types and locations for public access within the reserve.

3.6 *Collaborate with other reserve management partners, programs, and management actions to ensure connectivity across the Aquatic Reserve Program.* Coordinate environmental education opportunities and partnerships with other reserves education programs when appropriate.

Goal Four: Promote sustainable management of traditional recreational (e.g., boating, water skiing, fishing), commercial and cultural water-dependent uses in and adjacent to the site in a manner consistent with the goals for the reserve.

Objectives

4.1 *Work 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.

4.2 *Foster 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 access to public lands within and adjacent to the reserve. The reserve will provide a variety of quality opportunities to interact with aquatic resources that are safe, sustainable, consistent with state regulations, and compatible with reserve resources and purposes.

4.3 *Support 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.

Goal Five: Support the recovery and protection efforts for federal and state threatened and endangered species, species of special concern and their habitats.

Objective:

5.1 *Identify, monitor and protect all special-status plant and animal species found in the reserve.* DNR will work with WDFW, NOAA-Fisheries, interested Tribes and USFWS to support recovery of identified state and federally listed plant and animal species, such as forage fish, Chinook salmon and bull trout, by protecting and restoring suitable habitats within the reserve. Emphasis should be placed on species that are listed, proposed for listing, or candidates for listing at the state or federal level.

5. Management Actions

Management actions developed for the Nisqually Reach Aquatic Reserve seek to preserve natural environmental conditions while encouraging low impact public use opportunities that do not adversely affect resource values the Reserve is intended to protect. Management actions will also focus on the unique opportunities available for supporting and promoting environmental and scientific research. The management actions are intended to improve the ecological condition of the reserve and assist in the adaptive management process that occurs after the first 10 years of implementation (see introduction, Section 4).

As discussed in the introduction to Section 4.0, DNR will use this plan to guide decisions regarding authorizations for uses of SOAL within and directly adjacent to the aquatic reserve. The management emphasis for new authorizations on state-owned lands is to ensure new uses are consistent with the management plan's Goals and Objectives. Management of existing uses located on SOAL within or directly adjacent to the reserve stresses aiding in reducing impacts and ensuring the use conforms to the goals and objectives over the 90-year time frame of the reserve (WAC 332-30-151).

Since impacts to sensitive habitats and species within the reserve may be attributed to activities that DNR does not have explicit authority to manage, such as upland uses, DNR will seek management cooperation and collaboration from others managing groups or agencies. DNR will work with regulatory agencies, Tribes and others to ensure that existing and future uses and activities support the management goals and objectives of this plan.

This section details management actions that focus on the protection and restoration of sensitive aquatic resources in the context of planning for existing and future uses of state-owned aquatic lands within the Reserve. Implementation of the management actions will help attain the desired future conditions and Goals and Objectives identified in section 4. Nisqually Reach Aquatic Reserve management can be divided into five primary categories:

I. Resource protection, enhancement and restoration
II. Monitoring and research activities within the reserve
III. Environmental education
IV. Uses on state-owned aquatic land
V. Other uses within the reserve

I. Resource Protection, Enhancement, and Restoration

The Nisqually Reach Aquatic Reserve Management Actions are designed to support the Goals and Objectives in Section 4.0. Management actions help to maintain sensitive aquatic resources, plan for existing and future uses of state-owned lands, direct public use, and facilitate stewardship, research, monitoring, and environmental education. Protection maintains existing conditions by removing threats, restoration focuses on re-establishing the natural processes, while enhancement is designed to address degradation.

A. Protection

Protection of aquatic resources within the Nisqually Reach Aquatic Reserve is primarily achieved by restricting DNR authorizations that may harm, alter the naturally occurring condition, or further degrade sensitive and unique aquatic resources within the reserve and ensuring re-authorization and new use authorizations are consistent with the goals, objectives and management actions of the Nisqually Reach Aquatic Reserve Management Plan. Where opportunities arise, DNR will partner with state and local governments, Tribes, non-profit organizations, businesses and adjacent landowners to identify and implement protective practices within the Reserve and adjacent aquatic areas and uplands. When appropriate, DNR will support the development of site-specific habitat protection plans.

Management actions

1) Identify at the watershed scale, the watershed processes in the Nisqually Basin and the human activities that impair them. Rate the level of importance and impairment. Develop a plan for protection and restoration of the impaired processes (Grigsby et al. 2009) (also see Management Action II-A-2).
   Meets Goals 1 and 2

2) Focus appropriate DNR partnerships on the placement of important habitat on adjacent aquatic lands into conservation easements when possible.
   Meets Objectives 2.1, 3.1, 3.5, 4.1, 4.2

3) Emphasis will be placed on the acquisition of adjacent tidelands and shoreline property through gifts.
   Meets Objectives 2.1, 3.1, 3.5, 4.1, 4.2

4) Allow successional and other natural processes to operate unimpeded.
   Meets Goals 1 and 2

5) Ensure new and re-authorized uses are consistent with current and future habitat stewardship measures.
   Meets all Goals

6) Do not allow new use authorizations that will degrade the intertidal, subtidal, and deepwater habitats, ecosystem functions and processes, or cultural significance within the Aquatic Reserve.
   Meets all Goals

7) Work with new and existing marinas to encourage and support Clean Marina Certification within and adjacent to the Reserve. Where feasible docks and moorages with authorizations for use of state-owned aquatic lands that have facilities for more than 10 boats must have a written plan that identifies sewage management options for vessels that have holding tanks or portable toilets and available upland restroom facilities. DNR will work with the marine facilities in Oro Bay, the local boating community and other partners such as the Nisqually Reach Nature Center and Puget Soundkeeper Alliance to seek installation of at least one pump out facility to serve the boating community within the Reserve. **Meets Management Objectives 1.3, 1.6, 2.3**

8) Encourage all marinas adjacent to and within the Reserve to become members of the Clean Marina program.
Meets Management Objectives 1.3, 1.6, 2.3, 3.4, 4.1

9) Work with the Puget Sound Keeper Alliance on finding ways to reduce potential discharge from marinas to the waters adjacent to or within the Reserve.
Meets Management Objectives 1.3, 1.6, 2.3, 3.4, 4.1

B. Enhancement

DNR will encourage the enhancement of natural processes and habitats. Because enhancement does not address degradation and to enhance is to improve quality, if enhancement is not currently feasible or if habitat degradation is identified, restoration of habitat and species may be conducted to prevent further degradation (See Section C). When necessary, enhancement plans will be developed and will include involvement from all relevant parties including state and local governments, Tribes, non-profit organizations, businesses and affected landowners.

Management actions

1) Identify un-impaired habitats that would contribute to forage fish or salmonid survival if certain habitat functions were enhanced. Work with partners to identify funding sources for enhancement projects.
Meets Objectives 1.1, 1.4, 1.5, 1.6, 1.7, 2.2, 2.4, 3.1, 3.2, 3.3, 3.6, 4.1, 5.1

2) Work with partners and regulatory agencies to inventory appropriate sites for enhancement through use of beneficial dredge material.
Meets Objectives 1.5, 1.10, 2.1, 2.4

3) Work with regulatory agencies to streamline permits for use of beneficial dredge material at sites identified through inventory.
Meets Objectives 1.5, 1.10, 2.1, 2.4

4) Work with partners to identify potential enhancement activities that will support the management of the Reserve.
Meets Objectives 1.2, 1.7, 1.10, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3, 3.6

5) Support efforts to enhance native vegetation along the shoreline, particularly along county-designated setback zones landward of bluffs to

provide stabilization.
Meets Objectives 2.4, 3.1, 3.2, 4.1

6) Support voluntary marine debris beach cleanups, to be coordinated through community organizations or non-profits.
Meets Objectives 1.3, 1.5, 1.8, 1.9, 1.10, 2.2, 3.1, 3.2, 3.6, 4.1

C. Restoration

DNR Aquatic Reserves Program will participate in planning to identify appropriate locations that have significant levels of impaired processes and are appropriate for restoration activities. DNR will partner with state and local governments, Tribes, non-profit organizations and adjacent landowners, where appropriate, to assist in the development and guidance of restoration plans.

Management actions

1) Identify at the watershed scale, the physical processes in the Nisqually Basin that are impaired by human activities. Rate the level of importance and impairment. Develop a plan for protection and restoration of the impaired processes (Grigsby et al. 2009).
Meets Objectives 1.2, 2.1, 2.3, 3.1, 3.4

2) Partner with various entities like the South Puget Sound Salmon Enhancement Group and the Nisqually Reach Nature Center to identify restoration needs within the reserve, develop restoration plans, prioritize projects and help seek funding for their implementation and completion.
Meets Objectives 1.10, 2.1, 2.3, 2.6, 3.1, 3.2, 4.1

3) Use best available science, for example, Williamson, Walley, & Brakensiek (In Press: March 2011) and Williamson, Hodgson, Ellings, Leischner, & Cultler (In Press: April 2011) to inform the identification of restoration needs, and the development of restoration plans.
Meets Objectives 1.10, 2.1, 2.3, 2.6, 3.1, 3.2, 4.1

4) Support actions for the restoration of specific areas and species within the reserve, partnering with state and local governments, Tribes, non-profit organizations and adjacent landowners where possible.
Meets Objectives 1.10, 2.1, 2.3, 2.6, 3.1, 3.2, 4.1

5) Support proposals for the restoration of native plant species adapted to local conditions of freshwater or marine shorelines where riparian habitat has been either removed or eliminated as a result of past human activities, impairing naturally occurring processes.
Meets Objectives 1.2, 1.3, 1.4, 1.7, 1.8, 2.4, 3.2, 4.1, 5.1

6) Support and lead efforts to identify and restore environments damaged by human-produced disturbances by removing derelict or ghost fishing gear, creosote pilings, derelict vessels, abandoned utilities, bulkheads or any other human-created products that are damaging the aquatic environment and not promoting the goals and objectives of the reserve.
Meets Objectives 1.3, 1.4, 1.5, 1.8, 1.9, 2.4, 3.2, 4.1, 5.1

7) Prioritize restoration projects that support the prosperity of endangered, threatened or sensitive species and habitat, and conservation targets.
Meets Objectives 1.1, 1.2, 1.7, 1.10, 2.4, 2.5, 2.6, 5.1

8) Work with the counties, Tribes, DOE, and the Corps to evaluate the Reserve area for alternative compensatory mitigation options, such as advance mitigation, and in-lieu fee mitigation where on site and in-kind mitigation is not feasible.
Meets Objectives 1.1, 1.2, 1.3, 1.5, 1.7, 1.8, 1.9, 1.10, 2.1, 2.2, 2.3, 2.4

9) DNR will approve new proposals for restoration projects within the reserve when those proposals are determined to be consistent with the management goals and objectives of the reserve and support efforts to connect management activities with other existing restoration projects and plans for the area.
Meets all Goals

II. Research and Monitoring

DNR will seek to partner with local and state governments, federal agencies,Tribes, universities, non-profit organizations and the local citizens and business community to identify and develop research projects within the reserve. All research activities that occur within Nisqually Reach Aquatic Reserve must not result in damage to the ecosystem and must meet the goals and objectives of the reserve.

Identifying gaps in data collected of species assemblages, habitat distribution, and environmental processes within the Nisqually Reach Aquatic Reserve will help managers determine baseline conditions to help inform research at the site. After baseline conditions have been identified, continued monitoring for trends in habitat and species conditions should be conducted. Research can complement trend monitoring by providing possible answers for why species, habitats, and processes may be declining or improving. The following sections further describe the different components of monitoring and research and identify management actions for each.

There are four components to research and monitoring within the aquatic reserve:

A. Identify data gaps, baseline inventory to fill gaps and establish standards for trend monitoring.

B. Establish baseline conditions

C. Trend monitoring to determine the effectiveness of management activities and document natural variation; and

D. Research, to better understand observed changes and the interactions between management activities and natural resource conditions.

A. Data Gap Identification and Baseline Inventory

Effective adaptive management of aquatic resources within the Nisqually Reach Aquatic Reserve relies on having appropriate data. In order to gauge the success of management actions the current condition of ecosystem elements needs to be established in a baseline-type inventory. A baseline inventory will document current conditions by combining existing data with inventories of resources and ecological

processes that are not adequately documented. Through development of the management plan DNR has and will continue to identify areas where data is not available, current or complete. The following data gaps are where baseline research will be concentrated.

Management actions

1) Collaborate with stakeholders to complete a biomass index comprised of vegetation bed area and bed density to reflect native kelp and eelgrass bed conditions at the time of reserve designation.
Meets Objectives 1.4, 1.5, 3.3

2) Collaborate with local, state, federal, and tribal governments, to identify (at the watershed scale), the physical processes and the human activities that impair them, in the Nisqually Basin. Rate the level of importance and impairment (Grigsby et al. 2009) (also see Management Action I-A-1).
Meets Goals 1 and 2

3) Collaborate with non-profits and stakeholders on conducting inventories to determine current status of conservation targets.
Meets Objectives 1.2, 1.4, 1.5, 1.7, 1.8, 2.1, 2.2, 3.3, 4.1, 5.1

4) Determine current status of shoreline geomorphic characteristics and potential shoreline related impacts. A suitable baseline analysis may exist in the Puget Sound Nearshore Ecosystem Restoration Project geodatabase. However, information on priority shoreline sediment sources may be required at a finer scale of resolution (i.e. drift cell) to manage shoreline uses such as armoring and over-water structures.
Meets Objectives 1.5, 2.1, 3.3, 4.1

5) Collaborate with local, state, federal, and tribal governments, and local non-profits to inventory data on identified resources of interest to the Nisqually Reach Aquatic Reserve (e.g., eelgrass, forage fish, salmonids) and support a collective data repository. Emphasis should be placed on the conservation targets in section 3-I of this plan.
Meets Objectives 2.4, 2.5, 2.6, 3.1, 3.2, 3.3, 3.4, 3.5

6) Coordinate with private, governmental, and tribal partners, to continually identify gaps in the collection of data identified above and organize inventory/survey efforts, collection standards to fill data gaps, e.g. eelgrass, macroalgae, forage fish survey standards.
Meets Objectives 2.4, 2.5, 2.6, 3.1, 3.2, 3.3, 3.4, 3.5

7) Identify native and sensitive habitat to prioritize inventory efforts.
Meets Objectives, 1.4, 1.5, 1.6, 1.7, 2.1, 2.2, 2.3, 2.4, 3.1, 3.3

8) Support efforts to identify valuable resources and ecosystem functions previously unknown to the region.
Meets Objectives 2.5, 2.6, 3.3, 4.1, 4.3, 5.1

9) Establish a dataset cataloging current shoreline alterations and the condition of the shoreline at the drift cell scale. This may include data outside the reserve boundary that significantly influences existing conditions within the reserve, i.e. long continuous reaches of shoreline armoring, multiple

overwater structures within the same drift cell.
Meets Objectives 1.2, 1.3, 1.4, 1.5, 1.10, 2.1, 3.1, 3.3

10) Continue to classify and map the subtidal communities within the Reserve boundaries. Partner with stakeholders to outline diving opportunities within the Reserve boundaries as research proceeds.
Meets Objectives 1.6, 1.10, 2.6, 3.3

B. Trend Monitoring

After baseline conditions are identified, monitoring will identify ecological trends to assess whether management actions attain or exceed the goals identified in this plan. DNR will make building partnerships with local, state, and federal governments, Tribes, local non-profits and business a priority when conducting trend monitoring. DNR will also pursue citizen science support opportunities that may benefit the Aquatic Reserve.

Management actions

1) Identify and monitor activities that have the potential for disturbing foraging and nesting waterbirds and mammals.
Meets Objectives 1.7, 1.9, 2.1, 2.2, 2.3, 3.1, 3.3, 3.6, 4.1, 5.1

2) Support and partner with stakeholders on the monitoring of potential impacts from climate change (sea-level rise, ocean acidification, and seasonal changes in salinity) on the aquatic resources within the reserve.
Meets Objectives 3.2, 3.3, 3.4, 3.6, 4.3

3) Conduct forage fish spawning surveys in partnership with WDFW and WSU Beach Watchers.
Meets Objectives 1.1, 1.2, 1.4, 1.5, 1.6, 1.7, 2.2, 2.4, 2.6, 3.3, 5.1

4) Support and partner with stakeholder monitoring programs in support of the reserve's goals and objectives.
Meets Goals 3, 4 and 5

5) Support and partner with stakeholders on monitoring efforts to identify the short- and long-term effects of shoreline armoring and over-water structures on the function and integrity of drift cells and intertidal habitat.
Meets Objectives 1.1, 1.2, 1.3, 1.5, 1.6, 1.8, 2.1, 2.4, 2.6

6) Continue to support mapping and monitoring submarine delta bathymetry including the size, movement, and location of sand ridges and associated covering and uncovering of hard bottom benthic communities.
Meets Objectives 1.6, 1.9, 2.5, 3.3

7) Work with the Puget Sound Partnership and the Submerged Vegetation Monitoring Project to monitor the eelgrass bed along the margin of the Nisqually delta, monitor the non-canopy forming kelp beds along the shorelines of Anderson, McNeil, Ketron and Eagle Islands, and track the long-term health of those important subtidal communities.
Meets Objectives 1.4, 1.10, 2.4

C. Research

DNR will seek to partner with local and state governments, Tribes, universities, non-profit organizations and the local citizen and business community to identify and develop research projects within the reserve. All research activities that occur within the Nisqually Reach Aquatic Reserve must not result in damage to the ecosystem and must be consistent with the goals and objectives of the reserve management plan.

Management actions

Participants in the development of this plan have identified the need for the following data. DNR will seek to partner with local, state and federal governments, Tribes, research institutions, industrial users, and nonprofits to help reduce data gaps.

1) Identify and catalog habitat protection, enhancement, and restoration opportunities with special emphasis on native submerged aquatic vegetation.
   Meets Objectives 1.4, 1.5, 1.6, 1.9, 2.1, 2.2, 2.3, 2.4, 3.1, 5.1
2) Identify additional necessary and immediate protections for forage fish spawning habitats, marine and terrestrial bird habitat, and submerged vegetation.
   Meets Objectives 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.4
3) Conduct detailed seafloor mapping and analyze habitat characteristics associated with deep-water environments within the management area.
   Meets Objectives 1.6, 2.5, 2.6, 3.3
4) Review and comment on research by Nisqually Reach Nature Center interns working with the USGS on deepwater habitats and species associations.
   Meets Objectives 1.6, 2.5, 2.6, 3.3
5) Conduct detailed survey for derelict fishing gear.
   Meets Objectives 1.3, 1.5, 1.8, 1.9, 1.10, 2.5, 3.2, 4.1
6) Research and catalogue archeological, cultural and historical sites and uses located within the Reserve boundaries.
   Meets Objective 3.2, 3.6, 4.2, 4.3
7) Identify the location, extent and quality of forage fish (e.g., surf smelt, sand lance) spawning habitat.
   Meets Objectives 1.1, 1.2, 2.6, 3.2, 3.3, 5.1
8) Prioritize research proposals that focus on threatened or endangered species and habitat.
   Meets Objectives 5.1
9) Support research parameters characterized in a context that contribute to and are appropriate for between-site comparisons across the network of aquatic reserves and marine protected areas throughout Puget Sound.
   Meets Objectives 3.3, 3.6
10) Work with interested parties in proposing research in support of the reserve's goals and objectives.
    Meets Objectives 2.5, 2.6, 3.1, 3.2, 3.3, 3.6

11) Support and partner with, when possible, citizen sampling and data collection efforts.
Meets Objectives 3.1, 3.2, 3.3

12) Work with local colleges, universities, Tribes, local, state and federal agencies and non-governmental organizations to characterize and map the subtidal habitats of the reserve.
Meets Objectives 1.1, 1.4, 1.10, 3.3, 5.1

13) Research potential impacts of ongoing uses in the aquatic reserve to inform potential for degradation of shoreline natural processes through expansion of those uses.
Meets Objectives 1.8, 2.1, 2.3, 3.3, 3.4, 4.1

14) Support the bathymetric surveys being completed by NOAA-Fisheries, Nisqually Reach Nature Center and the USGS to characterize the Nisqually Delta and Reach.
Meets Objectives 2.5, 2.6, 3.3

15) DNR will support cumulative impact research to assess the cumulative impacts of chemicals of concerns in permitted outfalls within the Reserve focusing on analytical methods as described by Lubliner et al (2010).
Meets Objectives 1.3, 1.10, 2.2, 2.3, 3.3

16) Support shellfish aquaculture research. The Nisqually Reach Aquatic Reserve presents unique opportunities for research in a variety of areas supporting recreational and commercial shellfish, low-impact shellfish aquaculture, monitoring studies and impact studies. Provide a venue for public participation in the siting of any shellfish research project within the Reserve boundaries.
Meets Objective 3.3, 3.4

17) Conduct a siting study for future moorage demand. The 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.
Meets Objectives 4.1, 4.2

18) Support research that will help inform the potential impacts and benefits of shellfish aquaculture on aquatic habitat and species in the reserve.
Meets Objectives 3.2, 3.3, 3.4, 3.6, 4.1, 4.3

III. Environmental Education

The Nisqually Reach Aquatic Reserve is designated as an environmental, scientific and educational Aquatic Reserve. An Educational Reserve has a combination of the following attributes, unique physical features of the site enhance environmental protection, ongoing educational opportunities are provided to the public, lease activities are consistent with the objectives of the reserve and public access is present (see Final Aquatic Reserve Guidance 2005).

The existing partnerships and proximity to other protected environments presents a unique opportunity to support environmental education as a secondary objective. Environmental education will be developed, as opportunities arise, to enhance public awareness and care for the outstanding historic, cultural, geologic, ecological, and aesthetic values of the Nisqually Reach region.

Management actions

1) Develop interpretive materials in consultation with local Tribes that include tribal culture and history when possible.
   Meets Objectives 4.3

2) Support, and when possible partner with, efforts of other local environmental education stewards.
   Meets Objectives 3.1, 3.2, 3.3, 3.6

3) Design and erect static displays about the Aquatic Reserve at parks and public access points to convey conservation ethics and stewardship etiquette of the reserve.
   Meets Objective 3.3, 4.2, 4.3

4) Develop education materials and programs related to the management of the Anderson – Ketron dredge disposal site.
   Meets Objectives 3.4

5) Support the proposed expansion of the marine science educational programs offered at Nisqually Reach Nature Center to JBLM community on Solo Point, Anderson Island Community at park properties (owned and operated by the Anderson Island Parks Board), and the Lacey/Thurston County community at Tolmie State Park.
   Meets Objectives 3.2, 3.4, 3.6

6) Support funding to repair or replace the public access and educational pier at Nisqually Reach Nature Center.
   Meets Objectives 3.3, 4.2

7) Explore opportunities for special boat and kayak based educational outings throughout the Aquatic Reserve.
   Meets Objectives 3.1, 3.2, 3.3, 4.1, 4.2

8) Foster cooperative efforts with DOE, WDFW, Tribes and owners of overwater structures to educate on voluntary retrofitting and improvements on existing structures that will diminish wave and light- shading impacts to processes, habitats and species within the Reserve.
   Meets Objectives 3.1, 3.2, 3.4

9) Partner with WDFW, DOE, and/or the Puget Sound Partnership to provide education, technical assistance, and incentives to shoreline property owners on bulkhead removal and the replacement with soft bank or other alternatives that promote natural processes within or adjacent to the Reserve.
   Meets Objectives 1.5, 2.1, 3.1, 3.2, 3.4

10) Support and provide media-based opportunities for the public to learn about and provide input on resources within the reserve boundary, including public access locations.
Meets Objectives 3.1, 3.2, 3.5, 4.1, 4.2

IV. Uses on State-Owned Aquatic Land

A. New Use Authorizations

The following section outlines the requirements and considerations DNR will follow in reviewing new use authorizations for state-owned aquatic lands within and directly adjacent to the Aquatic Reserve:

Management Actions

1) Allow uses within and directly adjacent to the aquatic reserve if the proposed use is consistent with the desired future conditions of the Nisqually Reach Aquatic Reserve, the Goals and Objectives and the Management Actions of this plan . All proposals will be subjected to a critical review pursuant to WAC 332-30-151 and DNR will, in consultation with the Implementation Committee, region staff and other agencies make determinations about the consistency of any proposed uses and will work with proponents when possible.
Meets all Goals

2) For proposed uses on state owned aquatic lands, project proponents must clearly demonstrate consistency with the desired future conditions, the Goals and Objectives, and the Management Actions of this plan. Proponents must demonstrate that the proposed use will not result in degradation to the conservation targets listed previously in this plan and will maintain or improve ecosystem goods and services, and biodiversity at the scale of a shoreline process unit and shore form (defined by the Puget Sound Nearshore Ecosystem Restoration Project Technical Report # 2009-01).
Meets all Goals.

