DRAFT

Department of Natural Resources
Cherry Point Resource Protection and Management Plan

April 2009

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Acronyms

ARCO	Atlantic Ritchfield Company
ACOE	Army Corps of Engineers
BP	British Petroleum
CBI	Chicago Bridge and Iron
CAA	Clean Air Act
CO	Carbon monoxide
CO2	Carbon dioxide
CP	Cherry Point
CPWG	Cherry Point Work Group
CPTWG	Cherry Point Technical Working Group
CWA	Clean Water Act
DNR	Washington State Department of Natural Resources
DOE	Washington State Department of Ecology
DOH	Washington State Department of Health
EPA	Environmental Protection Agency
ET&S	Endangered, Threatened and Sensitive Species
GIS	Geographic Information Systems
GMA	Growth Management Act
gpm	gallons per minute
GPT	Gateway Pacific Terminal
GSX	Georgia Strait Crossing
HII	Heavy Impact Industrial
HPA	Hydraulic Project Approval
MESA	Marine EcoSystems Analysis
MHW	Mean High Tide
MLW	Mean Low Water
MLLW	Mean Low Low Water
MRC	Marine Resource Committee
MYA	Million Years Ago
NO_X	Oxides of nitrogen
NOAA	National Oceanic Atmospheric Association
NPDES	National Pollutant Discharge Elimination System
NWCAA	Northwest Clean Air Agency
OHWM	Ordinary High Water Mark
PAR	Photosynthetically Active Radiation
PDO	Pacific Decadal Oscillation
PM_{10}	Particulate matter 10 microns in diameter
PHS	Priority Habitat and Species (WDFW)
PSAMP	Puget Sound Ambient Monitoring Program
PSI	Puget Sound Initiative
RCW	Revised Code of Washington

SAV	Submerged Aquatic Vegetation
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SMP	Shoreline Master Plan
SO_x	Oxides of sulfur
SVMP	Submerged Vegetation Monitoring Plan
U&A	Usual and Accustomed
UGAs	Urban Growth Areas
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VEAT	Vessel Entries and Transit reports, produced by the Washington State Department of Ecology, Spill Program.
VOC	Volatile organic compounds
WAC	Washington Administrative Code
WCC	Whatcom County Code
WDFW	Washington State Department of Fish and Wildlife
WMU	Watershed Management Unit
WRIA	Water Resource Inventory Area
WWU	Western Washington University

1 Introduction

1.1 Washington's Department of Natural Resources

Washington Department of Natural Resources (DNR) is a State agency that protects and manages 5.6 million acres of state-owned land for the people of Washington. A majority of the land (3 million acres) is state trust land that provides revenue to help pay for construction of public schools, universities, and other state institutions, and funds many county services.

DNR's Mission is to provide professional, forward-looking stewardship of our state lands, natural resources, and environment, and to provide leadership in creating a sustainable future for the Trusts and all citizens. At DNR, employees envision a future in which our human and natural environment provides abundant and diverse social, ecological, and economic benefits for all the people of Washington, in this and all future generations. In acting to ensure this vision, we achieve sustainability.

1.1.1 State-Owned Aquatic Land Management

Upon statehood, all states received title to lands underlying navigable waters within state boundaries from the Federal Government. In its Constitution, Washington State claims ownership to its aquatic lands:

> "The state of Washington asserts its ownership to the beds and shores of all navigable waters in the state up to and including the line of ordinary high tide, in waters where the tide ebbs and flows, and up to and including the line of ordinary high water within the banks of all navigable rivers and lakes…" (Article XVII, §1).

Before 1971, the State sold about two-thirds of all tidelands[1] and some shorelands[2]. Following passage of RCW 79.01.470 (the Gissberg Amendment), the State no longer sells aquatic lands. The State retains ownership of all bedlands[3]. Statute directs the DNR to manage the majority of state-owned aquatic lands (approximately 2.6 million acres).