3) Work with proponents of research and monitoring programs within the aquatic reserve to ensure programs are consistent with the reserve's goals and objectives.
Meets all Goals

4) DNR will partner with various entities to support environmental education opportunities associated with the Nisqually Reach Aquatic Reserve and to ensure and encourage sustainable public access to the reserve.
Meets Goals 3 and 4

5) Improve communication between other local, state, and federal agencies on permitting applications for activities in and adjacent to the reserve.
Meets Objectives 1.1, 1.2, 1.4, 1.7, 2.5, 2.6, 3.1, 3.2, 4.1, 4.2

6) DNR will support sustainable recreational activities that are consistent with the Reserve's Goals and Objectives or a specific management action.
Meets Objectives 3.1, 3.2, 3.4, 3.5, 4.1

7) Only allow uses on state-owned aquatic lands within and directly adjacent to the aquatic reserve if the proposed use supports the Goals and Objectives of this plan, including maintaining or improving ecosystem goods and services. Ecosystem goods and services include, but are not limited to; light penetration; sediment transport; tidal and current regimes; freshwater inputs; water quality; nutrient cycling; turbidity; spawning, rearing, foraging and refuge habitat.
Meets all Goals

8) For unforeseen, proposed uses where potential impacts to ecosystem processes have not been documented in peer reviewed literature, proponents must review relevant best available science for the type and scale of the use, and associated impacts, presenting their findings to DNR and the Aquatic Reserve Implementation Committee. The Implementation Committee will review all relevant information presented and provide comments and recommendations to DNR on conditions to avoid or minimize degradation from the proposed use.
Meets all objectives.

B. Existing Use Authorizations

Appendix D lists existing leases and use authorizations within the Nisqually Reach Aquatic Reserve that are active or have a pending application. DNR cannot alter the terms and conditions of existing use authorizations without the consent of the tenant or grantee. This management plan does not alter existing contractual rights and obligations of any use authorization. Existing tenants or grantees may continue to conduct their activities in conformance with their current use authorization and in compliance with other local, state and federal regulations. DNR will encourage voluntary and cooperative efforts of existing lessees to implement the elements of this plan.

C. Reauthorization of Existing Uses

Consistent with WAC 332-30-151, and agency policy for all applications to use any state-owned aquatic land, DNR will consider an application to reauthorize existing uses within or adjacent to the Nisqually Reach Aquatic Reserve when existing agreements expire. At the time of application for reauthorization, DNR will evaluate whether the applicants proposal conforms to this management plan based on the criteria specified previously and below. Consistent with WAC 332-30-151(6) DNR will forward appropriate applications to the Implementation Committee for review and comments. DNR and the Implementation Committee will work with reauthorization applicants to ensure that continued use will comply with the Nisqually Reach Aquatic Reserve Management Plan's Goals, Objectives, and Management Actions and support the desired future conditions.

DNR will achieve the desired future conditions for the Nisqually Reach Aquatic Reserve by integrating contemporary knowledge, research findings, and action recommendations identified in this management plan into future lease and use agreements.

Consistent with DNR proprietary authority, reauthorizations may include terms requiring monitoring to help identify or reduce uncertainty regarding environmental

impacts. This will allow DNR to determine conditions to include in subsequent future use authorizations in order to successfully provide environmental protection for the Aquatic Reserve. If DNR adopts a habitat conservation plan for all state-owned aquatic lands, the agency will also integrate the habitat conservation plan's programmatic measures with the requirements of the Management Plan to address Reserve protection. DNR may require additional measures beyond those required in a habitat conservation plan to provide further protection to conservation targets and biodiversity at the scale of a shoreline process unit, or shore form. Additionally, DNR will expect cooperation from lessees and the support of other interested parties to enhance the quality of habitat and provide long-term protection to the Reserve.

Management Actions

1) DNR will consider the following questions when evaluating re-applications from existing authorizations and to determine consistency with this plan

   - Is the authorization in compliance with conditions of federal, state and local laws and permits?
   - Is the authorization in good financial and contractual standing with DNR?
   - Is the use managed in accordance with this plan and consistent with the Goals, Objectives and desired future conditions of the Nisqually Reach Aquatic Reserve Plan?
   - Has the project proponent submitted a plan proposing actions to reduce existing site-specific impacts to specific habitats and species identified for conservation?
   - Has the Implementation Committee reviewed and submitted comments and concerns regarding the use and application?

   Meets All Goals

2) DNR will use existing knowledge and science and work with other resource management authorities to identify regulatory and proprietary actions necessary to protect resources.
   Meets All Goals

3) DNR will discuss approval of any future use authorizations at the site with WDFW, to determine how to reauthorize a use in a way to ensure protection of ecological benefits provided by the Reserve.
   Meets All Goals

4) Existing cables and pipelines may be re-authorized according to the conditions of section 5-IV-C of this plan. Re-authorizations must be maintained in good condition and inspected on a regular basis to minimize the potential causing environmental harm.
   Meets Objectives 1.1, 1.5, 1.8, 1.10, 2.5,

5) DNR may reauthorize, or approve authorization modifications for existing discharge outfalls serving uses existing at the time of reserve designation if the outfall meets all current local, state and federal regulatory requirements, and water quality standards, if the applicant takes all appropriate steps to avoid or minimize substantial or irreversible damage to the environment,

and if the conditions of section 5-IV-C of this plan are met.
Meets Objectives 1.3, 2.3, 3.1

D. Commercial and Recreational Fishing

DNR does not manage commercial or recreational fisheries except for the commercial wildstock geoduck fishery. Commercial and recreational fisheries within the reserve will continue to be managed by WDFW, responsible tribal governments, and DNR shellfish section staff (wildstock geoduck, recreational and tribal shellfish only).

V. Other Uses

The Nisqually Reach Aquatic Reserve acknowledges that there are potential future authorizations that planners cannot foresee. All applications for uses of state-owned aquatic lands within and directly adjacent to the Reserve will be subject to the critical review pursuant to WAC 332-30-151 and must demonstrate to DNR that no adverse effects to the conservation targets, listed previously in the plan, and ecosystem goods and services will result from their proposal. All new uses within and directly adjacent to the Nisqually Reach Aquatic Reserve must be consistent with the Nisqually Aquatic Reserve Management Plan Goals, Objectives, and Management Actions. DNR retains the authority to authorize uses on state-owned aquatic lands within the reserve per WAC 332-30-151.

Management actions

1) DNR may authorize new uses, unforeseen or not listed in the management plan, only if the use is consistent with the desired future conditions of the Nisqually Reach Aquatic Reserve, the Goals and Objectives and the Management Actions of this plan. DNR will perform a critical review of all proposals pursuant to WAC 332-30-151 and take the Implementation Committee's formal comments on proposed use authorizations into advisement.
Meets Objectives 1.1, 1.2, 1.3, 1.4, 1.7, 2.6, 2.7, 3.1, 3.2, 4.2

2) Project proponents for new or unforeseen uses must clearly demonstrate consistency with the desired future conditions, the Goals and Objectives, and the Management Actions of this plan. Proponents must demonstrate that the proposed use will not result in the degradation to the conservation targets listed previously in this plan, and will maintain or improve ecosystem goods and services, and biodiversity at the scale of a shoreline process unit and shore form, (defined by the Puget Sound Nearshore Ecosystem Restoration Project Technical Report # 2009-01) and use best available science. DNR will, in consultation with the Implementation Committee, region staff and other agencies make determinations about the consistency of any proposed uses and will work with proponents when possible.
Meets all Goals

6. Implementation Guidance

The successful management of the Nisqually Reach Aquatic Reserve will require coordination and collaboration with public and private entities as well as local, state, federal, and tribal government, and non-government organizations. Review and evaluation of sound scientific and management information should guide future development, restoration and protection decisions. To increase collaboration in decision making, DNR will form a permanent Nisqually Reach Aquatic Reserve Implementation Committee, hereafter referred to as the Implementation Committee, whose purpose will be to guide the implementation of this plan and coordinate decisions that will affect the long-term health of resources and ecosystems of the Nisqually Reach Aquatic Reserve.

This section sets up the methods and time frames for the effective cooperative implementation and successful execution of the management actions of the Nisqually Reach Aquatic Reserve Management Plan. This includes the recruitment qualifications for potential members of the Implementation Committee, meeting timeframes, and committee decisions.

I. Nisqually Reach Aquatic Reserve Implementation Committee

The Implementation Committee is charged with the cooperative implementation of the Nisqually Reach Aquatic Reserve Management Plan. This includes, but is not limited to the review of re-lease proposals for restoration, enhancement, research, monitoring, and private or public uses within the aquatic reserve; evaluation and recommendation of restoration, research, monitoring, and educational needs; identification of partnerships for management action implementation; evaluation and consideration of potential sources of funding for management action implementation. The Implementation Committee should meet approximately every four months, or three times per year and develop a work plan to help guide the Committee. DNR will invite representatives of organizations and individuals to participate on the Implementation Committee through formal invitation letters. The Implementation Committee will have approximately 15 members including a reasonably broad spectrum of representation from the following:

- Adjacent land owners/residents
- Scientific community
- Educational organizations
- Government
- Tribal
- Business
- Recreational groups

From the interests listed above, seven permanent members of the committee will include:

- Nisqually Reach Nature Center
- Washington State Department of Natural Resources
- Medicine Creek Treaty Tribes (3)
- Nisqually National Wildlife Refuge
- Local Government

Use Authorization Evaluation Criteria

DNR will present new and renewal use authorization proposals pertaining to the state-owned aquatic lands within the Nisqually Reach Aquatic Reserve to the Implementation Committee for review and comment. Only those use authorization proposals that DNR determines are consistent with the Nisqually Reach Aquatic Reserve Management Plan will be forwarded to the committee. The Implementation Committee will evaluate how well each proposal meets the Nisqually Reach Aquatic Reserve Management Plan Goals, Objectives, and Management Actions. Each proposal should adhere to the proposal guidelines as described in this plan's Management Actions. Use authorizations must not result in degradation to the conservation targets listed previously in this plan, and maintain or improve ecosystem goods and services, and biodiversity at the scale of a shoreline process unit and shore form (defined by the Puget Sound Nearshore Ecosystem Restoration Project Technical Report # 2009-01).

In addition to reviewing and evaluating proposals, the Implementation Committee should discuss the merits of different proposals, including, if appropriate, comments on why a proposal should or should not be considered for acceptance.

Adaptive Management and Management Plan Updates

Scientific research and monitoring will guide Nisqually Reach Aquatic Reserve adaptive management. The management plan must be updated at least every 10 years and sooner if new knowledge and information require it. The process for updating the management plan will include the Implementation Committee serving as an advisor to DNR to help guide the development of an updated management plan.

Committee Decisions

Pursuant with WAC 332-30-151, DNR will retain management authority of the Nisqually Reach Aquatic Reserve and will forward use authorization applications to the Implementation Committee for review and comment. Implementation Committee comments will be received and taken into consideration by DNR as part of the critical review of all lease applications. The committee is not required to operate on consensus and comments from individual committee members should be compiled and submitted to DNR for consideration.

7. Glossary

Adaptive Management: Refers to a process in which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in management planning. Analysis of results help managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

Amphipod: Any of a large order of small, usually aquatic crustaceans with a laterally compressed body (for example, beach fleas).

Anadromous: Migratory fishes that spend most of their lives in the sea and migrate to freshwater to breed.

Aquaculture: The culture and/or farming of food fish, shellfish, and other aquatic plants and animals in fresh water, brackish water or salt water areas. Aquaculture practices may include but are not limited to hatching, seeding or planting, cultivating, feeding, raising, harvesting of planted crops or of natural crops so as to maintain an optimum yield, and processing of aquatic plants or animals.

Aquatic Lands: For the purposes of this publication, all state-owned tidelands and the bedlands of marine waters. Furthermore, aquatic lands mean all state-owned tidelands, shorelands, harbor areas, and the beds of navigable waters (RCW 79.105.060(1)). Aquatic lands are part of the public lands of the state of Washington and include many public places, waterways, bar islands, avulsively abandoned beds and channels of navigable bodies of water, managed by the department of natural resources directly, or indirectly through management agreements with other governmental entities.

Aquatic Reserves Program: The Aquatic Reserves Program is part of DNR's efforts to promote preservation, restoration, and enhancement of state-owned aquatic lands that provide benefits to the health of native aquatic habitat and species and other resources in the state of Washington. DNR is to establish Aquatic Reserves to protect important native aquatic ecosystems on selected state-owned aquatic lands throughout the state. These are to be aquatic lands of special educational or scientific interest, or lands of special environmental importance (WAC 332-30-151).

Authorization instrument: A lease, material purchase, easement, permit, or other document authorizing use of state-owned aquatic lands and/or materials.

Avulsion: A sudden and perceptible change in the shoreline of a body of water. Generally no change in boundary lines occurs.

Beach: The zone of unconsolidated material that extends landward from the low water line to the place where there is marked change in material or physiographic form, or to the line of permanent vegetation (usually the effective limit of storm waves). The seaward limit of a beach is the extreme low water line. A beach includes a foreshore and a backshore.

Bedlands or beds of navigable waters: For the purposes of this publication, those submerged lands lying waterward of the line of extreme low tide in navigable tidal waters.

Benthic zone: The benthic zone is the lowest level of a body of water, such as in an ocean or a lake. It is inhabited by organisms that live in close relationship with (if not physically attached to) the ground, called benthos or benthic organisms.

Benthic: Refers to organisms associated with the bottom of the sea, lake, or river.

Biological Diversity or biodiversity: The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur. The System's focus is on indigenous species, biotic communities, and ecological processes ("Regional biological diversity" is protected when habitat is provided to species that are becoming locally rare due to loss of habitat).

Biotoxin (marine): Marine biotoxins are poisons caused by microscopic toxin-producing algae (a type of phytoplankton) that naturally occur in marine waters, normally in amounts too small to be harmful. However, a combination of warm temperatures, sunlight, and nutrient-rich waters can cause rapid plankton reproduction, or "blooms."

Bivalve: Common term for pelecypods, members of the Mollusca in which the hard parts are composed of 2 sections fitting together to enclose a space that contains the soft part of the organism.

Bluff: An unvegetated high bank composed largely of unconsolidated deposits with a near-vertical face overlooking a body of water.

Cliff: A high, very steep to perpendicular or overhanging face of rock rising above the shore.

Coastal zone: The sea-land fringe area bordering the shoreline where the coastal waters and adjacent lands exert a measurable influence on each other.

Commerce: The exchange or buying and selling of goods and services. As it applies to aquatic land, commerce usually involves transport and a land/water interface.

Compatible use: A wildlife-dependent recreational or commercial use or any other use of a reserve that, in the sound professional judgment of DNR, will not materially interfere with or detract from the fulfillment of the goals and objectives or the purpose of the reserve. A compatibility determination, completed by the use proponent, supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.

Conservation Targets: Highly sensitive area or feature where special management attention is needed to ensure that the legislative mandate to protect such resources is being met.

Critical habitat: Those areas necessary for the survival of sensitive, threatened, and endangered species, as designated under the Federal Endangered Species Act and Washington State Forest Practices Rules.

Cultural resources: Archeological and historic sites and artifacts, whether previously recorded or still unrecognized, as administered by Department of Archaeology and Historic Preservation and protected under Title 27 of the Revised Code of Washington.

Delta: Shipman (2008) defines a river delta system as the long term deposition of fluvial sediment at river mouths. Resulting landforms include but are not limited to alluvial valleys and/or wedge-shaped estuaries.

Demersal: Organisms living at or near the bottom of a sea or lake but having the capacity for active swimming.

Demonstrate: Project proponents must demonstrate using professional and technical analysis that a proposed use will not result in a loss of ecosystem goods and services. The proponent of the activity is the demonstrator. The Technical Advisory Committee considers the demonstration and a makes recommendation to the Commissioner, who makes a final decision.

Department of Archaeology and Historic Preservation: The state agency was established to document and protect cultural resources.

Disturbance: Significant alteration of habitat structure, composition or species behavior. May be natural,(e.g. fire) or human-caused events, (e.g. aircraft overflight).

Dredging: The deepening of a river channel, harbor, or other aquatic land by excavating bottom material for recreational, commercial, or environmental purposes.

Ecosystem Goods and Services: The human benefits arising from the ecological functions of healthy ecosystems. Examples include light penetration; sediment transport; tidal and current regimes; freshwater inputs; water quality; nutrient cycling; turbidity; spawning, rearing, foraging and refuge habitat.

Ecosystem Management: Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and basic ecosystem processes are perpetuated indefinitely.

Ecosystem: A dynamic and interrelating ecological community consisting of all the living and non-living components of the physical environment.

Educational reserves: Accessible areas of aquatic lands typical of selected habitat types which are suitable for educational projects.

Embayment: System that is protected from wave action by small size and sheltered configuration. Landforms consist of open coastal inlets, barrier estuaries, barrier lagoons, and closed lagoons and marshes (Shipman 2008).

Endangered Species (Federal): A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.

Endangered Species (State): A plant or animal species in danger of becoming extinct or extirpated in Washington state within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.

Enhancement: Manipulation of physical, biological or chemical processes at a site to heighten, intensify, or improve specific functions, or alter a growth stage, if vegetation is present (eelgrass, kelp).

Environmental reserves: Areas of environmental importance, sites established for the continuance of environmental baseline monitoring, and/or areas of historical, geological or biological interest requiring special protective management.

Epibenthic: Pertaining to the environment and conditions of organisms living near the water bottom.

Estuary, Estuarine: An estuary is a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water mixes with fresh water. Shipman (2008) defines an estuary as an embayment with a high level of freshwater influence (compared to a lagoon).

Extreme low tide: The line as estimated by the federal government below which it might reasonably be expected that the tide would not ebb. Also considered to be the lowest recorded tidal event over the National Tidal Datum Epoch.

First class tidelands: The shores of navigable tidal waters belonging to the state lying within or in front of the corporate limits of any city, or within one mile thereof upon either side and between the line of ordinary high tide and the inner harbor line; and within two miles of the corporate limits on either side and between the line of ordinary high tide and the line of extreme low tide (RCW 79.105.060(4)). In general, the line of ordinary high tide is the landward boundary. The line of extreme low tide, or the inner harbor line where established, is the waterward boundary. To determine if the tidelands are within two miles of the corporate limits of a city, the distance is measured along the shoreline from the intersection of the corporate limit with the shoreline.

Gastropod: Any of a large class of mollusks, usually with a univalve shell or no shell and a distinct head bearing sensory organs, such as snails and slugs.

Gill Net: A type of fishing net utilized by commercial, tribal, and occasionally recreational fishing operations. These nets are the center of much controversy due to the high incidence of by-catch associated with their use.

Goal: Descriptive, open-ended, and often broad statements of desired future conditions that conveys a purpose but does not define measurable units.

Governmental entity: Means the federal government, the state, county, city, port district, or other municipal corporations or political subdivision thereof.

Habitat Restoration: Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.

Habitat: The components of the ecosystem upon which a plant or animal species relies upon for some stage in its life cycle.

Highly Sensitive Areas: Areas of land and/or water containing features such as fragile soils and vegetation (grassy balds, wetlands), cultural deposits, and habitat for sensitive, threatened, and endangered species, as well as other areas where special management attention is needed to ensure that the legislative mandate to protect such resources is being met.

Intertidal: The intertidal zone is also known as the foreshore and is that area exposed to the air at low tide and submerged at high tide, for example, the area between tide marks. This area can include many different types of habitats, including steep rocky cliffs, sandy beaches or vast mudflats.

Invasive: Executive Order 13112 (February 3 1999) defines an Invasive Species as a species, including its seeds, eggs, spores and all other biological material, not native to a particular ecosystem and the introduction of that species is does or is likely to cause economic or environmental harm or harm to human health (NISC, 2011).

Inventory: Both a compilation of existing data on human uses, and the biology and geology of aquatic lands as well as the gathering of new information on aquatic lands through field and laboratory analysis. Such data is commonly presented in map form such as the *Washington Coastal Atlas.*

Island: A body of land entirely and customarily surrounded by water. Land in navigable waters which is only surrounded by water in times of high water, is not an island within the rule that the state takes title to newly formed islands in navigable waters.

Lagoon: A tidal inlet largely or entirely isolated by a barrier beach and with no significant input of freshwater; type of embayment.

Littoral zone: Also called the foreshore, or intertidal zone, and is the section of the coast that is periodically covered by high tides and exposed during low tides.

Low-impact public use: Those "public recreation uses and improvements that do not adversely affect the resource values, are appropriate to the maintenance of the site in a relatively unmodified natural setting, and do not detract from long-term (natural) processes." (RCW 79.71.030)

Maintain site conditions: To protect natural site characteristics and ecosystem processes, such as wildlife habitat, soil conservation and succession of native plant communities.

Management Actions: Are derived from both Goals, and more so, specific objectives. A management action is a concise target statement of what will be achieved, how much will be achieved, when and where it will be achieved, and who is responsible for the work. Management Actions should be attainable and time-specific and should be stated quantitatively to the extent possible. If objectives cannot be stated quantitatively, they may be stated qualitatively.

Mean High Water (MHW): The average height of all the high tidal events reached during the year over a National Tidal Datum Epoch.

Mean Higher High Water (MHHW): The average of the highest high water events of each tidal day observed over the National Tidal Datum Epoch.

Mean Low Water: The average of all the low water events observed over the National Tidal Datum Epoch.

Mean Lower Low Water (MLLW): The average of the lowest low water events of each tidal day observed over the National Tidal Datum Epoch.

Migration: The seasonal movement from one area to another and back.

Mitigate: To minimize or compensate for potential adverse environmental impacts.

Monitor: The process of collecting and analyzing data to track changes of selected parameters overtime. A baseline is established and periodic measurements are taken to determine the extent and rate of change over time. Topics include: Beneficial and negative impacts of stewardship activities, natural events and public use.

Moorage facility: A marina, open water moorage and anchorage area, pier, dock, mooring buoy, or any other similar fixed moorage site.

Mysids: A group of crustaceans, also known as opossum shrimps that feed upon small zooplankton.

Native Species: Species that normally live and thrive in a particular ecosystem.

Natural landscape elements: The natural watercourses, topography, hydrology and vegetation which comprise a particular site.

Natural processes: Phenomena that shape the landscape's appearance and habitat potential. At Nisqually Reach Aquatic Reserve, natural processes include: littoral drift processes fed by cliff and bluff erosion, relatively free movement of wildlife among a dynamic mosaic of the area’s terrestrial and marine habitats, and more.

Nematodes: Non-segmented roundworms of the phylum Nematoda. They range widely in size and can be free-living or parasitic.

Neritic: Pertaining to the marine zone between low tides and the edge of the continental shelf, a depth of roughly 200 m. A neritic environment supports marine organisms, also described as neritic, that are capable of surviving in shallow water with moderate exposure to sunlight.

Non-native species: Species not endemic to a given ecosystem. Not necessarily invasive or noxious. May eventually become *naturalized.* Non-point source discharge: Nonpoint source pollution generally results from land runoff,

precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification. Technically, the term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act (see definition of point source).

Noxious weeds: RCW 17.10.080 and WAC-750-001 govern the states noxious weeds list, the purpose of which is to provide current information on "…plants that are highly destructive, competitive, or difficult to control by cultural or chemical practices." Objective: Objectives are derived from goals and provide the basis for determining management strategies. An objective is a target statement of what future conditions will be achieved. For the purposes of this document, objectives should be attainable and stated qualitatively.

Open moorage: Moorage slips and mooring floats that have completely open sides and tops.

Open water moorage and anchorage areas: Areas of state-owned aquatic lands leased for moorage and anchorage that do not abut uplands and do not include a built connection to the uplands. May contain mooring buoys, floating moorage docks, other moorage facilities not connected to the shoreline or anchorage areas in accordance with WAC 332-30-139(5).

Ordinary high tide: The same as mean high tide or the average height of high tide. In Puget Sound, the mean high tide line varies from 10 to 13 ft (3 to 4 m) above the mean lower low water datum.

Ordinary high water: The line of permanent upland vegetation along the shores of non-tidal navigable waters. In the absence of vegetation, it is the line of mean higher high water.

Pelagic zone: The pelagic zone is the part of the open sea or ocean and does not include the seafloor.

Percent slope: The direct ratio (multiplied by 100) between the vertical and the horizontal distance for a given slope; e.g., a 3 ft (1 m) rise in a 10 ft (3 m) horizontal distance would be a 30 percent slope.

Photic zone: The photic zone or euphotic zone is the depth of the water whether in a lake or an marine water body that is exposed to sufficient sunlight for photosynthesis to occur. The depth of the euphotic zone can be greatly affected by seasonal turbidity.

Pinniped: A suborder of carnivores that are marine mammals, have flippers, and eat mostly fish and marine invertebrates (e.g., sea lions, seals).

Point source discharge: The term "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture (taken from section 502(14) of the Clean Water Act).

Polychaetes: Any of a class (Polychaeta) of chiefly marine annelid worms (such as clamworms), usually with paired segmental appendages, separate sexes, and a free-swimming trochophore larva.

Preferred Alternative: This is the alternative determined [by the decision maker] to best achieve the reserves purpose, vision, and goals, addresses the significant issues, and is consistent with principles of sound aquatic land management.

Priority Species: Fish and wildlife species that WDFW believe require protective measures and/or management guidelines to ensure their perpetuation. Priority species include the following: (1) State-listed and candidate species; (2) species or groups of animals susceptible to significant population declines within a specific area or statewide by virtue of their inclination to aggregate (e.g., seabird colonies); and (3) species of recreation, commercial, and/or tribal importance.

Protection/Maintenance (Formerly *preservation*): Removing a threat to, or preventing the decline of, conditions by an action in or near the site. Preservation does not result in a gain of acreage, but may only result in a gain of functions over the long term, and is used only in exceptional circumstances (Source: USACE, DOE and the EPA, 2006).Public benefit: Means that all of the citizens of the state may derive a direct benefit from departmental actions in the form of environmental protection; energy and mineral production; utilization of renewable resources; promotion of navigation and commerce by fostering water-dependent uses; and encouraging direct public use and access; and generating revenue in a manner consistent with RCW 79.105.030.

Public lands: Lands belonging to or held in trust by the state, which are not devoted to or reserved for a particular use by law, and include state lands, tidelands, shorelands and harbor areas as herein defined, and the beds of navigable waters belonging to the state (RCW 79.02.010).

Public tidelands: Tidelands belonging to and held in public trust by the state for the citizens of the state, which are not devoted to or reserved for a particular use by law.

Public trust: Certain state-owned tidelands, shorelands and all beds of navigable waters are held in trust by the state for all citizens with each citizen having an equal and undivided interest in the land. The department has the responsibility to manage these lands in the best interest of the general public.

Public use beach: A state-owned beach available for free public use but which may be leased for other compatible uses.

Public use: To be made available daily to the general public on a first-come, first-served basis, and may not be leased to private parties on any more than a day use basis.

Public: Individuals, organizations, and groups; officials of Federal, State, and local government agencies; Indian Tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in reserve issues and those who do or do not realize that DNR decisions may affect them.

Rapid shoreline inventory: A survey of a defined section of shoreline detailing a set of physical and biological data that provides indicators of beach health and a better understanding of shoreline habitat and how it functions.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former or degraded site. For purposes of tracking net gains in acreage, restoration is divided "re-establishment" which represents a net gain, and "rehabilitation" which is the repair of a degraded state and does not represent a net gain (Source: USACE, DOE and the EPA, 2006).

Riparian: Relating to or living or located on the bank of a natural water course, such as a stream, lake or tidewater.

Runoff: That part of the precipitation from rain, snowmelt or irrigation that is not absorbed into the ground, instead often flowing over impervious surfaces, or directly into streams and other surface waters or land depressions.

Saturated: A condition in which the interstices of a material are filled with a liquid, usually water.

Scientific reserves: Sites set aside for scientific research projects and/or areas of unusually rich plant and animal communities suitable for continuing scientific observation.

Seabird: A type of waterbirds that obtain at least some food from the ocean by traveling some distance over its surface. They also typically breed on islands and along coastal areas. Seabirds include gulls, alcids, pelicans, albatrosses, storm-petrels, and cormorants, among others.

Second class tidelands: The shores of navigable tidal waters belonging to the state, lying outside of and more than two miles from the corporate limits of any city and between the line of ordinary high tide and the line of extreme low tide (RCW 79.105.060(18)). In general, the line of ordinary high tide is the landward boundary. The line of extreme low tide is the waterward boundary. To determine if the tidelands are more than two miles from the corporate limits of a city, the distance is measured along the shoreline from the intersection of the corporate limit with the shoreline.

Sensitive, threatened, and endangered species: Plants and animals protected under the federal Endangered Species Act or state designation, with the species level of risk from lower to higher.

Shore: That space of land which is alternately covered and left dry by the rising and falling of the water level of a lake, river or tidal area.

Shoreform: A description of various nearshore physical features that results from the geomorphic processes that shape and maintain the modern shoreline. Shipman (2005) has developed a nearshore typology outlining various types of shoreforms (or "shore types") in Puget Sound.

Shoreline: The intersection of a specified plane of water with a beach; it may migrate with tidal change.

State Candidate Species: Defined in WDFW Policy M-6001 to include fish and wildlife species that the Department will review for possible listing as State Endangered, Threatened, or Sensitive. A species will be considered for designation as a State Candidate if sufficient evidence suggests that its status may meet the listing criteria defined for State Endangered, Threatened, or Sensitive.

State Endangered Species: Defined in WAC 232-12-297, Section 2.4, to include "any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state."

State Environmental Policy Act (SEPA): The state law that guides a public environmental review process to evaluate potential impacts of a proposed action or plan on the site or area.

State Sensitive Species: Defined in WAC 232-12-297, Section 2.6, to include "any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened throughout a significant portion of its range within the state without cooperative management or removal of threats."

State Threatened Species: Defined in WAC 232-12-297, Section 2.5, to include "any wildlife species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats."

State-owned aquatic lands: Those aquatic lands and waterways administered by the department of natural resources or managed under department agreement by a port district. State-owned aquatic lands does not include aquatic lands owned in fee by, or withdrawn for the use of, state agencies other than the department of natural resources (RCW 79.105.060(20)).

Strategy: A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives

Subtidal zone: Also called the sublittoral zone of the coast. The subtidal zone (below low water) is a band that is affected only during the negative tides which occur periodically throughout the year

Succession: The natural changes in vegetation and animal life that occur as a plant community recovers from disturbance and proceeds to climax. In forested sites, colonizing plants inhabit bare ground, longer-lived shrubs and trees replace colonizers, and shrub/tree dominance changes with the establishment of a stable and complex system.

Supralittoral zone: Also called the splash zone (above high water), this area of the beach or coast remains exposed the longest and whose inhabitants are only

sprayed with water, although during episodic “flooding” it is covered by the tide.

Terminal: A point of interchange between land and water carriers, such as a pier, wharf, or group of such, equipped with facilities for care and handling of cargo and/or passengers (RCW 79.105.060(21)).

Threatened Species (Federal): Species listed under the Endangered Species Act that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Threatened Species (State): A plant or animal species likely to become endangered in Washington State within the near future, if factors contributing to population decline or habitat degradation or loss continue.

Tidelands: Marine lands between the lines of ordinary high tide and the line of extreme low tide.

Uplands: Lands, including lakes, wetlands and streams, above the line of ordinary high tide.

Vessel: A floating structure that is designed primarily for navigation, is normally capable of self propulsion and use as a means of transportation, and meets all applicable laws and regulations pertaining to navigation and safety equipment on vessels, including, but not limited to, registration as a vessel by an appropriate government agency.

Waterbird: This term is used by Audubon Society and in this plan to describe a diverse group of birds that are ecologically or taxonomically tied to bodies of water for some part or parts of their lives. Loons, grebes, cormorants, herons, coots, and gulls are waterbirds. Waterbirds, shorebirds, and seabirds are also part of this group. For purposes of this plan, management goals are designed to address any waterbird using the habitat and resources of the Nisqually Aquatic Reserve during migration, or when nesting, roosting, feeding or breeding.

Water-dependent use: A use which cannot logically exist in any location but on the water. Examples include, but are not limited to, waterborne commerce; terminal and transfer facilities; ferry terminals; watercraft sales in conjunction with other water dependent uses; watercraft construction, repair, and maintenance; moorage and launching facilities; aquaculture; log booming; and public fishing piers and parks (RCW 79.105.060(24)).

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Appendix A – Observed Species Lists

The following lists identify the various flora and fauna that are documented within the area of the Nisqually Reach Aquatic Reserve.

The species lists include: marine oriented mammals, birds, fish, invertebrates, insects and intertidal and shallow subtidal marine vegetation observed by local organizations, experts, or public agencies within the boundaries of the Aquatic Reserve.

Sources

1. Washington Department of Fish and Wildlife Trawl Data
2. Nisqually National Wildlife Refuge
3. Nisqually River Estuary Baseline fish DOE Study: 2003-2006
4. Nisqually Reach Nature Center
5. Black Hills Audubon Society Christmas Bird Counts
6. Tacoma Audubon Society Christmas Bird Count (Anderson Island)
7. Nisqually National Wildlife Refuge Bird List
8. Nisqually National Wildlife Refuge Appendix E - Species List
9. DNR Natural Heritage Program
10. Cascadia Research
11. Washington Department of Fish and Wildlife (marine mammal program)
12. DNR Aquatic Resource Division Scientists

Mammals

Both resident and transient species of marine mammals and local marine oriented species are found using the area in and around the Nisqually Reach Aquatic Reserve. This is not intended to be a complete species list.

Common Name	Scientific Name	Sources
Minke Whale	*Balaenoptera acutorostrata*	4, 8, 10, 11
Townsend's Big-eared Bat	*Corynorhinus townsendii*	8, 9
Big Brown Bat	*Eptesicus fuscus*	9
Gray Whale	*Eschrichtius robustus*	4, 8, 10, 11
Northern (Stellar) Sea Lion	*Eumetopias jubatus*	4, 8, 10, 11
Silver-haired Bat	*Lasionycteris noctivagans*	8, 9
Hoary Bat	*Lasiurus cinereus*	8, 9
River Otter	*Lutra canadensis*	11, 12
California Myotis	*Myotis californicus*	9
Long-eared Myotis	*Myotis evotis*	8, 9
Keen's Myotis	*Myotis keenii*	9
Little Brown Myotis	*Myotis lucifugus*	8, 9
Long-legged Myotis	*Myotis volans*	9
Yuma Myotis	*Myotis yumanensis*	8, 9
Killer Whale	*Orcinus orca*	4, 8, 10, 11
Harbor Seal	*Phoca vitulina*	4, 10, 11
Pacific Harbor Seal	*Phoca vitulina*	4, 10, 11
Harbor Porpoise	*Phocoena phocoena*	4, 10, 11
Dall's Porpoise	*Phocoenoides dalli*	4, 8, 10, 11
False Killer Whale (Rare)	*Pseudorca crassidens*	4, 8, 10
California Sea Lion	*Zalophus californianus*	4, 8, 10, 11

Birds

There are at least over 60 bird species that have been identified to use the area in and around the Nisqually Reach Aquatic Reserve. This should not be construed to be a complete species list.

Common Name	Scientific Name	Sources
American Coot	*Fulica americana*	4, 7
American Crow	*Corvus brachyrhynchos*	4, 6, 7
American Kestrel	*Falco sparverius*	6, 7
American White Pelican	*Pelecanus erythrorhynchos*	4, 7
American Wigeon	*Anas americana*	4, 5, 6, 7
Bald Eagle	*Haliaeetus leucocephalus*	4, 6, 7
Barrow's Goldeneye	*Bucephala islandica*	4, 5, 7
Belted Kingfisher	*Megaceryle alcyon*	4, 6, 7
Black Scoter	*Melanitta nigra*	5, 7
Bonaparte's Gull	*Larus philadelphia*	4, 7
Brandt's Cormorant	*Phalacrocorax penicillatus*	5, 7
Brant	*Branta bernicla*	4, 5, 7
Bufflehead	*Bucephala albeola*	4, 5, 6, 7
Canada Goose	*Branta canadensis*	4, 5, 6, 7
Canvas Back	*Aythya valisineria*	5, 7
Caspian Tern	*Sterna caspia*	4, 7
Common Goldeneye	*Bucephala clangula*	4, 5, 6, 7
Common Loon	*Gavia immer*	4, 5, 6, 7
Common Merganser	*Mergus merganser*	4, 6, 7
Common Murre	*Uria aalge*	4, 7
Common Raven	*Corvus corax*	6
Double-crested Cormorant	*Phalacrocorax auritus*	4, 5, 6, 7
Dunlin	*Calidris alpina*	4, 6, 7
Eared Grebe	*Podiceps nigricollis*	5, 7
Eurasian Wigeon	*Anas penelope*	5, 6, 7
Gadwall	*Anas strepera*	4, 7
Glaucous-winged Gull	*Larus glaucescens*	4, 6, 7
Glaucous-winged x Western Gull		4, 7
Great Blue Heron	*Ardea herodias*	4, 5, 6, 7
Greater Scaup	*Aythya marila*	4, 5, 7
Greater Yellowlegs	*Tringa melanoleuca*	4, 7
Green-Winged Teal	*Anas crecca*	4, 7
Harlequin Duck	*Histrionicus histrionicus*	5, 7
Herring Gull	*Larus argentatus*	4, 7
Hooded Merganser	*Lophodytes cucullatus*	4, 6, 7
Horned Grebe	*Podiceps auritus*	4, 5, 6, 7

Common Name	Scientific Name	Sources
Killdeer	*Charadrius vociferus*	4, 7
Least Sandpiper	*Calidris minutilla*	4, 7
Lesser Scaup	*Aythya affinis*	5, 7
Long-tailed Duck	*Clangula hyemalis*	5, 7
Mallard	*Anas platyrhynchos*	4, 5, 6, 7
Marbled Murrelet	*Brachyramphus marmoratus*	4,7
Mew Gull	*Larus canus*	4,7
Northern Harrier	*Circus cyaneus*	4,7
Northern Pintail	*Anas acuta*	4, 5,7
Osprey	*Pandion haliaetus*	4, 7
Pacific Loon	*Gavia pacifica*	4, 5, 7
Pelagic Cormorant	*Phalacrocorax pelagicus*	4, 5, 6, 7
Pied-billed Grebe	*Podilymbus podiceps*	4, 5, 7
Pigeon Guillemot	*Cepphus columba*	4, 6, 7
Purple Martin	*Progne subis*	4
Red-breasted Merganser	*Mergus serrator*	4, 6, 7
Red-necked Grebe	*Podiceps grisegena*	4, 5, 6, 7
Red-tailed Hawk	*Buteo jamaicensis*	4, 6, 7
Red-throated Loon	*Gavia stellata*	4, 5, 7
Ring-billed Gull	*Larus delawarensis*	4, 7
Ring-necked Duck	*Aythya collaris*	4, 6, 7
Rock Dove	*Columba livia*	4, 7
Rock Pigeon	*Columba livia*	6, 7
Spotted Sandpiper	*Actitis macularius*	6, 7
Surf Scoter	*Melanitta perspicillata*	4, 5, 6, 7
Violet-green Swallow	*Tachycineta thalassina*	4, 7
Western Grebe	*Aechmophorus occidentalis*	4, 5, 6, 7
Western Gull	*Larus occidentalis*	4, 6, 7
Western Sandpiper	*Calidris mauri*	4, 7
Whimbrel	*Numenius phaeopus*	4, 7
White-winged Scoter	*Melanitta fusca*	4, 5, 6, 7
Yellow-billed Loon	*Gavia adamsii*	5, 7

Fish

The area within the reserve is rich with aquatic vegetation that fish rely on during various life stages. The following list represents species identified within and adjacent to the reserve boundaries. It should not be construed to be a complete species list.

Common Name	Scientific Name	Sources
American Shad	*Alosa sapidissima*	1, 3
Arrow Goby	*Clevelandia ios*	3, 8
Arrowtooth Flounder	*Atheresthes stomias*	1
Bay Goby	*Lepidogobius lepidus*	8
Bay Pipefish	*Syngnathus leptorhynchus*	2, 3, 8
Big Skate	*Raja binoculata*	1
Bigfin Eelpout	*Aprodon cortezianus*	1
Blackbelly Eelpout	*Lycodes pacificus*	1
Blacktip Poacher	*Xeneretmus latifrons*	1, 8
Brown Rockfish	*Sebastes auriculatus*	1, 8
Buffalo Sculpin	*Enophrys bison*	1, 8
Bull Trout	*Salvelinus confluentus*	2, 8
Butter Sole	*Isopsetta isolepis*	1, 8
Cabezon	*Scorpaenichthys marmoratus*	1, 8
Calico Sculpin	*Clinocottus embryum*	8
Chinook Salmon	*Oncorhynchus tshawytscha*	2, 3, 8
Chum Salmon	*Oncorhynchus keta*	2, 3, 8
C-O Sole	*Pleuronichthys coenosus*	1, 8
Coastal Cutthroat	*Oncorhynchus clarki clarki*	2, 3
Coastrange Sculpin	*Cottus aleuticus*	8
Coho Salmon	*Oncorhynchus kisutch*	1, 2, 3, 8
Copper Rockfish	*Sebastes caurinus*	1, 8
Crescent Gunnel	*Pholis laeta*	3, 8
Dover Sole	*Microstomus pacificus*	1, 8
English Sole	*Parophrys vetulus*	1, 3, 8
Eulachon	*Thaleichthys pacificus*	1
Flathead Sole	*Hippoglossoides elassodon*	1, 8
Gray Starsnout	*Asterotheca alascana*	1
Great Sculpin	*Myoxocephalus polyacanthocephalus*	1, 8
Grunt Sculpin	*Rhamphocottus richardsoni*	1, 8
High Cockscomb	*Anoplarchus purpurescens*	8
Hybrid Sole	*Inopsetta ischyra*	1
Kelp Greenling	*Hexagrammos decagrammus*	1, 8
Kelpfish uniden.	*Clinidae spp.*	1
Lingcod	*Ophiodon elongatus*	1

Common Name	Scientific Name	Sources
Longnose Skate	*Raja rhina*	1
Longspine Combfish	*Zaniolepis latipinnis*	1
Manacled Sculpin	*Synchirus gilli*	8
Marbled Snailfish	*Liparis dennyi*	1
Northern Anchovy	*Engraulis mordax*	1, 3
Northern Clingfish	*Gobiesox meandricus*	8
Northern Rock Sole	*Lepidopsetta polyxystra*	1
Northern Ronquil	*Ronquilus jordani*	1
Northern Sculpin	*Icelinus borealis*	1
Northern Spearnose Poacher	*Agonopsis vulsa*	1, 8
Pacific Cod	*Gadus macrocephalus*	1, 8
Pacific Hake	*Merluccius productus*	8
Pacific Herring	*Clupea harengus pallasi*	1, 2, 3, 8
Pacific Lamprey	*Lampetra tridentata*	8
Pacific Pompano	*Perrilus simillimus*	1
Pacific Sand Lance	*Ammodytes hexapterus*	2, 3, 8
Pacific Sanddab	*Citharichthys sordidus*	1, 8
Pacific Snake Prickleback	*Lumpenus sagitta*	8
Pacific Spiny Lumpsucker	*Eumicrotremus orbis*	1
Pacific Staghorn Sculpin	*Leptocottus armatus*	1, 2, 8
Pacific Tomcod	*Microgadus proximus*	1, 8
Pacific Whiting (Hake)	*Merluccius productus*	1
Padded Sculpin	*Artedius fenestralis*	1, 8
Painted Greenling	*Oxylebius pictus*	8
Penpoint Gunnel	*Apodichthys flavidus*	3, 8
Petrale Sole	*Eopsetta jordani*	1
Pile Perch	*Rhacochilus vacca*	1, 2, 3, 8
Pink Salmon	*Oncorhynchus gorbuscha*	2, 3, 8
Plainfin Midshipman	*Porichthys notatus*	1, 8
Poacher Uniden.	*Agonidae spp.*	1
Prickly Sculpin	*Cottus asper*	8
Puget Sound Rockfish	*Sebastes emphaeus*	1
Pygmy Poacher	*Odontopyxis trispinosa*	8
Quillback Rockfish	*Sebastes maliger*	1, 8
Red Irish Lord	*Hemilepidotus hemilepidotus*	1, 8
Redstripe Rockfish	*Sebastes proriger*	1
Reticulate/Riffle Sculpin	*Cottus perplexus/gulosus*	8
Rex Sole	*Glyptocephalus zachirus*	1, 8
Ribbed Sculpin	*Triglops pingeli*	1
Ribbon Snailfish	*Liparis cyclopus*	1
Ringtail Snailfish	*Liparis rutteri*	8
Rock Greenling	*Hexagrammos lagocephalus*	8

Common Name	Scientific Name	Sources
Rock Sole	*Pleuronectes bilineata*	1, 3, 8
Rockweed Gunnel	*Apodichthys fucorum*	8
Roughback Sculpin	*Chitonotus pugetensis*	1,8
Sablefish	*Anoplopoma fimbria*	1, 8
Saddleback Gunnel	*Pholis ornata*	2, 3, 8
Sailfin Sculpin	*Nautichthys oculofasciatus*	1, 8
Sand Sole	*Psettichthys melanostictus*	1, 8
Sanddab	*Citharichthys spp.*	2
Sandpaper Skate	*Raja kincaidi*	1
Sculpin Uniden.	*Cottidae spp.*	1, 3
Sharpchin Rockfish	*Sebastes zacentrus*	1
Sharpnose Sculpin	*Clinocottus acuticeps*	8
Shiner Perch	*Cymatogaster aggregata*	1, 2, 3, 8
Shortfin Eelpout	*Lycodes brevipes*	1
Shorthead Sculpin	*Cottus confusus*	8
Showy Snailfish	*Liparis pulchellus*	1
Silverspotted Sculpin	*Blepsias cirrhosus*	8
Sixgill Shark	*Hexanchus griseus*	1
Slender Cockscomb	*Anoplarchus insignis*	8
Slender Sole	*Lyopsetta exilis*	1
Slim Sculpin	*Radulinus asprellus*	1
Slipskin Snailfish	*Liparis fucensis*	1
Smelt Uniden.	*Osmeridae spp.*	1
Smoothhead Sculpin	*Artedius lateralis*	8
Snailfish Uniden.	*Cyclopteridae (Liparidinae) spp.*	1
Snake Prickleback	*Lumpenus sagitta*	1, 3
Sockeye	*Oncorhynchus nerka*	3, 8
Soft Sculpin	*Psychrolutes sigalutes*	8
Southern Rock Sole	*Lepidopsetta bilineata*	1
Speckled Sanddab	*Citharichthys stigmaeus*	1, 3, 8
Spiny Dogfish	*Squalus acanthias*	1, 8
Spinyhead Sculpin	*Dasycottus setiger*	1
Spotted Ratfish	*Hydrolagus colliei*	1, 8
Starry Flounder	*Platichthys stellatus*	1, 2, 3,8
Steelhead	*Oncorhynchus mykiss*	2, 3, 8
Steven's Hermit	*Pagurus stevensae*	1
Striped Seaperch	*Embiotoca lateralis*	1, 8
Sturgeon Poacher	*Agonus acipenserinus*	1, 8
Surf Smelt	*Hypomesus pretiosus*	2, 3, 8
Tadpole Sculpin	*Psychrolutes paradoxus*	8
Three Spine Stickleback	*Gasterosteus aculeatus*	2, 3, 8
Tidepool Sculpin	*Oligocottus maculosus*	8

Common Name	Scientific Name	Sources
Torrent Sculpin	*Cottus rhotheus*	8
Tubenose Poacher	*Pallasina barbata*	8
Tube-snout	*Aulorhynchus flavidus*	8
Walleye Pollock	*Theragra chalcogramma*	1,8
Wattled Eelpout	*Lycodes palearis*	1
White Sturgeon	*Acipenser transmontanus*	8
Whitespotted Greenling	*Hexagrammos stelleri*	1, 8

Invertebrates

The area surrounding the Reserve supports numerous types of invertebrates. This should not be construed to be a complete species list.