Unlike the forest lands managed by DNR, state-owned aquatic lands are not established as fiduciary trusts with a guiding principle of generating sustainable revenue. Rather, aquatic lands have statutorily established general management guidance, under Revised Code of Washington (RCW) 79.105.030. Benefits that are to be provided by state-owned aquatic lands include:

1. Encourage direct public use and access;

[1] (the area in marine water between ordinary high tide and extreme low tide)
[2] (the area in freshwater between ordinary high water and the line of navigability)
[3] (the area below ordinary high tide or the line of navigability)

2. Foster water-dependent uses;
3. Ensure environmental protection;
4. Utilize renewable resources.

When consistent with the above public benefits, revenue generation is also considered a public benefit. The DNR generates revenue from aquatic lands by leasing these lands for private and commercial use (such as docks and marinas) and by selling the materials harvested from aquatic lands. Such materials vary from gravel to geoducks. These revenues fund DNR aquatic land management activities as well as other local and state programs to enhance aquatic lands and improve public access to these lands.

DNR's management of state-owned aquatic lands is governed by RCW Chapters 79.105-.140 and WAC Chapter 332-30. In addition, federal laws, Treaties, and court decisions affect DNR's management activities. Other entities, such as the US Corp of Engineers, Washington Department of Fish and Wildlife and the Washington Department of Ecology have responsibilities to regulate certain activities on both private and publicly-owned aquatic lands, and DNR's management is subject to such regulations. The Public Trust Doctrine also applies to DNR managed lands. This Doctrine provides for public use and access of navigable waters for navigation, fishing, and recreational activities.

1.1.2 Cherry Point Aquatic Reserve Background

DNR has been involved in aquatic land management at the Cherry Point area of Whatcom County since the 1950's when the first refinery pier was constructed on state-owned aquatic lands. As additional facilities were proposed at Cherry Point, DNR and other stakeholders recognized the need for striking a balance between economic development and environmental protection. In 2000 the Commissioner of Public Lands Jennifer Belcher proposed to designate an environmental aquatic reserve for state-owned aquatic lands at Cherry Point not already under a lease agreement. This set in motion DNR's actions to establish a balance of protecting the unique ecosystem while managing the area consistent with Whatcom County's "Cherry Point Special Management Area" designation. The purpose of this plan is to serve these actions.

Cherry Point had been withdrawn from further leasing opportunities, designated an aquatic reserve, and no specific guidance existed on where to go from there. In 2001, interim management guidance was finalized and applied to Cherry Point Aquatic Reserve. This guidance was modeled after the Approved Interim Management Guidance for Aquatic Reserves and Withdrawn Areas, approved by Fran McNair, Aquatics Steward, on June 27, 2001.

DNR began discussing the future of the Cherry Point Aquatic Reserve in 2003. DNR staff and scientists prepared preliminary documents that provided background regarding the uses in the area and a list of potential issues of concern related to the aquatic ecosystem in the Cherry Point area. Outreach included the various agencies, tribes and interest groups in the area. Information was gathered to broaden the considerations in the planning process. Public meetings were held to

further refine the scope of the planning process. This led to the development of an outline for future discussions of planning needs.

The planning process was put on hold temporarily in 2004 while DNR attempted to address some differences of opinion within the community regarding the future and direction of the Cherry Point Reserve. Attempts to successfully resolve these issues to the satisfaction of all stakeholders resulted in a delay in the planning process. DNR completed management plans for three other reserves while issues at Cherry Point were being addressed.

In 2006 DNR staff working with Whatcom County Shoreline planners and their consultants examined the opportunity to merge planning efforts. The County Shoreline Master Program (SMP) update was underway and needed to examine and plan for environmental and public access considerations in the Cherry Point Management Area. Believing there were common interests to be addressed, the County and DNR considered the option of incorporating certain aspects of an aquatic reserve management plan into the SMP and at the same time provide an a potential alternative to the Cherry Point Reserve. DNR agreed to this process based on the understanding that any alternative approach to managing this area must meet or exceed the protection for resources provided under an Aquatic Reserve Management Plan.