Common Name	Scientific Name	Sources
Speckled Sea Lemon	*Anisodoris nobilis*	1
Amphipod	*Anisogammarus pugettensis*	4
Aggregating anemone	*Anthopluera elegantissima*	12
Sea Mouse Uniden.	*Aphroditidae* spp.	1
California Arminid	*Armina californica*	1
Glassy Sea Squirt	*Ascida paratropa*	1
Moon jelly	*Aurelia* spp.	12
Acorn barnacle	*Balanus glandula*	12
Big Red Squid	*Berryteuthis magister*	1
Zoae etc	*Brachyuran Crab Zoea*	4
Calanoid Copepod	*Calanoid*	4
Bay Ghost Shrimp	*Callianassa/Neotrypaea californiensis*	4
Graceful Crab	*Cancer gracilis*	1
Dungeness Crab	*Cancer magister*	1
Pygmy Rock Crab	*Cancer oregonensis*	1
Red Rock Crab	*Cancer productus*	1
Longhorned Decorator Crab	*Chorilia longipes*	1
Barnacles	*Cirripedian* nauplius larvae	4
Cladoceran	*Cladocera*	4
Heart cockle	*Clinocardia nuttallii*	12
Copepods	*Copepoda* nauplius larvae	4
Amphipod	*Corophium salmonis*	4
Amphipod	*Corophium spinicorne*	4
Amphipod	*Corophium* spp.	4
Shrimp	*Crangon* spp.	4
Crangonid Shrimp Uniden.	*Crangonidae* spp.	1
Japanese Oyster	*Crassostrea gigas*	12
Rose Sea Star	*Crossaster papposus*	1
Little brown barnacle	*Cthamalus dalli*	12
Orange Sea Cucumber	*Cucumaria miniata*	1
Salt And Pepper Cucumber	*Cucumaria piperata*	1
Hooded Shrimp	*Cumacea sp.*	4
Lion's mane Jelly	*Cyanea capillata*	12
Cyclopoid Copepod	*Cyclopoid*	4
Water Flea	*Daphnia* spp.	4
Sand dollar	*Dendraster excentricus*	12

Common Name	Scientific Name	Sources
Rainbow Nudibranch	*Dendronotus irus*	1
Leather Star	*Dermasterias imbricata*	1
Amphipod	*Eogammarus confervicolus*	4
Amphipod	*Eogammarus* spp.	4
Shortscale Eualid	*Eualus suckleyi*	1
White Sea Cucumber	*Eupentacta quinquesemita*	1
Krill	*Euphausia pacifica*	4
Mottled sea star	*Evasterias troschelii*	1,12
Oregon Hairy Triton	*Fusitriton oregonensis*	1
Isopod	*Gnorimosphaeroma oregonese*	4
Scale Worm	*Halosydna brevisetosa*	1
Harpacticoid Copepod	*Harpacticoid*	4
Hairy Shore crab	*Hemigrapsus oregonensis*	12
Hippolytidae	*Hippolytidae* spp.	1
Amphipod	*Hyperiidae*	4
Isopod	*Isopod* Unid.	4
California Market Squid	*Loligo opalescens*	1
Limpet	*Lottia pelta*	12
Banana Starfish	*Luidia foliata*	1
Pointed macoma	*Macoma inquinata*	12
Bent-nose macoma	*Macoma nasuta*	1
Vermilion Star	*Mediaster aequalis*	1
Gigantic Anemone	*Metridium farcimen*	1
Metridium Uniden.	*Metridium* spp.	1
Sweet Potato Sea Cucumber	*Molpadia intermedia*	1
Squat Lobster	*Mundia quadrispina*	1
False Geoduck	*Mya truncata*	1
Soft-shell clam	*Mya arenaria*	12
Pacific blue mussle	*Mytilus trossulus*	12
Opossum Shrimp	*Neomysis mercedis*	4
Frilled dogwinkle	*Nucella lamellosa*	12
Giant Octopus	*Octopus dofleini*	1
Little Red Octopus	*Octopus rubescens*	1
Sea Anemone Uniden.	*Order Actiniaria* spp.	1
Sea Urchin Uniden.	*Order Echinoidea* spp.	1
Graceful Decorator Crab	*Oregonia gracilis*	1
Ostracod	*Ostracod*	4
Native Olympia oyster	*Ostreola conchaphila*	12
Hairy Porcelain Crab	*Pachycheles pubescens*	1
Hermit Crabs uniden.	*Paguridae* spp.	1
Dock Shrimp	*Pandalus danae*	1

Common Name	Scientific Name	Sources
Sidestriped Shrimp	*Pandalus dispar*	1
Alaskan Pink Shrimp	*Pandalus eous*	1
Spotted Prawn	*Pandalus platyceros*	1
Geoduck Clam	*Panope abrupta*	1
Horned Shrimp	*Paracrangon echinata*	1
Red Sea Cucumber	*Parastichopus californicus*	1
Amphipod	*Parathemisto pacifica*	4
Fried Egg Jellyfish	*Phacellophora camtschatica*	1
Sponge Uniden.	*Phylum Porifera* spp.	1
Pink Short-spined Seastar	*Pisaster brevispinus*	1
Moon Snail	*Polinices lewisii*	1
Native littleneck clam	*Protothaca staminea*	12
Slime Star	*Pteraster tesselatus*	1
Orange Sea Pen	*Ptilosarcus gurneyi*	1
Graceful Kelp Crab	*Pugettia gracilis*	1
Kelp Crab	*Pugettia producta*	1
Sunflower Star	*Pycnopodia helianthoides*	1
Feather duster worm	*Sabellidae*	12
Butter clam	*Saxidomus gigantea*	12
Calcareous tube worm	*Serpulidae*	12
Morning Sun Star	*Solaster dawsoni*	1
Stimpson's Sun Star	*Solaster stimpsoni*	1
Mottled Orange Anemone	*Stomphia coccinea*	1
Green Sea Urchin	*Strongylocentrotus droebachiensis*	1
Squid Uniden.	*Theuthidida-Myopsida*	1
Pacific Gaper clam	*Tresus nuttallii*	1
Common Or Spot Nudibranch	*Triopha catalinae*	1
Rosy Tritonia	*Tritonia diomedea*	1
Blue Mud Shrimp	*Upogebia pugettensis*	1, 4
Sand Rose Anemone	*Urticina columbiana*	1
Scarlet Anemone	*Urticina lofotensis*	1
Manila clam	*Venerupis phillippinarum*	12
Smooth Stem Sea Whip Uniden.	*Virgularia* spp.	1
Rough piddock clam	*Zirfea pilsbyri*	12

Insects

There are various groups of insects that have been identified within the Nisqually Reach Aquatic Reserve using fall out traps. This should not be construed to be a complete species list.

Common Name	Scientific Name	Sources
Sucking Lice	*Anoplua*	3,4
Spiders	*Araneae*	3,4
Suborder of Fly	*Brachycera*	3,4
Beatles	*Coleoptera*	3,4
Springtails	*Collembola*	3,4
Earwigs	*Dermaptera*	3,4
Flies	*Diptera*	3,4
Termites	Family *Isoptera*	3,4
Dragonflies	Family *Odonata*	3,4
True bugs	*Hemiptera*	3,4
Aphids, cicadas	*Homoptera*	3,4
Wasp Ant Bee	*Hymenoptera*	3,4
Moths and Butterflies	*Lepidoptera (sp)*	3,4, 9
Scorpionflies	*Mecoptera*	3,4
Thread-horns/ Flies	*Nematocera*	3,4
Stoneflies	*Plecoptera*	3,4
Booklice, barklice or barkflies	*Psocoptera*	3,4
Fleas	*Siphonaptera*	3,4
Thrips	Suborder *Thysanoptera*	3,4
Caddisflies	*Trichoptera*	3,4

Marine Vegetation

There are various species and subspecies of marine vegetation identified during recent surveys within the Nisqually Reach Aquatic Reserve (From Mumford, T. 2010). This should not be construed as a complete list.

Common Name	**Scientific Name**	**Notes**
	***Chlorophyceae* (Green algae)**	
	Acrosiphonia coalita	12
Grass kelp	***Ulva intenstinalis***	12
Green string lettuce	***Ulva linza***	12
Sea lettuce	***Ulva* sp.**	12
	***Rhodophyceae* (Red algae)**	
	***Callophyllis* sp.**	12
	***Ceramium* sp.**	12
Turkish Towel	***Chondracanthus exaspertus***	12
	Delesseria decipiens J.	12
	***Gracilaria* sp.**	12
Turkish washcloth	***Mastocarpus papillatus***	12
Black Tar Spot	***Mastocarpus petrocelis***	12
Iridescent seaweed	***Mazzaella splendens***	12
	Microcladia coulteri	12
	Odonthalia floccosa	12
	***Polysiphonia* sp.**	12
	Porphyra cuneiformis	12
	***Porphyra* spp.**	12
	***Prionitis* sp.**	12
	***Pterosiphonia* sp.**	12
	Sarcodiotheca gaudichaudii	12
	Sparlingia pertusa	12
	Unknown red blade (possibly Palmaria palmata?)	12
	***Phaeophyceae* (Brown algae)**	
	Alaria marginata	12
	Costaria costata	12
Flattened acid kelp	***Desmarestia ligulata***	12
	Desmarestia munda	12
	Desmarestia viridis	12
	Fucus gardneri subsp.	12
	Leathesia difformis (L.)	12
	Saccharina latissima (L.)	12
	Sargassum muticum	12
	Scytosiphon lomentaria	12
	Soranthera ulvoidea	12
	***Anthophyta* (Flowering plants)**	

Common Name	**Scientific Name**	**Notes**
Saltbrush	***Atriplex patula***	12
Salt grass	***Distichilis spicata***	12
American Dunegrass	***Elymis mollis***	12
Gumweed	***Grindelia integrifolia***	12
Seaside Plantain	***Plantago maritima***	12
Pickleweed	***Salicornia virginica***	12
Japanese eelgrass	***Zostera japonica***	12
Eelgrass	***Zostera marina L.***	12

DRAFT

Appendix B – Maps

The following maps were created to better inform the management of the Nisqually Reach Aquatic Reserve by identifying the species and habitat and environments that exist in and around and use the Nisqually reach Aquatic Reserve and other uses, designations, or management of the region.

Figure B-7 NOAA chart

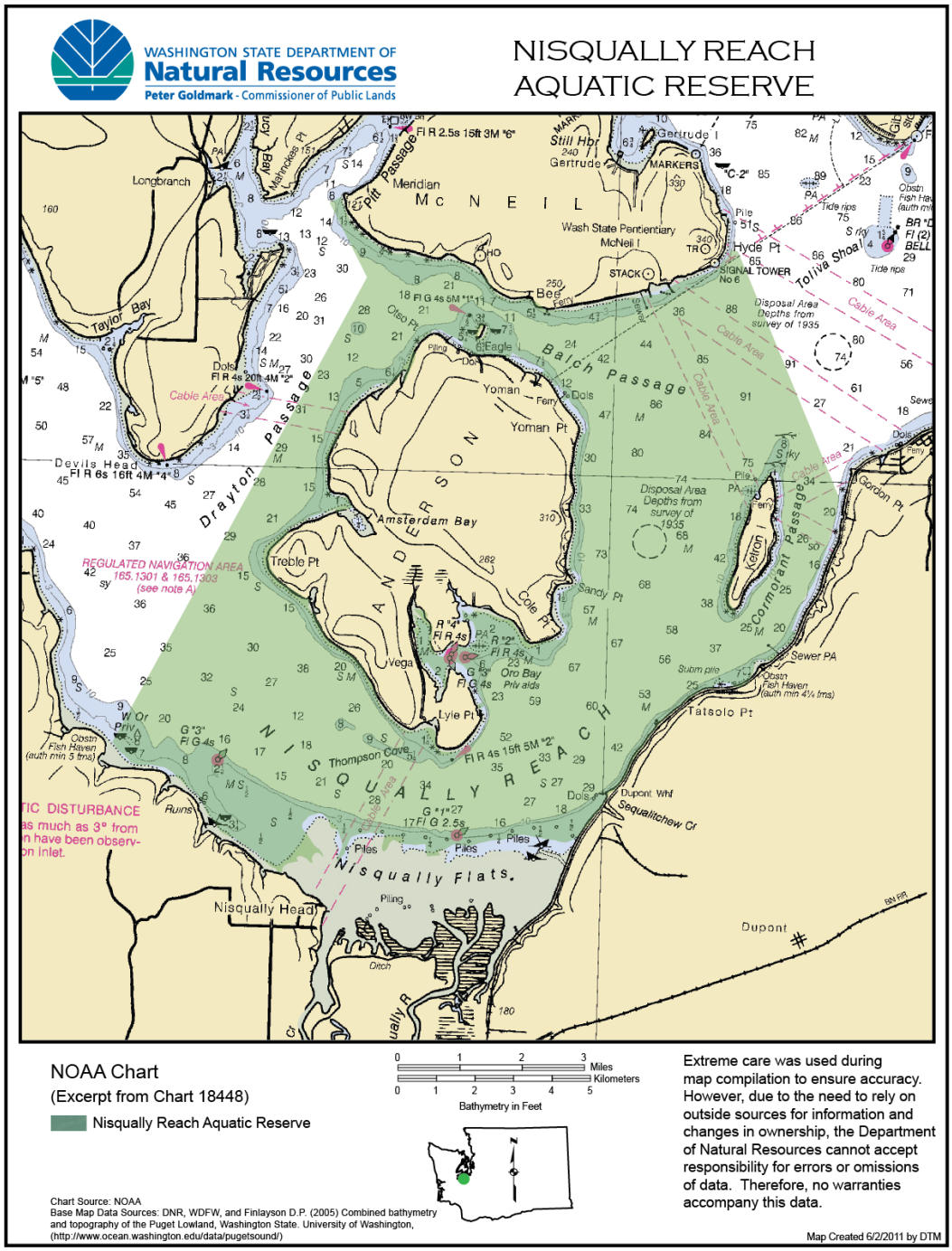


Figure B-8 Nisqually Reach freshwater inputs

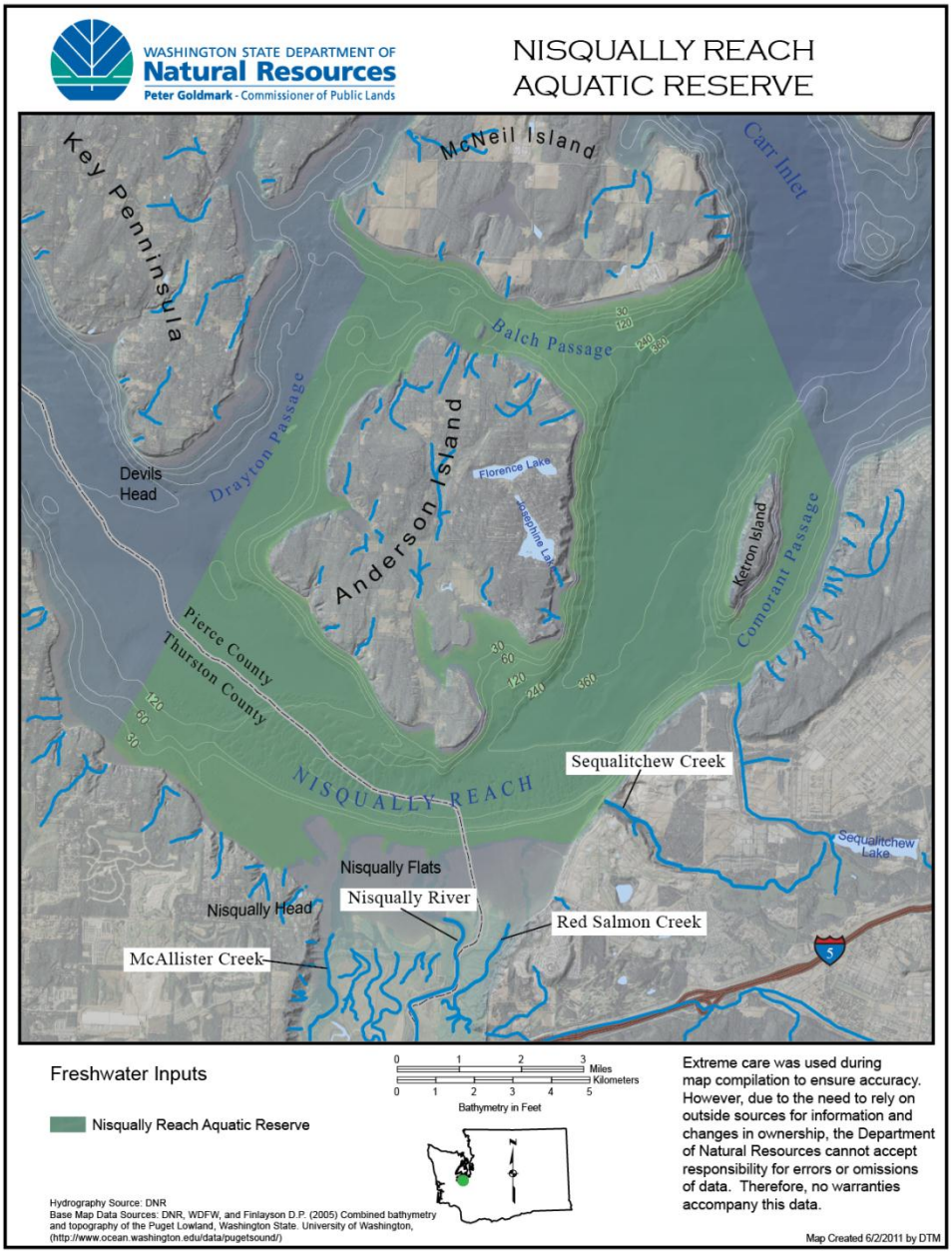


Figure B-9 Nisqually Reach littoral drift

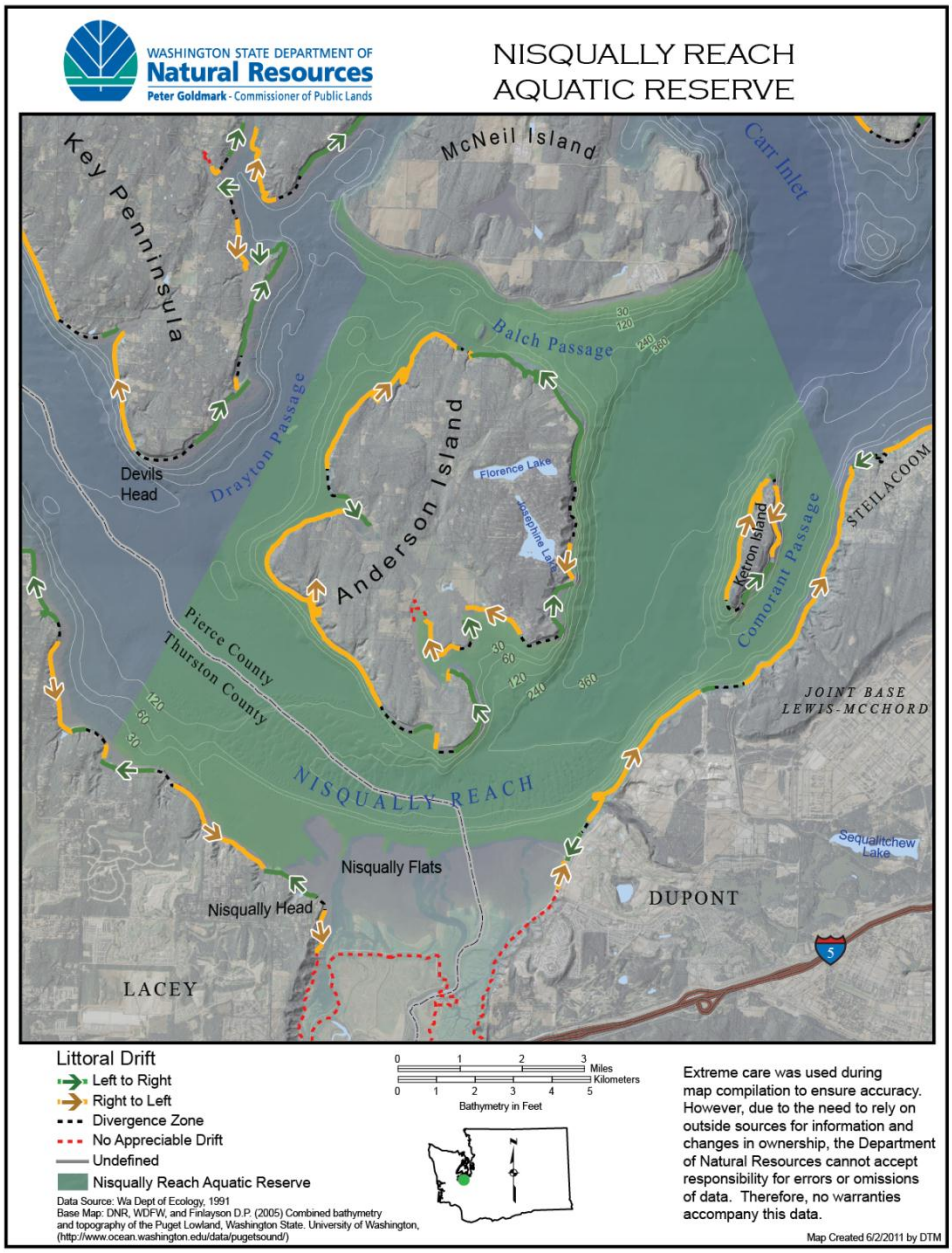


Figure B-10 Nisqually Reach embayment habitat

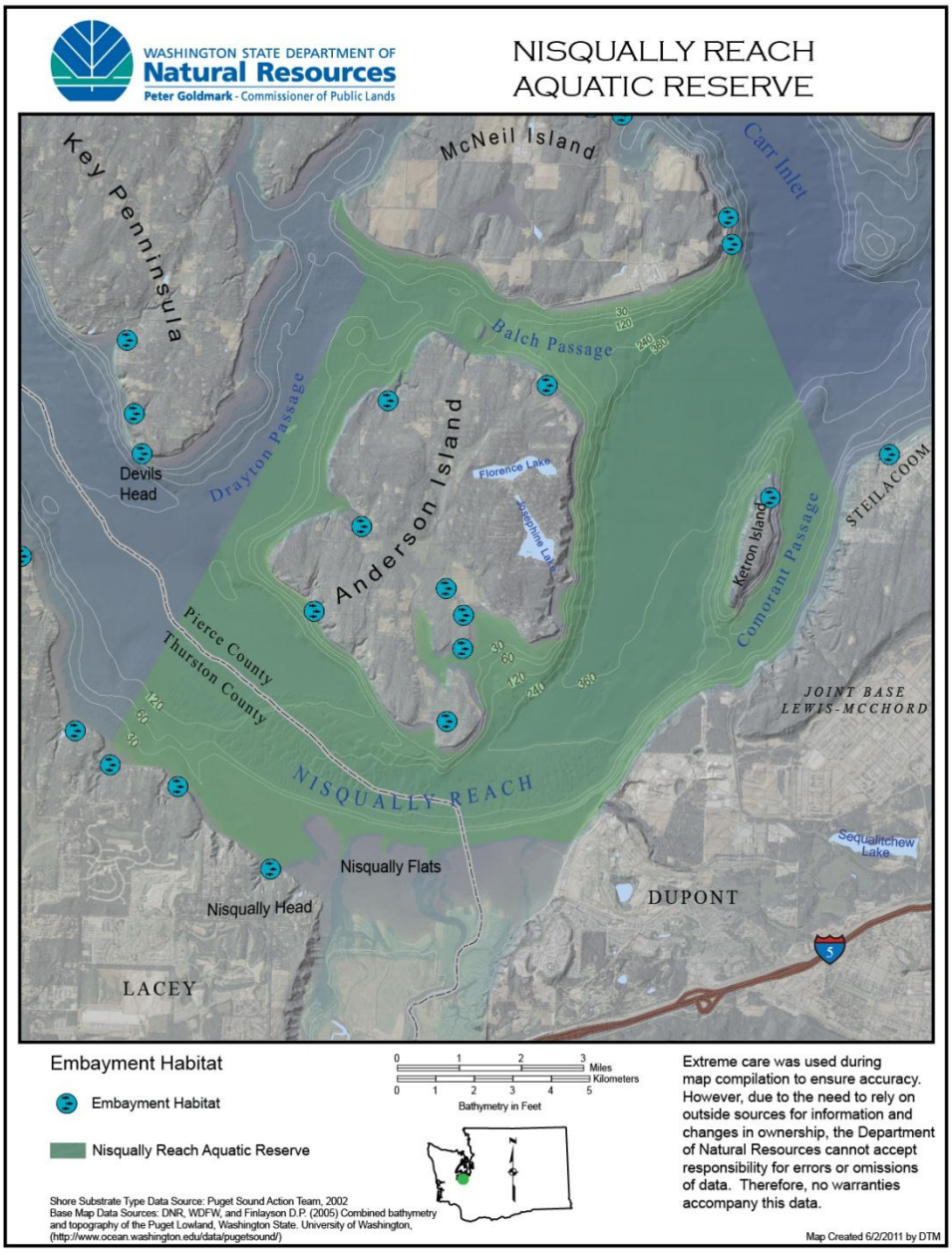


Figure B-11 Nisqually Reach beach substrate type

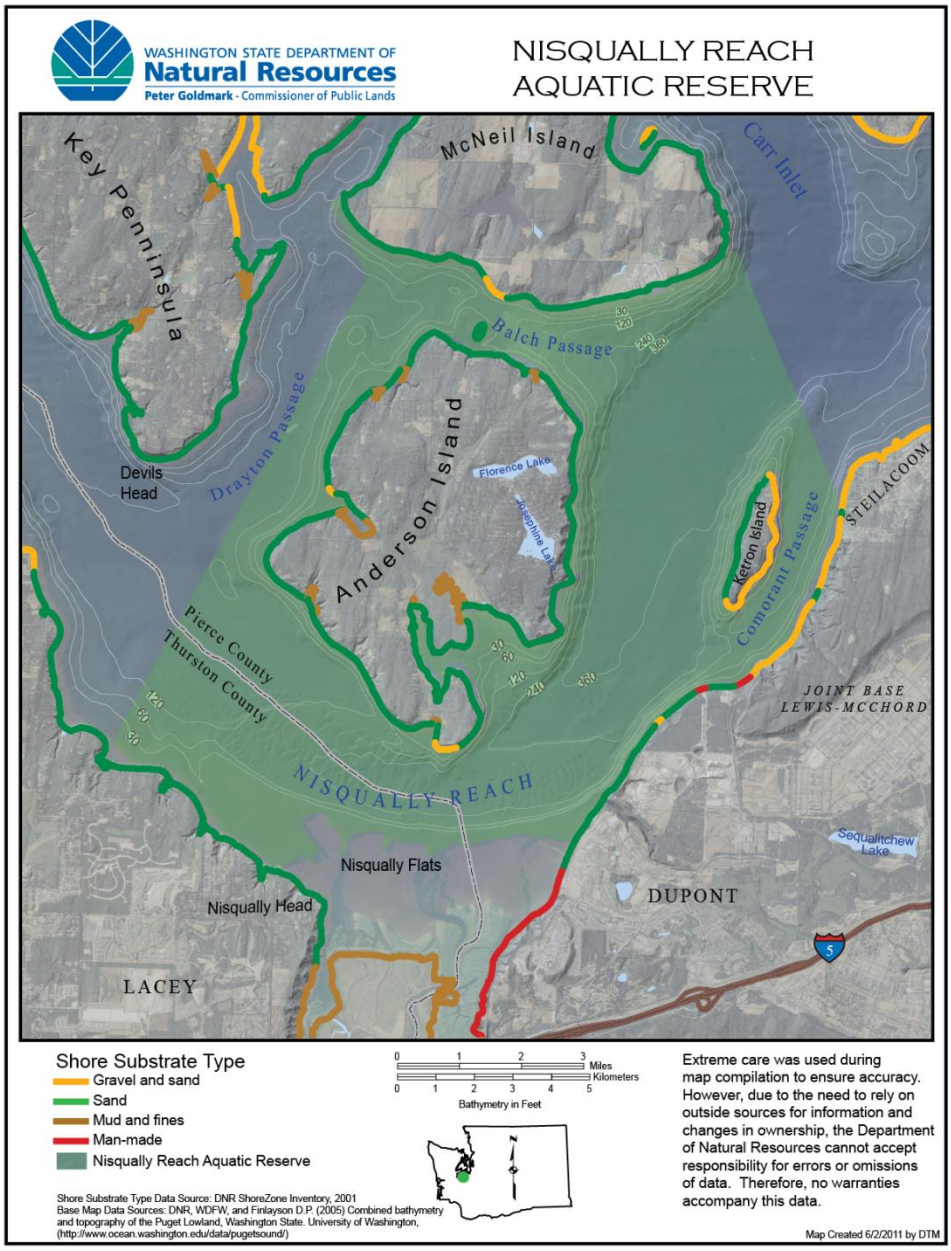


Figure B-12 Nisqually Reach salt marsh habitat

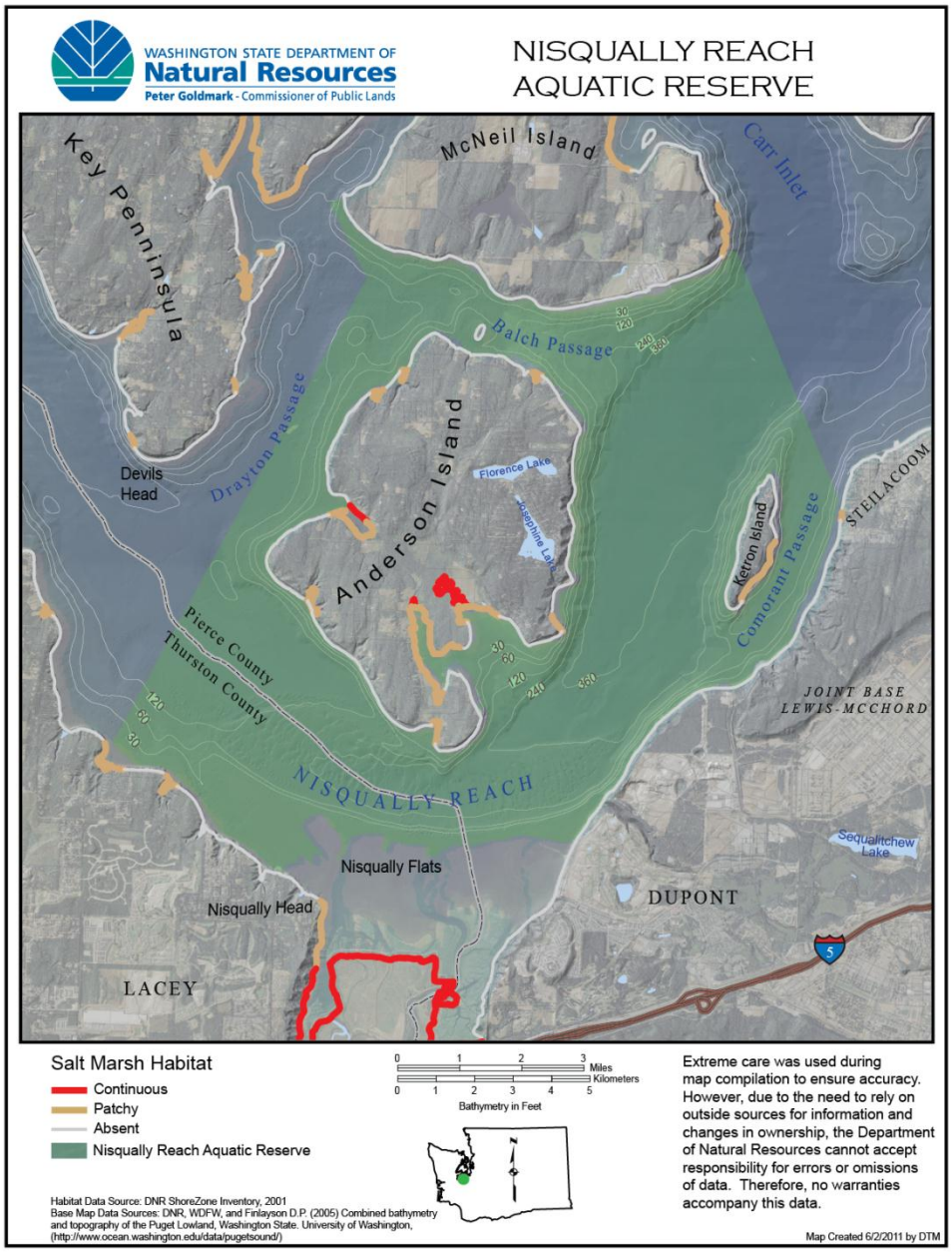


Figure B-13 Nisqually Reach eelgrass

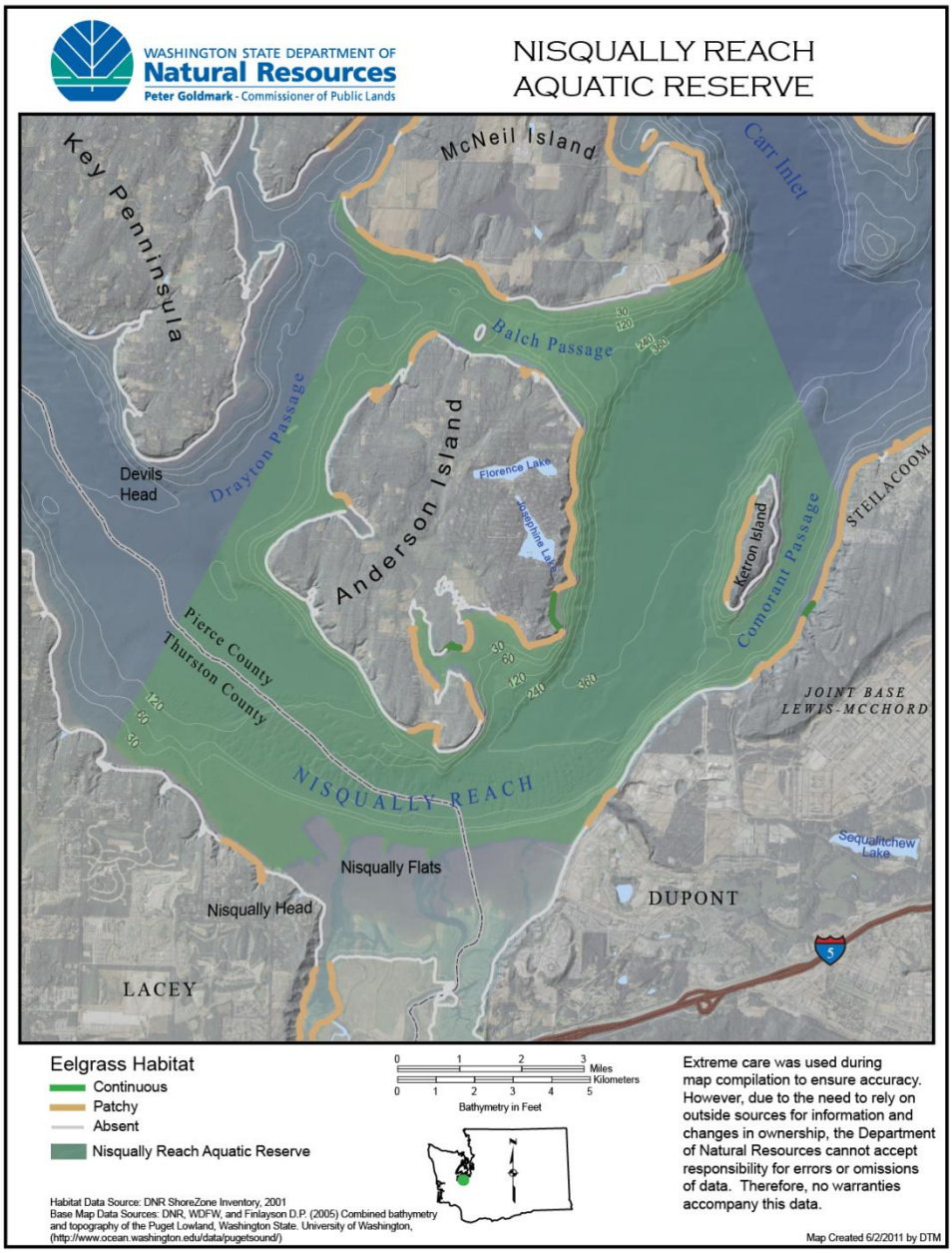


Figure B-14 Non-floating kelp distribution

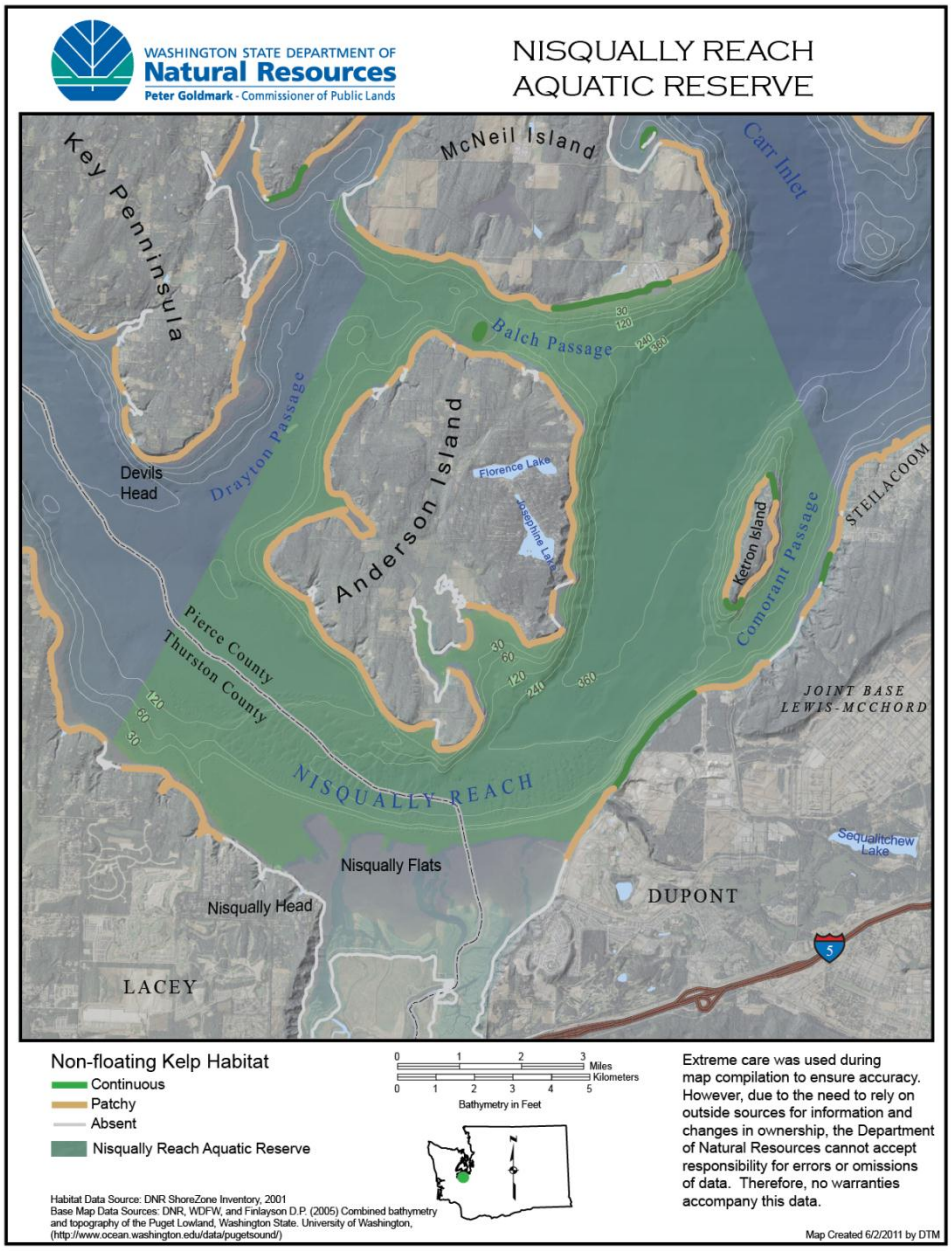


Figure B-15 Pigeon Guillemot observations 1992 - 96

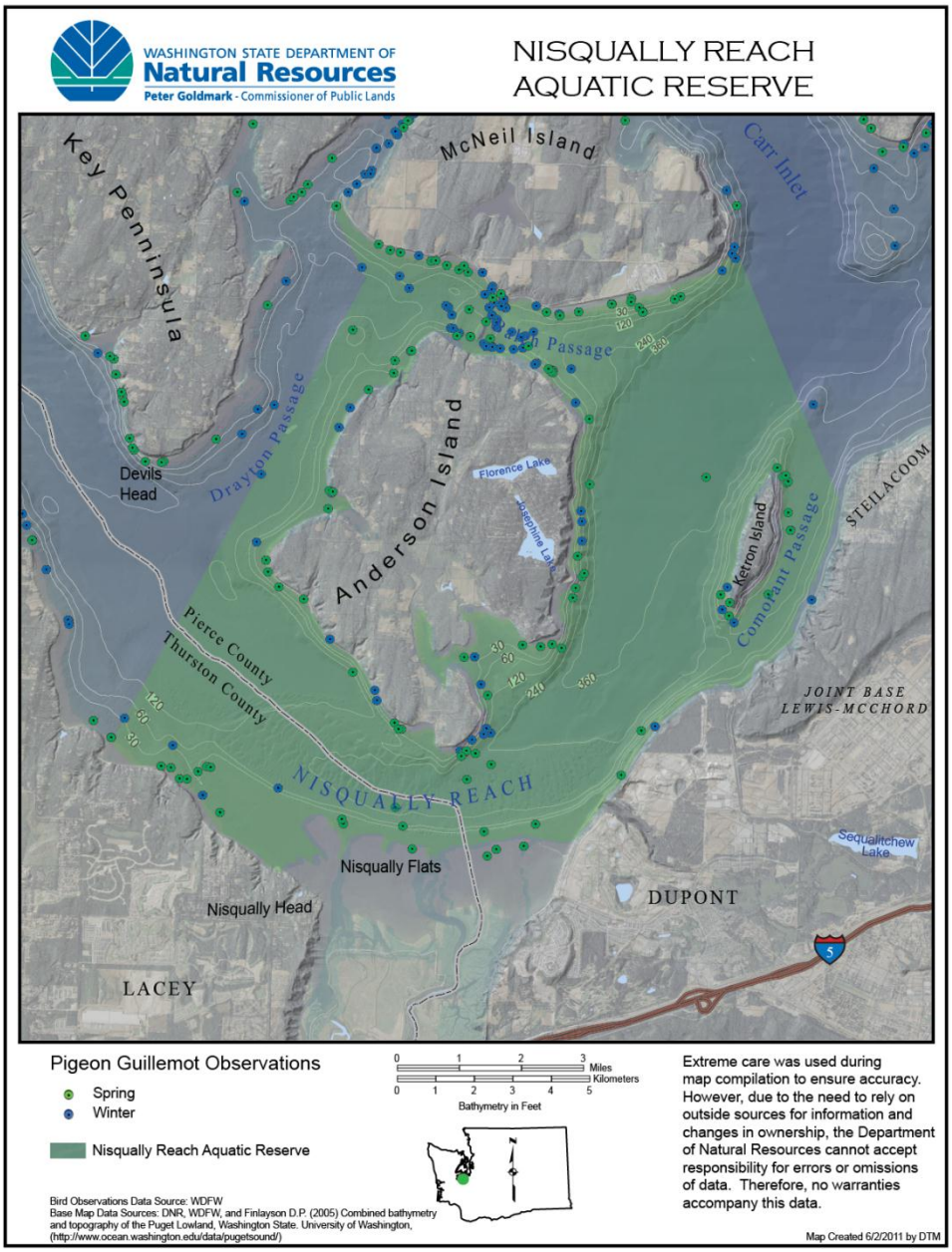


Figure B-16 Double-crested Cormorant and Rhinoceros Auklet observations, winter and spring