1.1.3 Plan Development and the Cherry Point Workgroup

In 2007, DNR proposed that a workgroup of interested parties be formed to evaluate options for the management of the area within the Cherry Point Aquatic Reserve. The agency undertook this planning process in an effort to move forward and determine the future of the Cherry Point Aquatic Reserve. As the resource manager tasked with protecting the state's assets, DNR was acutely aware of the need to complete development of a management plan and implement actions that would address declining populations of herring and impacts to other key organisms and habitats. To address the need for maintaining a balance of uses and protection of resources into the future, DNR instigated the planning process described below and took responsibility for the plan development.

To this end, DNR identified a group of stakeholders with a wide range of interests in the community and Puget Sound. They called this group the Cherry Point Workgroup. The workgroup met for the first time in July 2007 for a preliminary discussion of the goals and possible outcomes of the process. The group decided that the process was a worthwhile activity and agreed to begin meeting to formulate a path and explore options.

Between July 2007 and April 2008 the Cherry Point Workgroup (Workgroup) and several subcommittees examined the management of the activities in the vicinity of Cherry Point over the last 10 years. The group sought out information and answers from a wide range of professionals regarding all aspects of resource and industrial management in the area. The primary products of the Workgroup are a series of recommended actions that were derived from these discussions as guided by the Common Aim developed by the Workgroup in its earliest meetings.

The Workgroup developed a Common Aim to guide the collaborative process in which this management plan was designed, and under which future actions or ideas would be considered. The Common Aim provided consistent guidance and direction for the Cherry Point planning process.

1.1.3.1 The Common Aim

"Participants of the Cherry Point Collaborative Process will work together to create an agreement that contains a set of recommendations for action, to be jointly submitted to the appropriate entities, for the sustainable long-range management of the Cherry Point Resource Area.

In the process of developing this agreement, the following objectives will be considered:

- protection and restoration of the Cherry Point water quality, aquatic ecosystem, and its valued species, including but not limited to, Cherry Point herring, Nooksack Chinook, and migratory waterfowl;
- public recognition of Cherry Point's unique ecological resources;
- determining whether there is an ongoing need for the Cherry Point Aquatic Reserve;
- respecting reserved treaty rights that protect cultural resources including the sustainable harvest of natural resources in usual and accustomed areas; and
- sustainable economic development, and the long-term viability of existing and pending leases as planned for by Whatcom County's current shoreline management program, and other activities at the site, in a way that is not detrimental or does not put resources or adjoining neighborhoods in jeopardy.

All of these objectives will be considered in a way that respects all interests in environmental protection and restoration, economic sustainability of water-dependent uses, and community goals. Although all of the above objectives will be considered in developing the agreement, there is no present commitment made to include any or all of them in the agreement. However, no party will consider entering the agreement unless it determines its interests have been met."

1.1.3.2 Cherry Point Workgroup Activities

The Cherry Point Workgroup had two primary tasks. The first of these was to develop a set of recommended actions to address key resource issues and concerns. The second was to determine which framework or process resulted in the best implementation of these recommended actions.

While some participants were anxious to address the framework early in the discussions, the group agreed to develop the recommended actions first, then determine the appropriate framework for implementation.

1.1.3.2.1 Task One – Development of Recommendations, Actions, and Supporting Information

The development of the recommended actions and supporting information focused on the following key steps:

Development of a list of preliminary issues and concerns:

The group began their discussions with review of the original research documentation and results of the public scoping process for the original Reserve plan. Additional local knowledge from the area was integrated into these findings. The result was a list of topical areas the workgroup agreed were appropriate to evaluate further.

Gathering information regarding issues and concerns:

In this phase of the process, the workgroup scheduled regular meetings where invited specialists presented the most up to date information available related to the ecological concerns. In some cases the speakers were provided specific questions to address before the group. Time was provided after each presentation for discussion and questions. Recommendations were solicited from the speakers for later consideration by the Workgroup. While this approach worked for most topics, in some cases, workgroup members singly or in small workgroups assembled key information needed for the group as a whole. This was presented in issue paper format for the Workgroup to discuss.