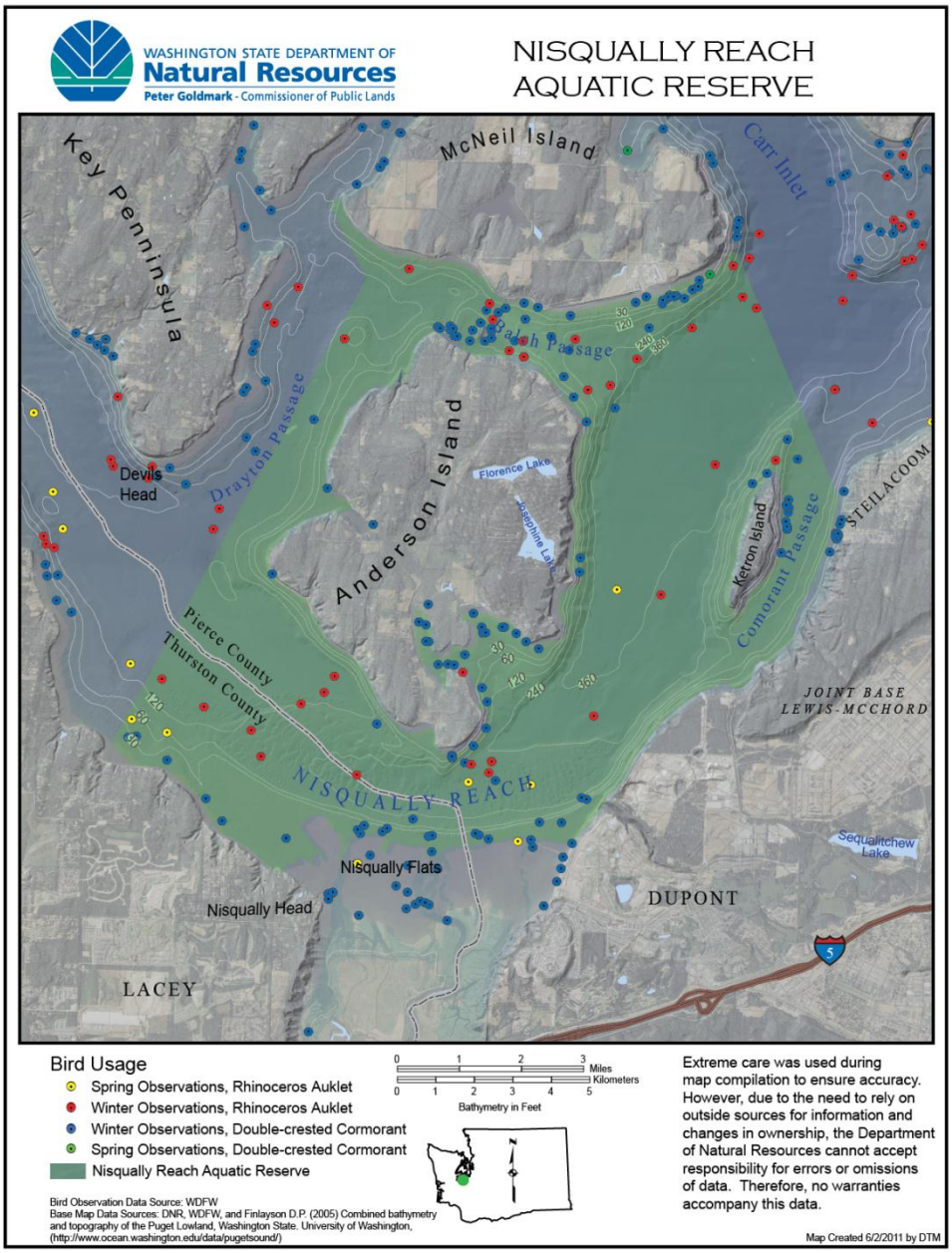


Figure B-17 Bald Eagle observations, spring only

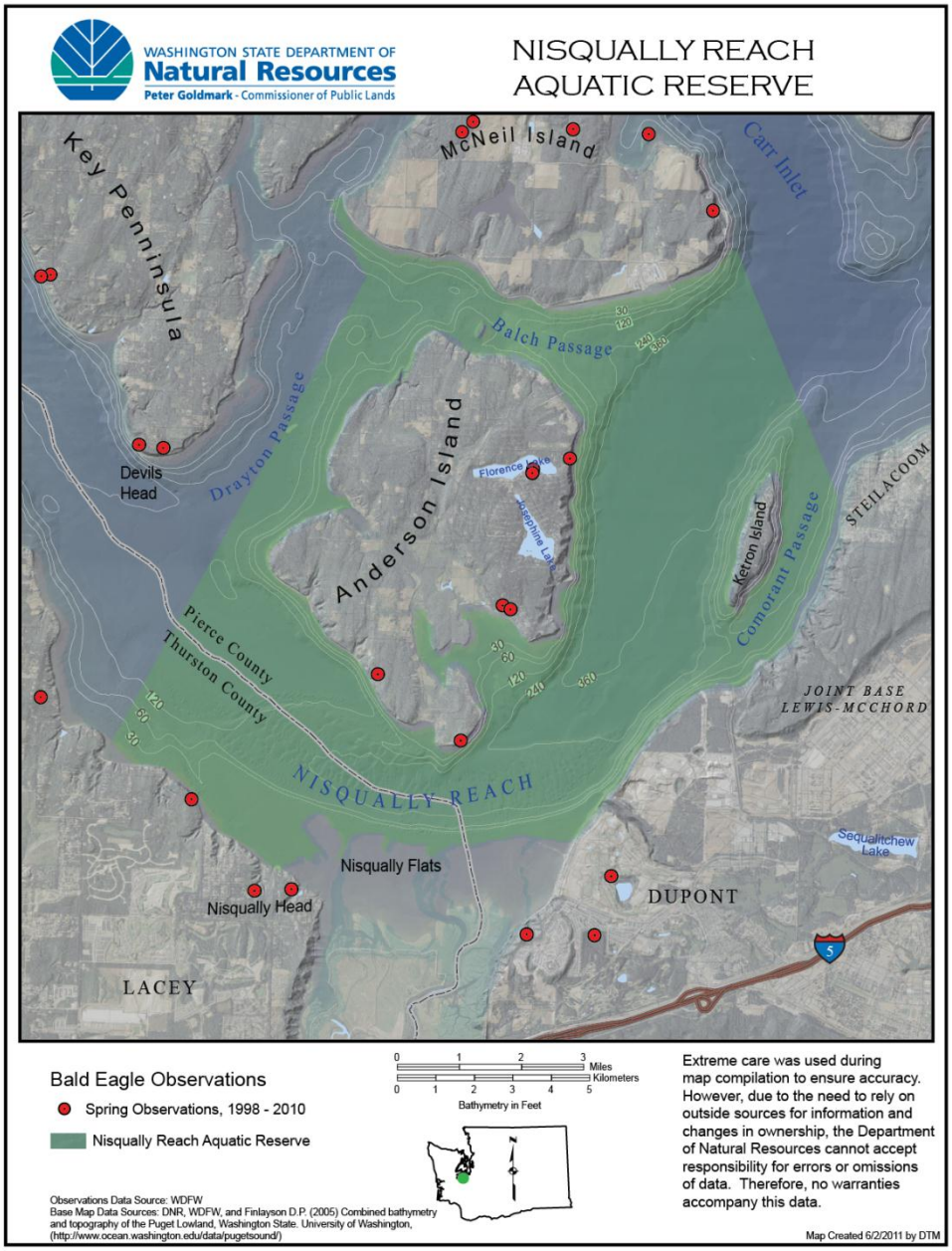


Figure B-18 Herring holding and forage fish spawning habitat

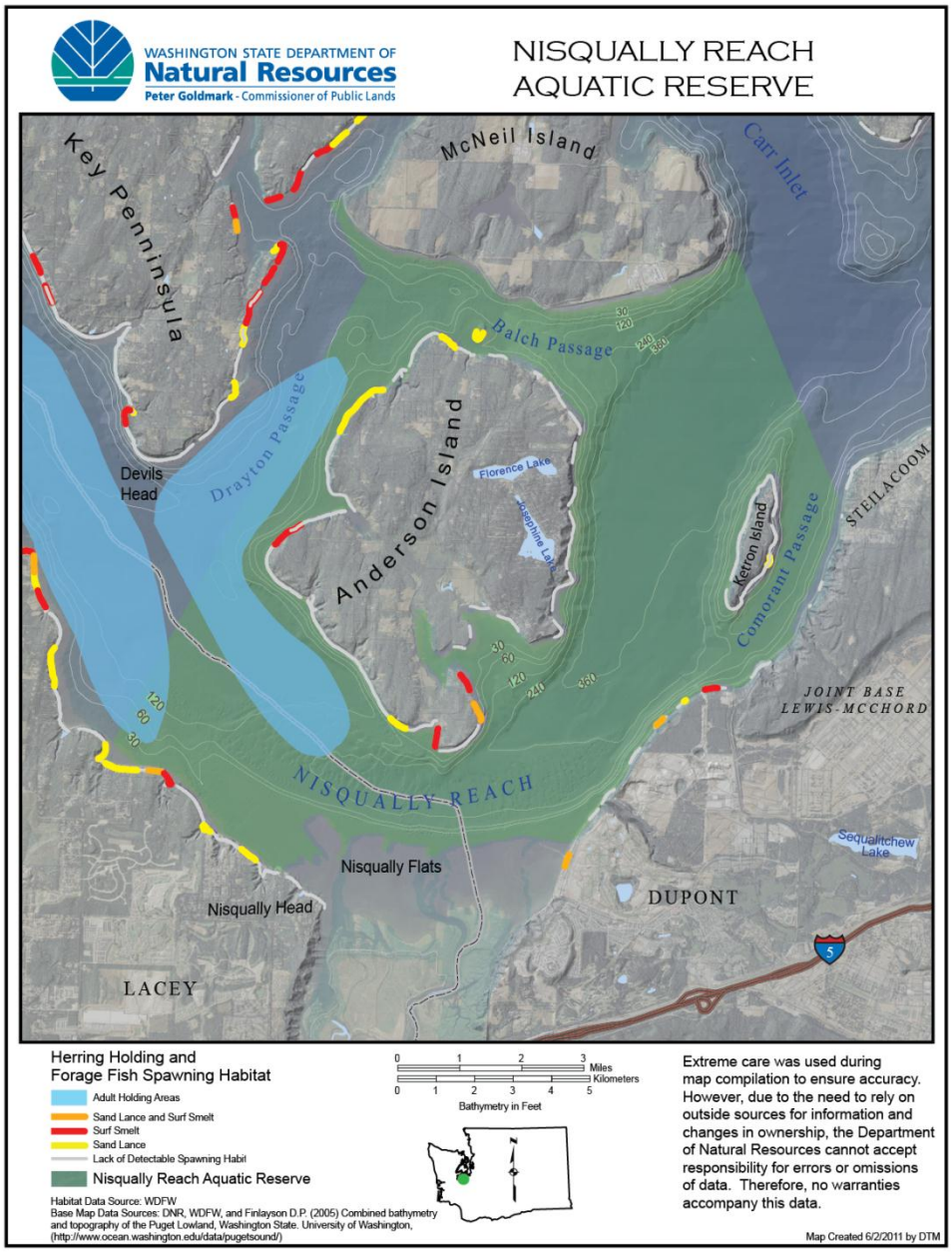


Figure B-19 Nisqually Reach fish sampling location by year

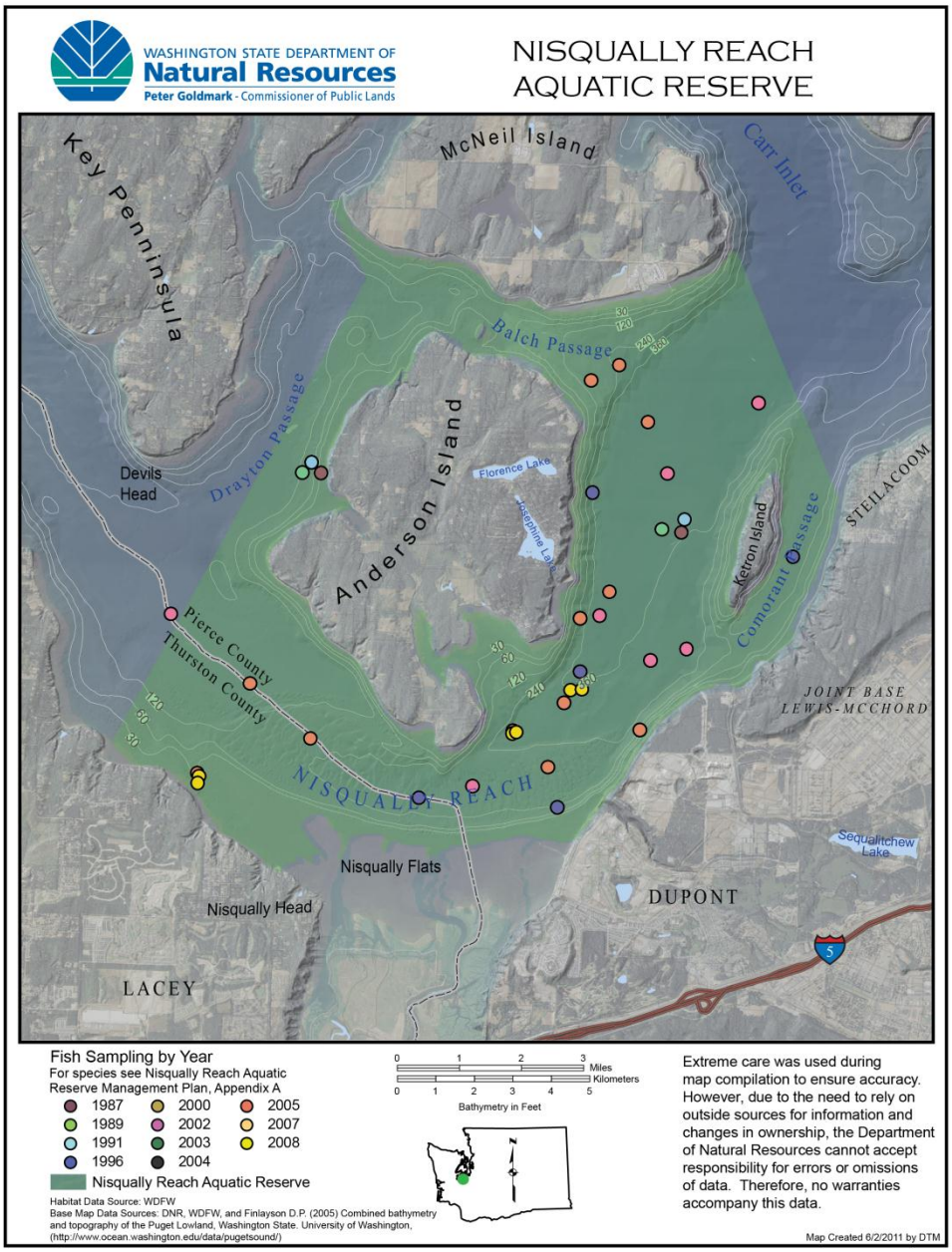


Figure B-20 Geoduck harvestable tracts

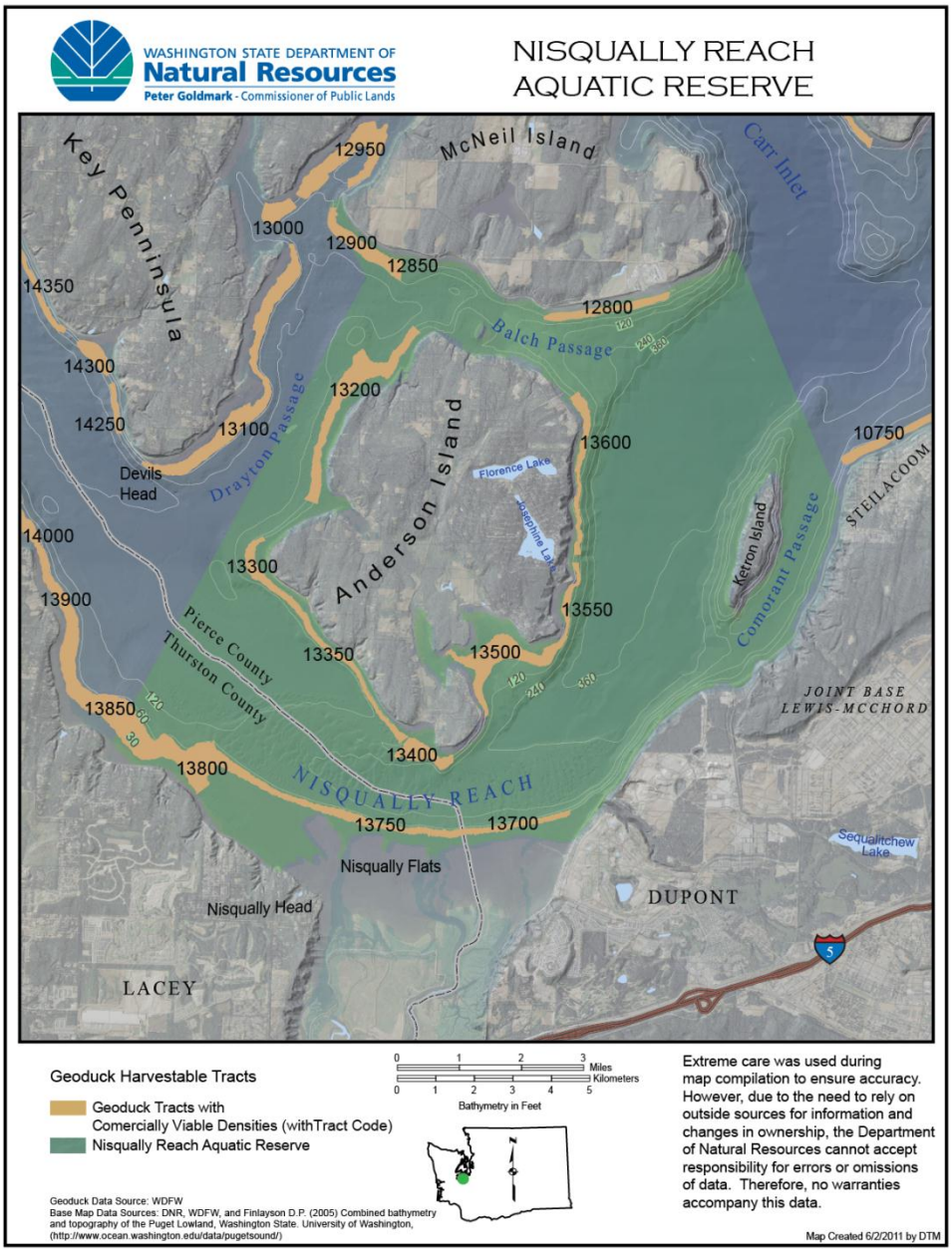


Figure B-21 Marine mammal observations

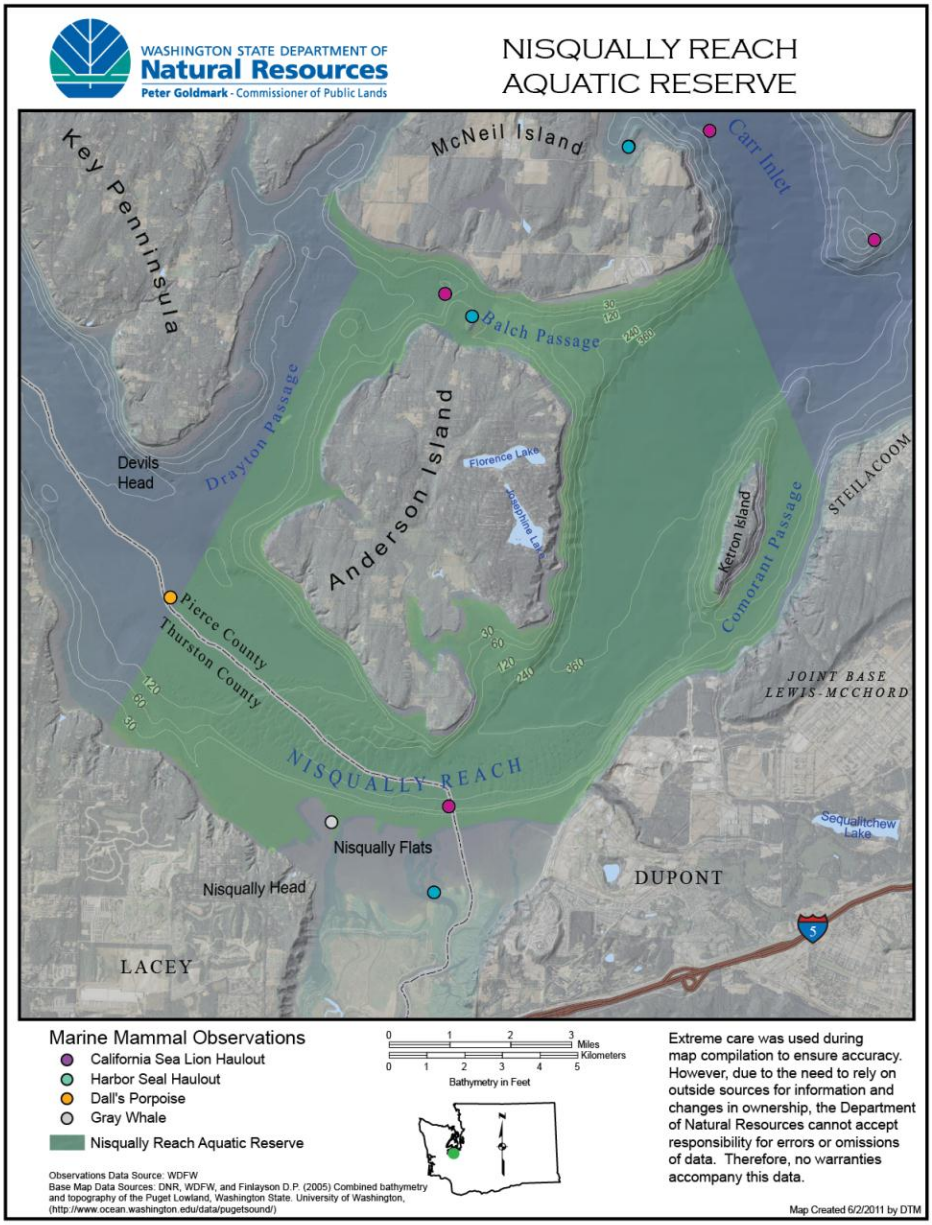
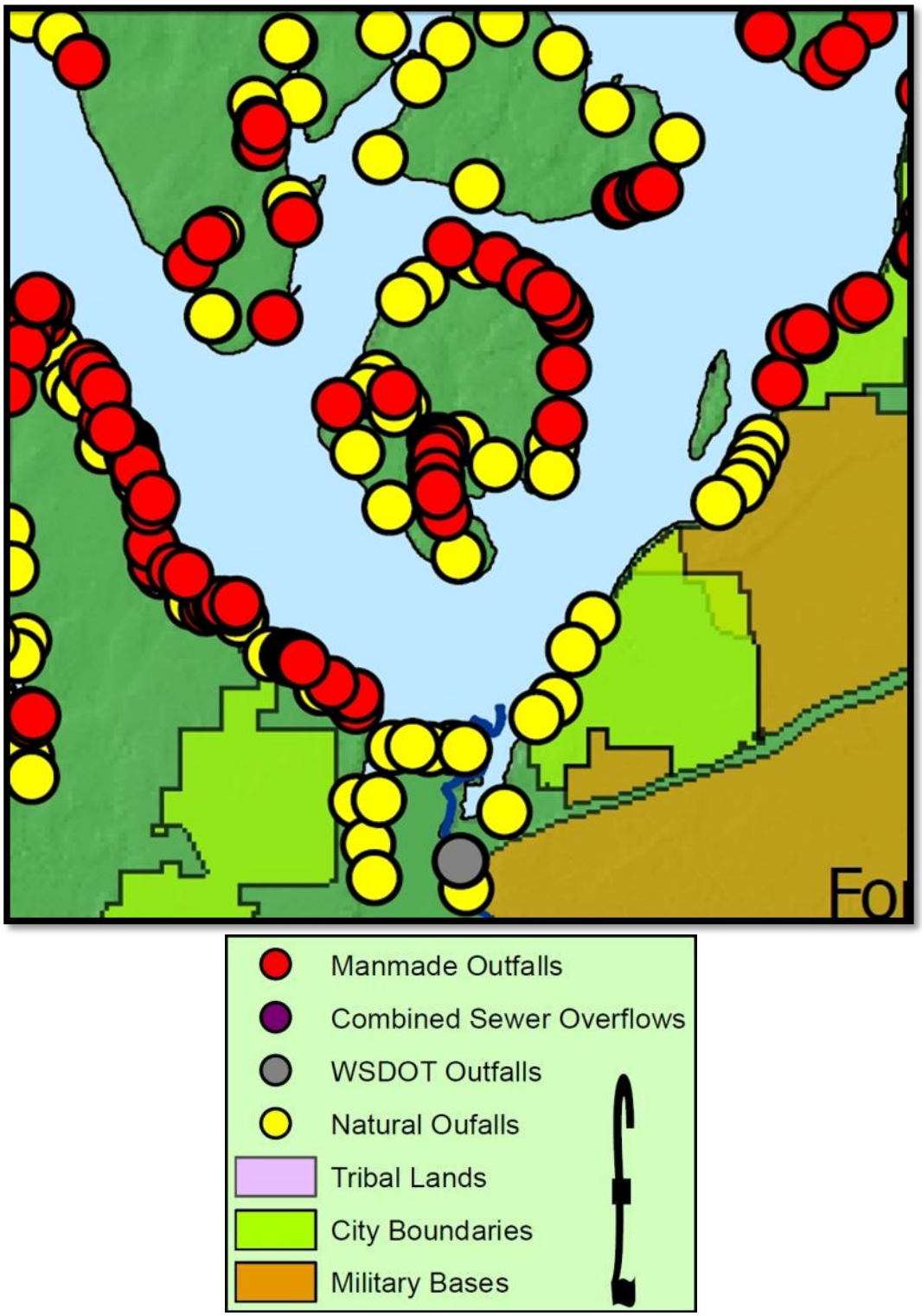


Figure B-22 Public outfalls in the Nisqually Reach (*Public Stormwater Outfalls to Puget Sound, People for Puget Sound, 2009*)



"Natural" refers to creeks, rivers and channels that convey stormwater – the Nisqually is a "natural" outfall or conveyance for stormwater.
All outfalls mapped are tidally influenced. Private outfalls are not included