Developing recommendations for actions:

With the best science and feedback from speakers and the small teams in hand, the Workgroup went through the painstaking process of developing recommendations. Each ecological concern was evaluated in great detail with a focus on reaching consensus on all recommendations. This required considerable discussion and group editing. The workgroup followed this process to address most of the ecological concerns. Due to time constraints dictated by the Workgroup themselves, some issues and recommendations were developed and circulated to the workgroup by DNR staff without full Workgroup discussion. Feedback was summarized by the lead on those topics and incorporated into the recommendations.

Finalizing recommendations:

Each time the Workgroup addressed recommendations on a specific topic, the product was distributed to the members after the meeting and all members were given until the next meeting to develop any final comments on the recommendation. At the following meeting all final comments were heard, issues addressed, and the topic was set aside from further discussion. In most cases there was no further need to return to that topic. DNR staff tracked recommendations to ensure appropriate integration and prevent overlap across the topical areas.

1.1.3.2.2 Task Two – Evaluate Appropriateness and Effectiveness of Various Approaches

The second primary task of the Workgroup was to evaluate the appropriateness and likely effectiveness of various framework approaches. Per prior agreement, one alternative evaluated was continuance of the Cherry Point Aquatic Reserve. Alternative management frameworks were measured by their ability to meet or exceed the expected environmental outcomes of an aquatic reserve.

Early in the Workgroup discussions, several framework ideas were proposed for consideration as possible alternatives management as an aquatic reserve. These included:

- Managing the area under the County's Shoreline Master Program, including a DNR Conservation Lease;
- Management as a DNR withdrawn area

Some additional framework options were not fully evaluated because of their lack of capacity to address implementation. Analysis of any proposed management framework options will be completed under the State Environmental Policy Act (SEPA), if it meets the described Purpose and Need (see Section 1.3 of this Plan). Alternatives considered but not otherwise pursued will also be described under SEPA. Those alternatives were considered, but found not to have met the intended Purpose and Need.

The Workgroup agreed that it was seeking a framework best capable of implementing the Workgroup's recommended actions. They spent two half day sessions evaluating the relative merits of each of the framework approaches. The relative merits of an aquatic reserve plan were measured at the same time. Attempts were made throughout this discussion to objectively evaluate the various proposals. After evaluating the alternatives, the workgroup struggled to reach agreement on a single framework approach.

An aquatic reserve framework seemed to provide a relatively high level of focus and organization needed to achieve the Workgroup's desired outcomes. DNR made the point that a reserve alone would not likely achieve the results sought by the group due to the inherent limitations associated with DNR's authorities.

The DNR then proposed an integrated approach utilizing multiple tools (aquatic reserve, SMP, withdrawal, permitting programs and voluntary efforts) believing this would have the greatest chance of success. DNR also indicated that it would take an integrated approach, particularly between the resource managers (agencies, county and tribes) to improve the chances of getting funding needed to successfully implement the plan. This led to additional debate, and no consensus was reached.

With the recommendations provided, DNR prepared a draft plan for the workgroup to evaluate. DNR staff attempted to capture the months of work and decisions by the Workgroup. The first draft of the plan was then sent out to Workgroup members for review.

Members of the workgroup and others who reviewed the plan provided a significant number of comments and suggestions. These were catalogued and distributed to the workgroup including DNR's response to comments for the next version of the plan. Commentors were often contacted directly, seeking new information to substantiate various aspects of the plan.

A recommendation was still needed for the appropriate framework proposal to be included in the plan. After additional discussion regarding DNR's role in developing this plan and consultation with the resource agencies regarding future implementation, DNR proposed this plan as comprehensive community resource management plan. While authored by DNR with Workgroup input, the plan is designed to be cooperatively managed and implemented by resource agencies, tribes and the county.

DNR also recommended that the Aquatic Reserve designation should remain as a framework to direct DNR activities as identified in the Plan. DNR further recommended that resource managers and their respective organizations should work together to implement the plan with the assistance of community groups, industry and the research institutions. Linkages should be sought with the County Shoreline Master Program and other development and regulatory programs.

The plan was circulated one last time to the Workgroup members for a short review. With the final Workgroup review, the local planning process was largely completed. Then the plan was provided to the public for broad review and comment under SEPA.

1.2 Cherry Point Resource Area

The Cherry Point Resource Area is located along the western shores of Whatcom County, facing the waters of Georgia Strait. Georgia Strait is a 150 mile long body of water running in between Vancouver Island and British Columbia, south to Puget Sound and the Strait of Juan de Fuca. Cherry "Point" is a small tip of land located east of the southernmost wing of the British Petroleum (BP) pier approximately in the midpoint of the Resource Area.

Cherry Point Resource Area falls within Water Resources Inventory Area 1, or the Nooksack WRIA. It includes uplands, tidelands and shorelands bordered to the north by Birch Bay and by the Lummi Indian Nation Reservation to the south. The total area is 9,280 acres or 15 square miles. See Figure 1:

Cherry Point Resource Area

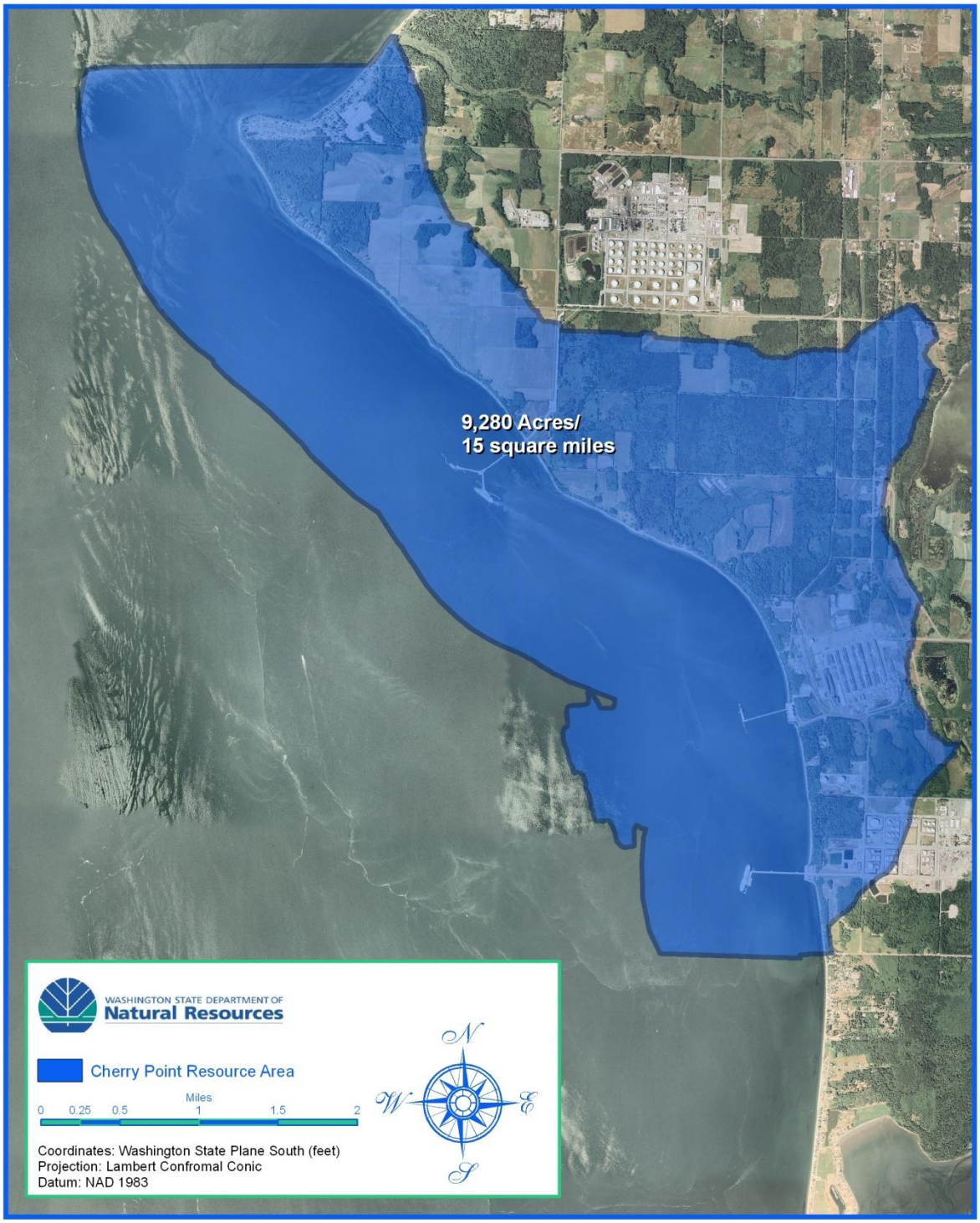

Figure 1 Cherry Point Resource Area

The proximity of Cherry Point to Georgia Strait sets it apart from many other locations in the Northwest corner of Washington. The Strait of Georgia is distinctly different from Puget Sound, influenced to a higher degree by the Pacific Ocean, resulting in different biodiversity. Many oceanic species are relatively common in the Strait of Georgia, compared to the Puget Sound estuary (Whatcom County 2006).

Freshwater mixing, salinity, circulation and water temperatures are four factors of many that clearly separate the Strait of Georgia, and thus Cherry Point, from Puget Sound. This aquatic environment of the Cherry Point Resource Area is vitally important to a wide variety of fish and wildlife species. These resources have been relied upon by local Native American Indians since time immemorial for ceremonial, subsistence, and commercial purposes. Fish and wildlife utilize a combination of adjacent upland, wetland and marine environments existing at Cherry Point Resource Area. The location is also considered a valuable resource to the local economy, by providing deep water access to industries that are involved in manufacturing, shipping and commerce on uplands zones high impact heavy industrial. The access provides efficient transportation of raw materials and product through the piers within the Resource Area.

Cherry Point also has a distinctive bathymetry with water depths of more than 70 feet relatively close to shore, decreasing tidal currents in the nearshore environment, and a steep gradient along the intertidal habitat that could be important to marine diversity (Whatcom County 2006). Industrial ownership of large portions of the shoreline has limited urban development and resulted in protection of many physical features and habitats along the Cherry Point shoreline.