Figure B-23 Anderson-Ketron Disposal Site

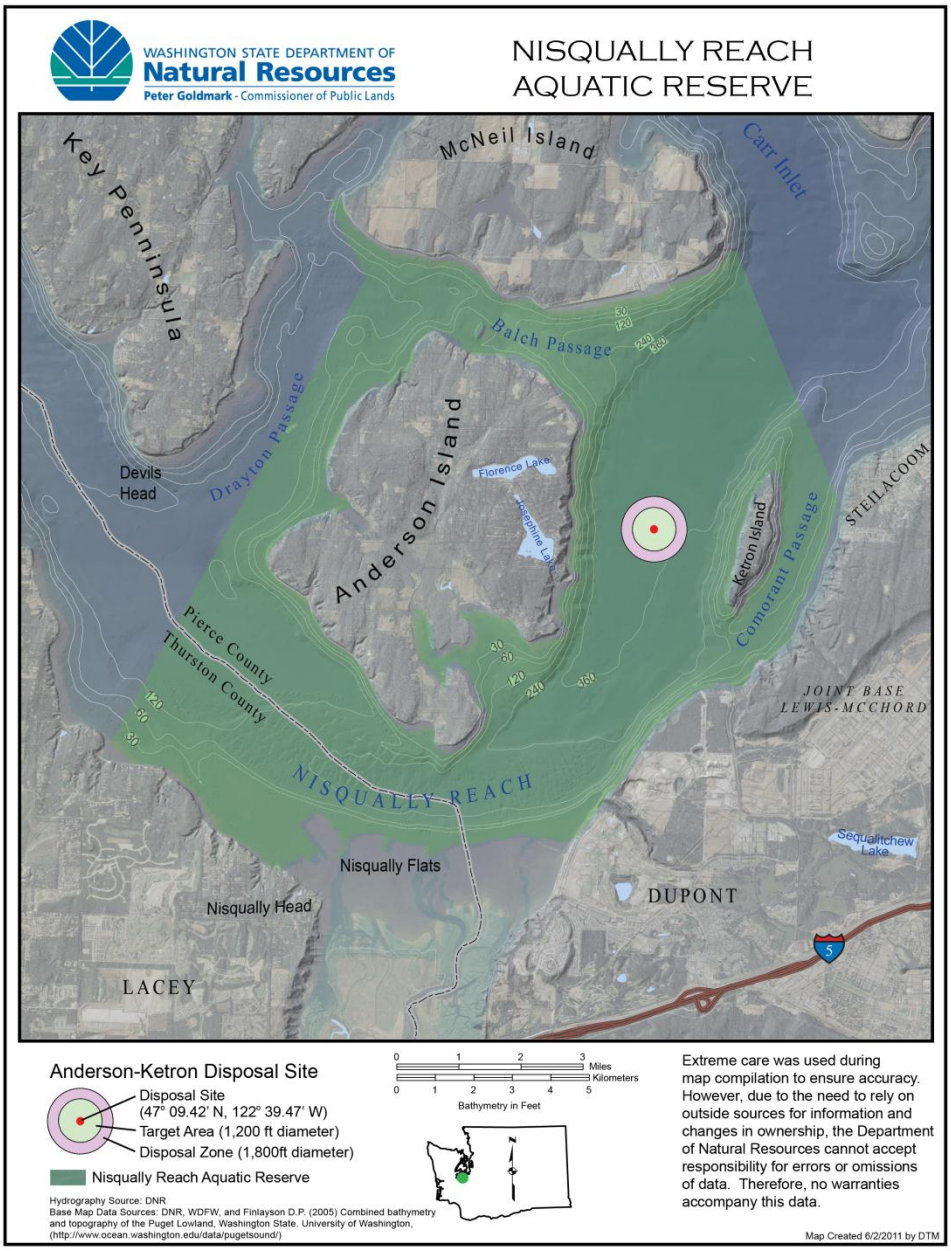


Figure B-24 Encumbrances by activity type in Nisqually Reach

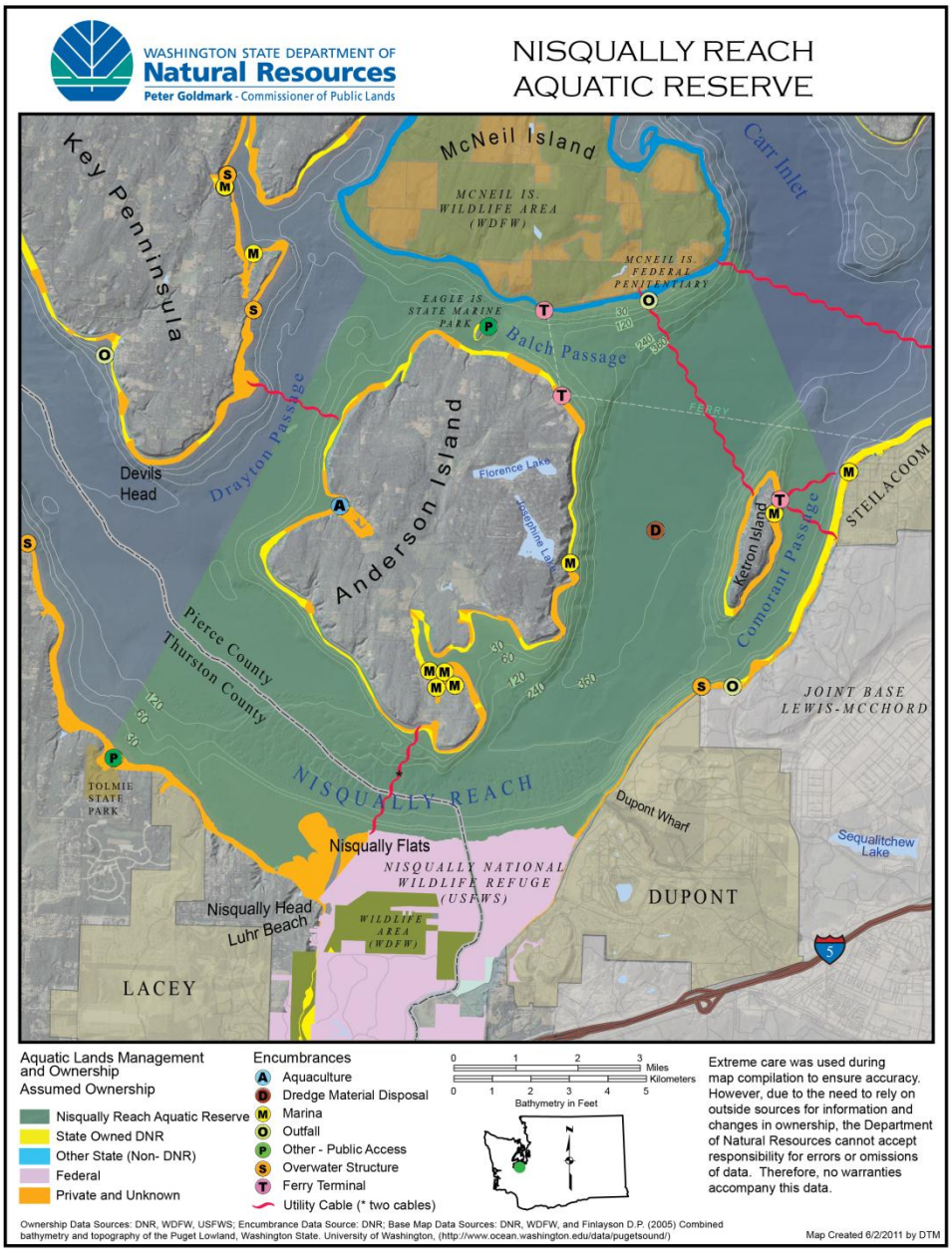


Figure B-25 Shoreline type in Nisqually Reach

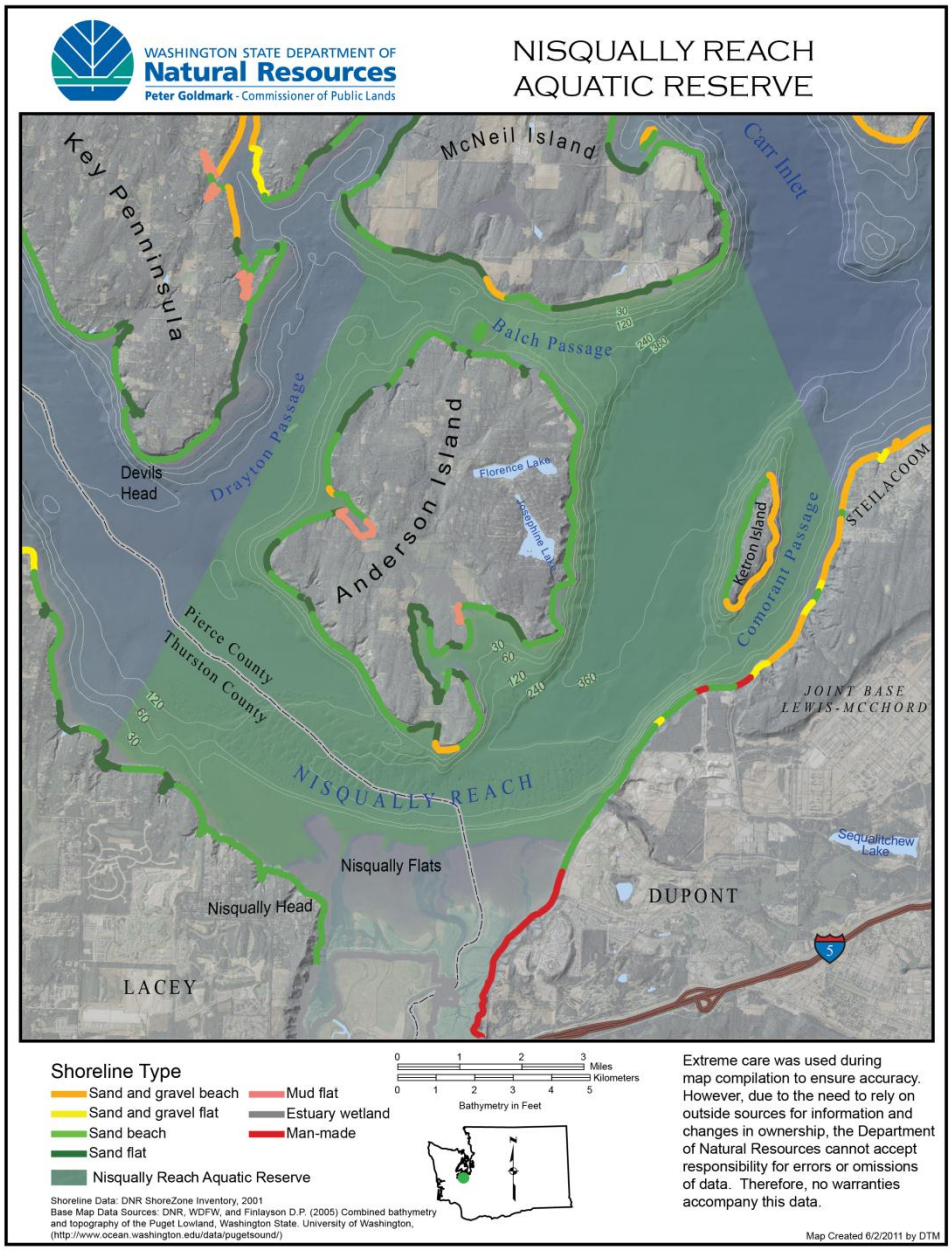


Figure B-26 Overwater structures reference map

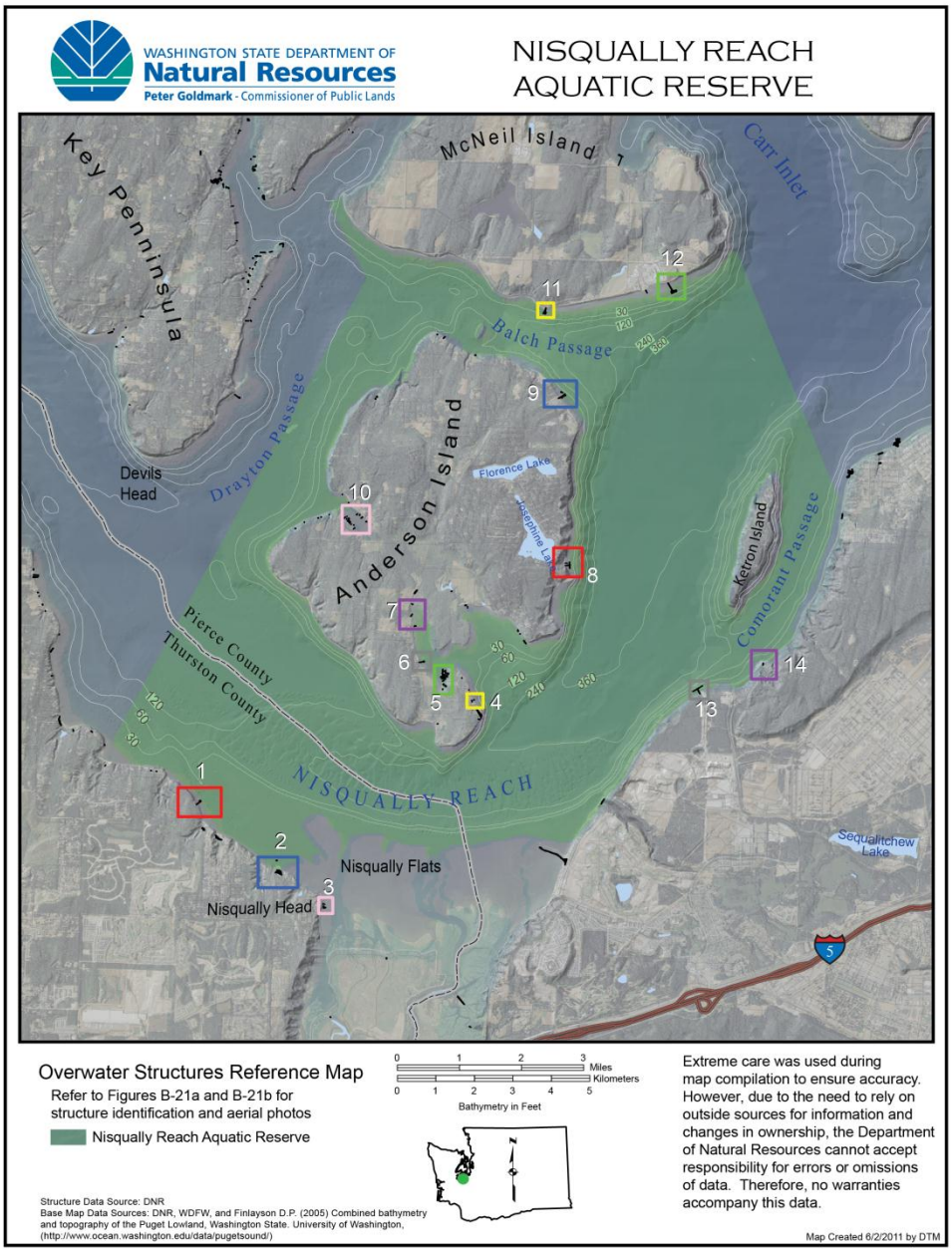


Figure B-27a Overwater structure identification and aerial photos

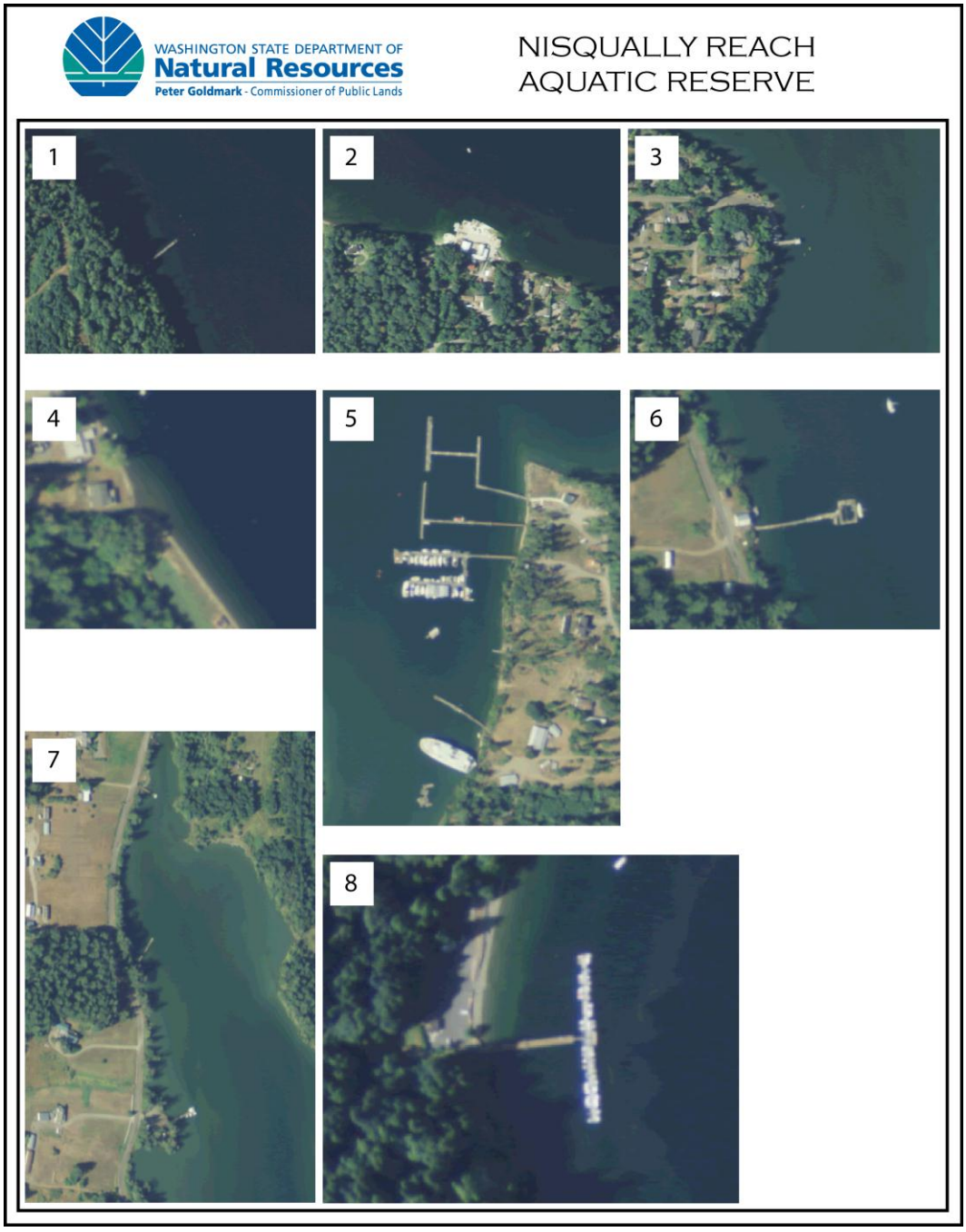


Figure B-27b - Overwater structure identification and aerial photos

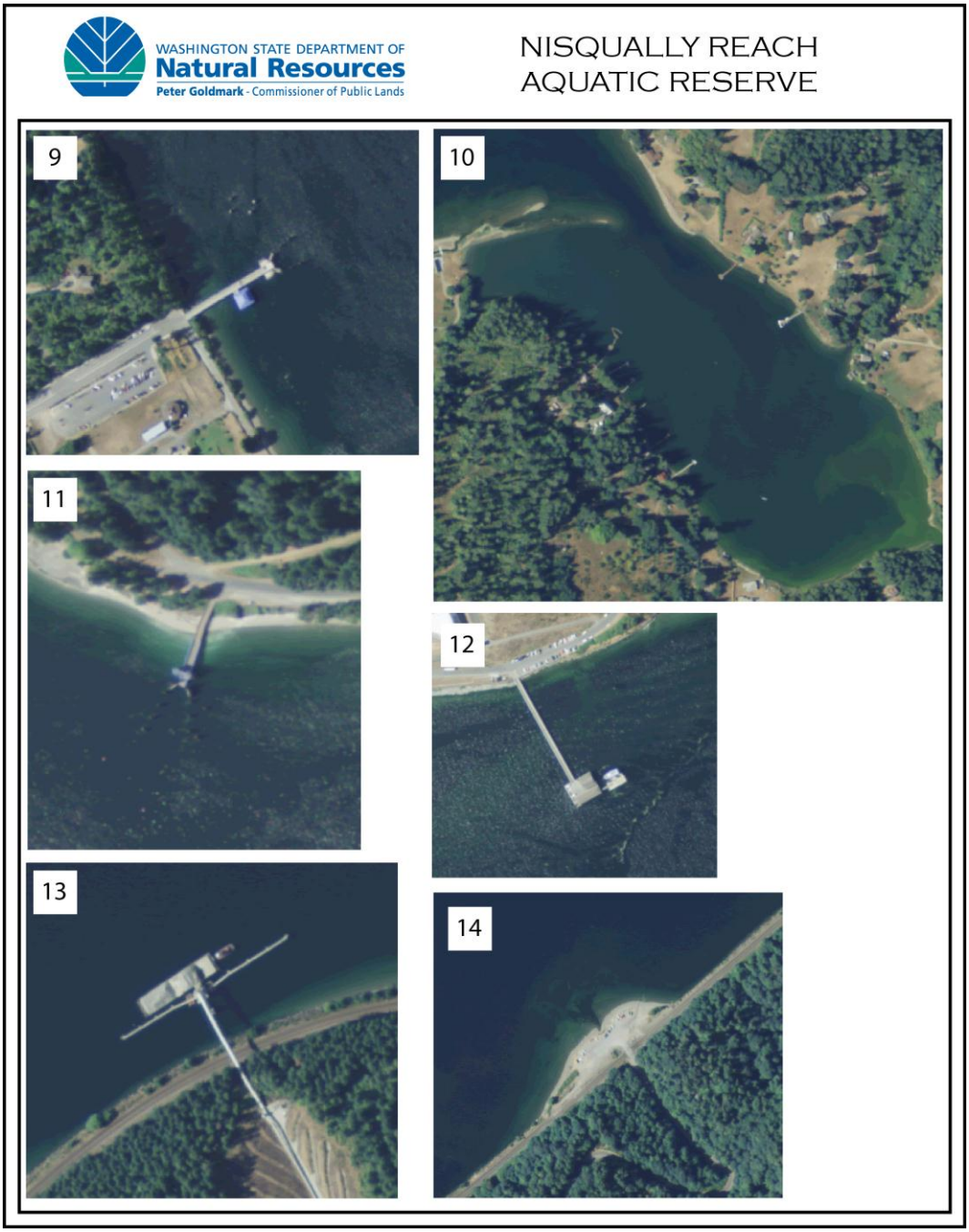


Figure B-21 –Thurston County Shoreline Master Program Draft Update

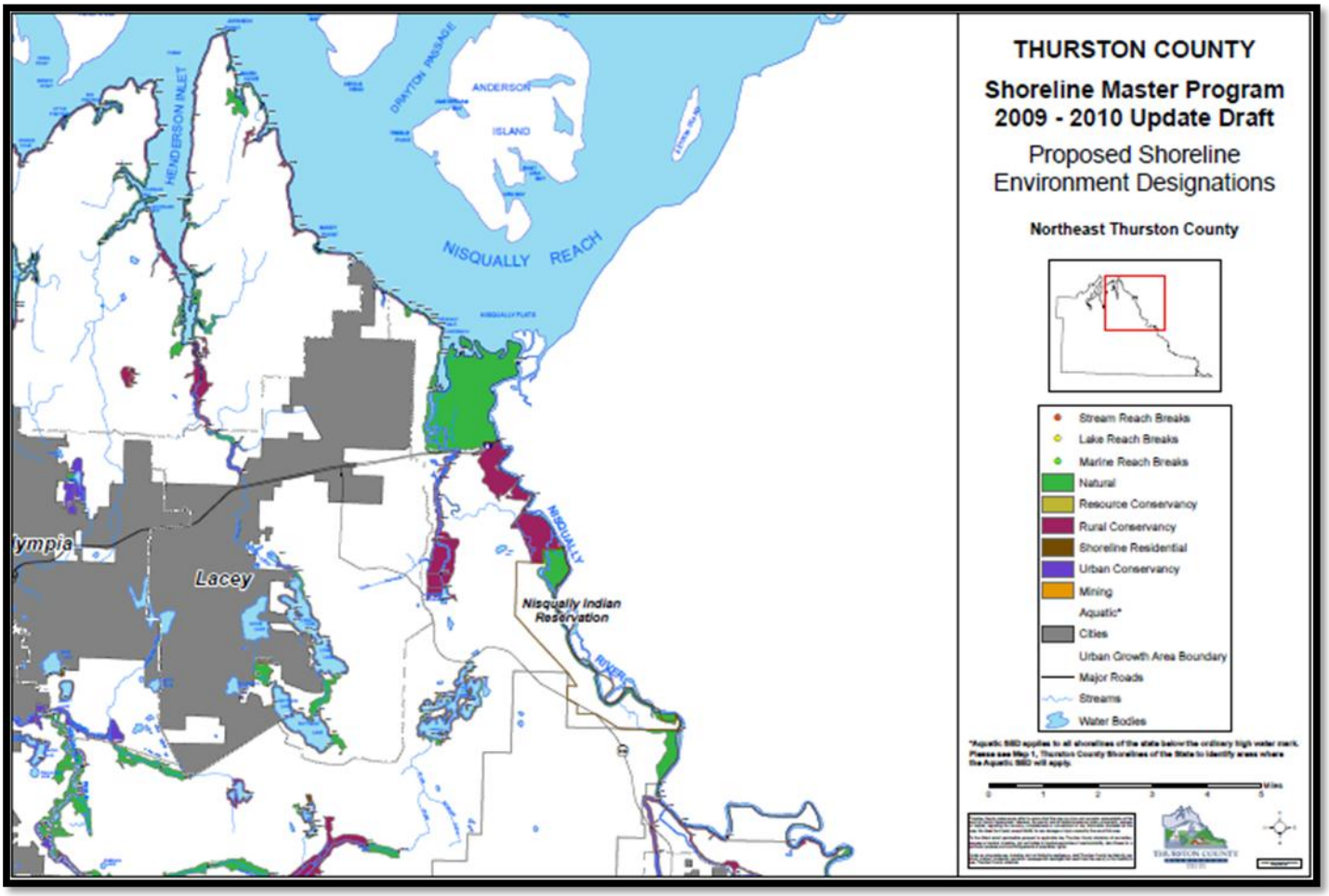


Figure B-22 – Critical Saltwater habitats within the Lacey Urban Growth Boundary, and within the Aquatic Reserve Boundary [1]