While much of the shoreline is undisturbed, the unique aquatic resource environment in the Cherry Point Resource Area is and has been affected by both the users of that environment as well as the adjacent uplands. Valuable natural resources continue to play an important role in the local and Tribal communities. Public recreational activities such as boating, fishing, shellfish harvest, swimming, and beach walking are popular. Offshore areas have traditionally been used for Tribal, commercial and recreational harvest of numerous species including salmon, herring, Dungeness crab, and bottomfish using a variety of methods, including gillnets, setlines, trawl, purse seine and crab pots. Docks and other hardened structures impact currents and tidal action. Industrial and stormwater outfalls within the Cherry Point Resource Area contribute millions of gallons of water and runoff this part of Georgia Strait. Non-indigenous aquatic plants have found a foothold in the nearshore of Resource Area and are displacing certain types of native algae.

The water quality and habitat supporting these resources and uses at Cherry Point Resource Area are affected by the influences of immediate and adjacent land use and in-water activities, the Georgia Strait, the Frazer and Nooksack Rivers, and the general climatic conditions of northwest Washington. A number of resources addressed in this plan have shown signs of decline in the past, or are still in decline, within the Cherry Point Resource Area.

One example is the Cherry Point Herring, a principal food source for birds, fish and marine mammals. The decline in herring may point to other resource issues at Cherry Point. Cherry Point Herring is a species of great concern and was nominated, but not given, listing under the federal Endangered Species Act. The stocks for Cherry Point Herring have declined from 15,000

tons in 1973 to 1,352 tons in 2008. Other key species which characterize the Cherry Point Resource Area include Nooksack Chinook salmon, Southern Resident Orca, Surf Scoter and the Marbled Murrelet.

1.2.1 Cherry Point Resource Area Boundary

The Cherry Point Resource Area boundary includes both uplands and aquatic lands for research, planning and management purposes. The administrative boundary for the aquatic lands includes all tidelands and bedlands within approximately 5000 ft of the marine shoreline as shown in Figure 1. The administrative boundary for the upland areas includes all lands with surface water drainage to the reach. Finally, one site outside the hydrologic boundary has been included in the planning discussion. The Treoil site is believed to have a groundwater influence on the Cherry Point reach that may be contaminated and is thus included in the plan.