[1] Reproduced with permission from D. Burns, AICP, Principal Planner, City of Lacey

Appendix C – Legal Description of Nisqually Reach Aquatic Reserve

Nisqually Aquatic Reserve Legal Description:

A portion of the Tidelands and Bedlands owned by the State of Washington within Puget Sound lying North of the Nisqually River and South of McNeil Island in Pierce County and in Thurston County, Washington. Said Tidelands are fronting and abutting Government Lot 2 of Section 1, Government Lots 1 and 2 of Section 12, Government Lots 2 to 5 of Section 23, Government Lot 1 of Section 24, and Government Lots 1 to 3 of Section 25, all in Township 19 North, Range 1 West, Willamette Meridian; Government Lots 1 to 3 and 5 to 7 of Section 1, Government Lots 1 to 3 of Section 2, Government Lots 1 to 4 of Section 4, Government Lots 1 to 5 of Section 6, Government Lots 1 to 4 of Section 7, Government Lots 1 to 5 of Section 8, Government Lots 1 to 7 of Section 9, Government Lots 1 and 2 of Section 11, Government Lots 1 to 5 of Section 12, Government Lot 1 of Section 13, Government Lots 1 to 4 of Section 14, Government Lot 1 of Section 15, Government Lot 1 of Section 16, Government Lots 1 to 10 of Section 17, Government Lots 1 to 3 of Section 18, Government Lot 1 of Section 20, Government Lots 1 to 4 of Section 22, Government Lots 1 and 2 of Section 27, Government Lots 1 to 5 of Section 28, Government Lots 1 to 4 of Section 29, Government Lots 1 to 4 of Section 30, Government Lot 1 of Section 31 and Government Lot 4 of Section 33, all in Township 19 North, Range 1 East, Willamette Meridian; a portion of Government lot 4 along with Government Lots 5 and 6 of Section 19, Governments Lots 1 to 3 of Section 20, a portion of Government lot 4 of section 23, Government Lot 1 of Section 26, Government Lot 1 to 4 of Section 27, Government Lots 1 to 4 of Section 28, Government Lots 1 to 3 of Section 29, Eagle Island in Sections 28 and 29, Government Lots 1 and 2 and the Northeast Quarter of the Northeast Quarter of Section 32, Government Lots 1 to 5 of Section 33, and Government Lots 1 to 3 of Section 31, all in Township 20 North, Range 1 East, Willamette Meridian.

Said Reserve Is Further Described As Follows:

Commencing at the Section Corner common to Sections 22, 23, 26, and 27, Township 20 North, Range 1 East, Willamette Meridian, located on McNeil Island in Pierce County, Washington; thence East along the South Line of said Section 23 to the East Meander Corner common to said Sections 23 and 26; thence continuing East along the Prolongation of said South Line of Section 23 to the Line of Extreme Low Tide and **Point of Beginning**; thence Northeasterly, fronting a portion of Government Lot 4 of said Section 23, to a Position that intersects a Geographic Latitude of 47°12’03.81” North; thence Southeasterly to a Geographic Position with a Latitude of 47°12’02.95”

North and a Longitude of 122°38’25.43” West; thence Southeasterly to a Position on the Outer Harbor Line of

Steilacoom Harbor, map of said Steilacoom Harbor being adopted on November 3, 1891, said position intersecting a Geographic Latitude of 47°09’50.69” North and fronts Government Lot 5 of Section 1 of said Township 19 North, Range 1 East; thence Southerly along said Outer Harbor Line fronting a portion of Government Lot 5, along with Government Lots 6 and 7 of Section 1, Government Lots 2 to 4, and a portion of Government Lot 5 of Section 12, all in said Township 19 North, Range 1 East, to the Southwest corner of said Steilacoom Harbor; thence Easterly along the Southerly Line of said Steilacoom Harbor to the Northwest Corner of Tract 36, said Tract 36 being a portion of the First Class Tidelands of Steilacoom Tidelands, map of said Steilacoom Tidelands being approved in February of 1895, said tract 36 being sold to Mary A. Bloom by that deed dated April 12, 1904 and filed in Volume 5 at Page 136 in State Records of Tideland and Shoreland Deeds at the Office of the Commissioner of Public Lands; thence Southwesterly along the Westerly Line of said Tract 36, fronting a portion of Government lot 5 of said Section 12; thence Southwesterly along the Westerly Line of Tract 37 of the First Class Tidelands of said Steilacoom Tidelands fronting Government Lot 1 of Section 13 of said Township 19 North, Range 1 East, said Tract 37 being awarded to the United States of America on July 14, 1920 per Cause No. 42358, Army Post Condemnation Case No. 2, Pierce County Records along with and Northern Pacific Railroad on January 26, 1909 per Decree No. 27279, Pierce County Records, to the most Northerly Corner of Tract 38 of the First Class Tidelands of said Steilacoom Tidelands sold to Frank I. Curtis by that deed dated February 10, 1909 and filed in Volume 9 at Page 55 in State Records of Tideland and Shoreland Deeds at the Office of the Commissioner of Public Lands; thence Southwesterly along the Northwesterly Line of said Tract 38, fronting Government Lot 1 and a portion of Government Lot 2 of Section 14 of said Township 19 North, Range 1 East, to the Northwest Corner of said Tract 38; Thence Southerly along the Westerly Line of said Tract 38 to the Northerly Line of said Government Lot 2; thence Southerly and Easterly, along the Waterward Boundaries of a portion of Government Lot 2 along with Government Lots 3 and 4 of Section 14, Government Lot 1 of Section 15, Government Lots 1 to 4 of Section 22, all in said Township 19 North, Range 1 East, to the Meander Corner common to Section 22 and 27 of said Township 19 North, Range 1 East; thence Southwesterly along a Line lying North of the Nisqually River and McAllister Creek to the Meander Corner common to Section 25 of said Township 19 North, Range 1 West and Section 30 of said Township 19 North, Range 1 East; thence Northwesterly along the Waterward Boundaries of Government Lots 1 to 3 of Section 25, Government Lot 1 of Section 24, Government Lots 2 to 5 of Section 23, all in Township 19 North, Range 1 West, to the Southeast Corner of Government Lot 1 of said Section 23; thence Northeasterly across the Nisqually Reach and the Drayton Passage to a Geographic Position with a Latitude of 47°11’43.47” North and a Longitude of 122°43’19.30” West; thence Northwesterly to a Geographic Position with a Latitude of 47°12’23.46” North and a Longitude of 122°43’50.75” West opposite Hogan Point on McNeil Island; thence Northeasterly to a Position on the Line of Extreme Low Tide that intersects a Geographic Latitude of 47°12’26.72” North and fronts Government Lot 4 of Section 19 of said Township 20 North, Range 1 East; thence Easterly along said Line of Extreme Low Tide fronting a portion of said Government lot 4 along with Government Lots 5 and 6 of said Section

19, Government Lots 1 to 3 of Section 20, Government Lot 1 of Section 29, Government Lots 1 to 4 of Section 28, Government Lots 1 to 4 of Section 27, Government Lot 1 of Section 26, and a portion of Government Lot 4 of Section 23, all in Township 20 North, Range 1 East, to the **Point of Beginning**.

Excepting Therefrom:

Anderson Island

Eagle Island

Ketron Island

Any existing Bedlands and Shorelands of the Nisqually River and McAllister Creek

Also, Excepting Therefrom,
The Following Conveyances Filed In The State Records Of Shoreland And Tideland Deeds At The Office Of The Commissioner Of Public Lands:

- Horace Middaugh by that deed dated March 20, 1903, filed in Volume 4 at Page 212.
- Pioneer Sand and Gravel Company by that deed dated June 24, 1913, filed in Volume 12 at Page 249.
- E. I. Dupont deNemours Powder Company by that deed dated June 6, 1912, filed in Volume 12 at Page 17.
- The Eastern Dynamite Company by that deed dated June 23, 1906, filed in Volume 7 at Page 429.
- Samuel C. Knowles by that deed dated January 20, 1913, filed in Volume 12 at Page 36.
- Samuel C. Knowles by that deed dated June 6, 1911, filed in Volume 10 at Page 342.
- United States of America by that deed for mineral interests dated December 20, 1933, filed in Volume 17 at Page 409.
- D. H. Bales by that deed dated October 23, 1920, filed in Volume 14 at Page 377.
- W. H. Bennett by that deed dated October 23, 1920, filed in Volume 14 at Page 379.
- W. H. Yeager Jr. by that deed dated March 9, 1943, filed in Volume 19 at Page 215.
- J. H. Duncan by that deed dated September 15, 1932, filed in Volume 17 at Page 338.
- George Martin Babare by that deed dated January 10, 1962, filed in Volume 23 at Page 232.
- W. C. Luhr by that deed dated September 22, 1943, filed in Volume 19 at Page 327.
- Robert S. Barbare by that deed dated January 17, 1962, filed in Volume 23 at Page 233.
- Mary Tomich by that deed dated April 21, 1932, filed in Volume 17 at Page 305.
- Martin Tomich by that deed dated September 20, 1933, filed in Volume 17 at Page 444.
- Martin Tomich by that deed dated December 12, 1941, filed in Volume 19 at Page 1.

- George Babare by that deed dated December 28, 1960, filed in Volume 23 at Page 130.
- O. C. Hanson by that deed dated June 6, 1911, filed in Volume 11 at Page 386.
- O. C. Hanson by that deed dated August 31, 1934, filed in Volume 17 at Page 373.
- G. M. Utterback and C. C. Cherry by that deed dated February 14, 1913, filed in Volume 12 at Page 59.
- George Olson and Abbie Olson with an undivided one half interest and George M. Utterback with an undivided one half interest by that deed dated July 15, 1942, filed in Volume 19 at Page 97
- W. H. Yeager by that deed dated May 9, 1916, filed in Volume 13 at Page 212.
- Mary M. Miller, a widow, and Winlock W. Miller by that deed dated August 4, 1919, filed in Volume 14 at Page 148.
- Mary M. Miller Sons, by that deed dated June 6, 1911, filed in Volume 11 at Page 469.
- Tacoma Mill Company by that deed dated January 22, 1909, filed in Volume 9 at Page 41.
- Tacoma Mill Company by that deed dated June 6, 1911, filed in Volume 10 at Page 614.
- Tacoma Mill Company by that deed dated September 23, 1903, filed in Volume 4 at Page 337.
- J. A. Hoshor by that deed dated December 19, 1911, filed in Volume 10 at Page 613.
- J. A. Hoshor by that deed dated June 6, 1911, filed in Volume 11 at Page 503.
- Lena Christensen by that deed dated October 20, 1953, filed in Volume 21 at Page 812.
- Lena Christensen by that deed dated April 21, 1953, filed in Volume 21 at Page 721.
- Cammon Brothers Sawmill by that deed dated June 26, 1951, filed in Volume 21 at Page 465.
- Nettle E. Swan by that deed dated May 4, 1945, filed in Volume 19 at Page 575.
- Ernest Lusier and Helen Lusier by that deed dated June 26, 1951, filed in Volume 21 at Page 478.
- Fred A. Lee by that deed dated April 26, 1923, filed in Volume 15 at Page 79.
- Stephen Gulseth by that deed dated September 26, 1941, filed in Volume 18 at Page 671.
- Carl Tueson by that deed dated April 26, 1923, filed in Volume 15 at Page 78.
- Hattie L. Johnson by that deed dated October 20, 1953, filed in Volume 21 at Page 813.
- Benjamin E. Johnson by that deed dated August 26, 1952, filed in Volume 21 at Page 640.
- Mrs. Iva Hicock by that deed dated May 19, 1944, filed in Volume 19 at Page 428.
- Chester A. Burg by that deed dated May 2, 1944, filed in Volume 19 at Page 419.
- Rupert Burg by that deed dated May 2, 1944, filed in Volume 19 at Page 420.
- Ruby St. Jean by that deed dated May 2, 1944, filed in Volume 19 at Page 423.
- Mrs. Mable Joelson by that deed dated May 2, 1944, filed in Volume 19 at Page 422.
- Agaton Olson by that deed dated April 4, 1950 filed in Volume 21 at Page 337.

- E. A. Ehricke by that deed dated July 12, 1945 filed in Volume 19 at Page 629.
- Agaton Olson by that deed dated October 6, 1955 filed in Volume 22 at Page 240.
- C. J. Eikeness by that deed dated July 12, 1945 filed in Volume 19 at Page 644.
- W. J. Baskett by that deed dated July 12, 1945 filed in Volume 19 at Page 645.
- Mrs. W. J. Baskett by that deed dated November 2, 1945 filed in Volume 20 at Page 31.
- Kautz Investment Company by that deed dated March 2, 1921 filed in Volume 14 at Page 447.
- Edwin H. Wilcox and Marjorie L. Wilcox by that deed dated February 20, 1959 filed in Volume 22 at Page 815.
- Peter P. Dahlgreen by that deed dated February 3, 1914 filed in Volume 12 at Page 367.
- Peter P. Dahlgreen by that deed dated June 6, 1911 filed in Volume 10 at Page 304.
- Carl A. Petterson by that deed dated April 30, 1909 filed in Volume 9 at Page 120.
- Carl J. Ostling by that deed dated April 28, 1910 filed in Volume 9 at Page 377.
- B. F. Jacobs by that deed dated February 8, 1911 filed in Volume 10 at Page 74.
- W. I. Moulton by that deed dated March 10, 1917 filed in Volume 13 at Page 291A.
- W. I. Moulton by that deed dated June 6, 1911 filed in Volume 11 at Page 282.
- Christine Anderson by that deed dated August 18, 1948 filed in Volume 21 at Page 131.
- Foss Launch and Tug Company by that deed dated January 7, 1955 filed in Volume 22 at Page 159.
- Raymond F. Weinrich by that deed dated July 12, 1943 filed in Volume 19 at Page 268.
- John E. Johanson by that deed dated October 18, 1949 filed in Volume 21 at Page 318.
- J. W. Rollag by that deed dated April 21, 1953 filed in Volume 21 at Page 727.
- L. H. Hill by that deed dated May 4, 1945 filed in Volume 19 at Page 576.
- Fred J. Robbins by that deed dated May 4, 1945 filed in Volume 19 at Page 578.
- Sanford A. Stoner by that deed dated May 2, 1944 filed in Volume 19 at Page 417.
- J. L. Skelton by that deed dated January 25, 1946 filed in Volume 20 at Page 90.
- J. L. Skelton by that deed dated August 26, 1946 filed in Volume 20 at Page 190.
- Isabel Judson by that deed dated October 18, 1939 filed in Volume 18 at Page 442.
- Lesh Land Company by that deed dated November 6, 1909 filed in Volume 9 at Page 267.
- Andrew Anderson by that deed dated April 21, 1953 filed in Volume 21 at Page 725.
- Harry S. Thorberg by that deed dated August 8, 1945 filed in Volume 19 at Page 648.
- Harry S. Thorberg by that deed dated April 21, 1943 filed in Volume 19 at Page 231.
- Helda Lindstrom by that deed dated March 3, 1911 filed in Volume 10 at Page 93.
- Mrs. W. F. McClelland by that deed dated March 21, 1917 filed in Volume 13 at Page 286.

- Francis E. Berry by that deed dated April 22, 1954 filed in Volume 22 at Page 45.
- Charles R. Buchanan by that deed dated July 12, 1945 filed in Volume 19 at Page 630.
- Robert Wingate Estate by that deed dated March 11, 1913 filed in Volume 12 at Page 110.
- Robert Wingate Estate by that deed dated June 6, 1911 filed in Volume 10 at Page 325.
- Stetson Trust Company by that deed dated January 26, 1906 filed in Volume 7 at Page 261 and 262.
- Stetson Trust Company by that deed dated June 6, 1911 filed in Volume 11 at Page 281.
- Stetson Trust Company by that deed dated May 11, 1909 filed in Volume 9 at Page 141.
- Robert Wingate Estate by that deed dated August 22, 1918 filed in Volume 13 at Page 488.

Subject To:

- A Right of Way Easement for two Submarine Cable Crossings over a Portion of the State Owned Aquatic Lands of Puget Sound granted to the Department of Corrections under Authorization #51-077187.
- A Right of Way Easement for a Sewer Outfall over a Portion of the State Owned Aquatic Lands of Puget Sound granted to the United States Penitentiary under Authorization #51-033301.
- A Right of Way Easement for a Submarine Cable Crossing over a Portion of the State Owned Aquatic Lands of Puget Sound granted to the Pacific Northwest Bell Telephone Company under Authorization #51-038213.
- A Right of Way Easement for a Wharf Site over a Portion of the State Owned Aquatic Lands of Puget Sound granted to Pierce County under Authorization #51-000396.
- A Right of Way Easement for a Submarine Cable Crossing over a Portion of the State Owned Aquatic Lands of Puget Sound granted to Sound Telephone Company under Authorization #51-032139.
- A Right of Way Easement for a Ferry Landing over a Portion of the State Owned Aquatic Lands of Puget Sound granted to Pierce County under Authorization #51-01762.
- A lease for a Private Marina over a Portion of the State Owned Aquatic Lands of Puget Sound granted to the Riviera Community Club under Authorization #20-A012471.
- A Right of Way Easement for a Submarine Cable Crossing over a Portion of the State Owned Aquatic Lands of Puget Sound granted to the Pacific Northwest Bell Telephone Company under Authorization #51-031615.
- A Right of Way Easement for a Submarine Cable Crossing over a Portion of the State Owned Aquatic Lands of Puget Sound granted to the City of Tacoma under Authorization #51-030276.

- A Right of Way Easement for a Ferry Dock over a Portion of the State Owned Aquatic Lands of Puget Sound granted to Pierce County under Authorization #51-003071.
- A lease for a Private Marina and Boat Moorage over a Portion of the State Owned Aquatic Lands of Puget Sound assigned to Thomas and Kathleen Palmer under Authorization #20-013175.
- A lease for a Private Marina over a Portion of the State Owned Aquatic Lands of Puget Sound granted to Oro Bay Properties under Authorization #20-013385.
- A lease for a Private Marina over a Portion of the State Owned Aquatic Lands of Puget Sound granted to the Tacoma Yacht Club under Authorization #20-A012239.
- A lease for a Private Marina over a Portion of the State Owned Aquatic Lands of Puget Sound granted to the Bremerton Yacht Club under Authorization #20-A013429.
- A Right of Way Easement for a Sewer Outfall over a Portion of the State Owned Aquatic Lands of Puget Sound granted to the United States Corp of Engineers under Authorization #51-033960.
- Withdrawal of a Portion of the State Owned Aquatic Lands of Puget Sound granted to the State Parks and Recreation Commission under Authorization #20-009760 and Commissioner's Order #72-252.
- A Right of Way Easement for a Submarine Cable Crossing over a Portion of the State Owned Aquatic Lands of Puget Sound granted to Mutual Power and Light Company under Authorization #51-026946.
- A lease for a Private Barge Loading Dock and a Mooring Buoy over a Portion of the State Owned Aquatic Lands of Puget Sound granted to Lone Star Northwest Incorporated under Authorization #20-013511.

<u>Pending Applications for Use Authorizations:</u>

- A pending lease applied for by the Nisqually Indian Tribe for Clam Cultivation over a Portion of the State Owned Aquatic Lands of Puget Sound under Application #20-070874.
- A pending lease applied for by Pierce County for a Ferry Dock over a Portion of the State Owned Aquatic Lands of Puget Sound under Application #20-013513.
- A pending lease with WA Parks and Recreation for the tidelands and bedlands surrounding Eagle Island and extending to ¼ mile; a use agreement was proposed in 1978, but the agreement was never signed by the two Departments under Application #20-0011390.
- An application with the Department of Corrections for the passenger ferry dock to service the McNeil Island prison; a use agreement was proposed in 1989, but the agreement was never signed by the two Departments. A survey and legal description were prepared for the authorization, but the correspondence stopped in 1991. In Sept. 2010, DNR sent a letter to the Department of Corrections in an attempt to resume communications, no reply letter located under Application #20-0012901.

Appendix D – List of Existing Use Authorizations within the Reserve Boundary

Applicant	DNR Application or Lease No.	Use Authorization	Current or Pending?
Department of Corrections	51-077187	Right-of-Way Easement for submarine cable crossings	Current
Department of Corrections	51-033301	Right of Way Easement for a Sewer Outfall	Current
Qwest	51-038213	Right-of-Way Easement for submarine cable crossing	Current
Pierce County	51-CR0396	Right of Way Easement for a Wharf Site	Current
CenturyTel	51-032139	Right-of-Way Easement for submarine cable crossing	Current
Pierce County	51-CR1762	Right of Way Easement for a Ferry Landing	Current
Riviera Community Club	20-A012471	Lease for a Private Marina	Current
Qwest	51-031615	Right of Way Easement for a Submarine Cable Crossing	Current
City of Tacoma	51-030276	Right of Way Easement for a Submarine Cable Crossing	Current
Pierce County	51-CR3071	Right of Way Easement for a Ferry Dock	Current
Thomas and Kathleen Palmer	20-013175	Lease for a Private Marina and Boat Moorage	Current
Oro Bay Properties	20-013385	Lease for a Private Marina	Current
Tacoma Yacht Club	20-A012239	Lease for a Private Marina	Current
Bremerton Yacht Club	20-A013429	Lease for a Private Marina	Current
United States Corp of Engineers	51-033960	Right of Way Easement for a Sewer Outfall	Current
State Parks and Recreation	Authorization #20-009760 and	Withdrawal granted to the State Parks and Recreation	Current

Commission	Commissioner's Order #72-252.	Commission	
Mutual Power and Light Company	51-026946	Right of Way Easement for a Submarine Cable Crossing	Current
Lone Star Northwest Incorporated	20-013511	Lease for a Private Barge Loading Dock and a Mooring Buoy	Current
Tanner Electric	51-00085598	Right of Way Easement for a Submarine Cable Crossing	Current
Nisqually Indian Tribe	20-070874	Clam Cultivation	Pending
Pierce County	20-013513	Ferry Dock	Pending
State Parks and Recreation Commission	20-0011390	Pending Lease for tidelands and bedlands surrounding Eagle Island	Pending
Department of Corrections	20-0012901	Application for passenger ferry dock service to McNeil Island Correctional Center	Pending
WA DNR	RCW 79.105.500	Authorizations for disposal of dredge material at the Anderson-Ketron DMMP site	Current & Ongoing