1.3 Purpose and Need for this Plan

The purpose of this plan is to describe the natural resources, habitats and species that occur at Cherry Point and establish current and future management consideration. The plan will also identify management goals, objectives, and actions to address the ***protection***, ***enhancement***, and ***restoration*** of resources within Cherry Point Resource Area. The emphasis of this plan will be on protection and enhancement of aquatic resources at Cherry Point.

The need for this plan is based upon an extensive review of the environmental health, natural resources, fish and wildlife species located in the Cherry Point Resource Area. Many of these resources have been identified as requiring protection, enhancement and/or restoration.

Those who assisted with the development of this plan (Please see Acknowledgements) realize that the aquatic environment of Cherry Point provides essential habitat and irreplaceable biological and ecological functions; is a portion of Treaty-protected Usual and Accustomed (U&A) grounds and stations of local Native American Indians; and provides significant economic benefits, recreational opportunities and other social values. The plan will provide the basis for greater understanding of factors affecting the aquatic ecosystem of the Cherry Point Resource Area and allow for adaptive management in order to protect these resources, while addressing the continued industrial and water-dependent uses located in the Cherry Point Resource Area.

This plan will address the Purpose and Need by the following three sections, generally described here:

1. **Cherry Point Resource Characterization and Potential Impacts**: Sections Two through Five introduce the reader to the land use and ownership, fish, wildlife and habitat characteristics that make Cherry Point unique. Potential impacts and data gaps are also identified in these sections.

2. **Desired Future Conditions:** Section Six identifies desired future ecological conditions for the Cherry Point Resource Area.
3. **Management Actions:** Sections Seven through Nine outline tasks or deliverables intended to achieve the goals and objectives described in the earlier chapters. These sections also include the monitoring and adaptive management to assess the success of implementation of the recommended actions.

This management plan includes provisions which, if implemented by the appropriate entities and programs, will result in a better understanding of the current state of the Cherry Point Resource Area leading to targeted actions that will ensure the long-term health of the of aquatic ecosystem and the organisms that rely on it.

1.4 Objectives of this Plan

The following are objectives of the Cherry Point Plan:

- Protect and restore water quality to support key species and healthy functioning habitats;
- Identify, protect, restore and enhance the functions and natural processes of aquatic nearshore and subtidal ecosystems that support endangered, threatened and sensitive species and aquatic resources identified for conservation;
- Reduce legacy sources of groundwater contamination and prevent new sources;
- Minimize risk of environmental impacts from vessel accidents;
- Reduce risk of spills and increase capacity to respond;
- Develop baseline inventories and ongoing monitoring plans to evaluate the trend of aquatic resources indentified for conservation;
- Ensure future land use and permit decisions do not alter natural system forming processes, degrade habitat or result in impacts to key species;
- Remove and reduce the impact from derelict fishing gear, debris and structures;
- Minimize the impact from current and future recreational uses;
- Reduce or eliminate sources of invasive species;
- Increase public awareness of natural resource values;
- Consider climate change when planning restoration projects and future development.
- Ensure this resource protection and management plan addresses and protects Lummi Nation and Nooksack tribal culture and values and treaty rights, and is consistent with the Northwest Tribes policy on Marine Protected Areas (NWIFC, 2003)

2 Land Use and Ownership

This section provides a general overview of the history of tideland and bedland use at or near Cherry Point Resource Area. Aquatic lands are classified as (1) tidelands, the area under marine water between the lines of ordinary high tide and extreme low tide and (2) bedlands, the area under marine water below extreme low tide. Upland describes land above the line of ordinary high tide.

2.1 Site Ownership

All bedlands within the Cherry Point Resource Area are owned by the State of Washington and managed by the Department of Natural Resources. Of the approximately 296 acres of tidelands in the Cherry Point Resource Area, 69 acres are privately owned and approximately 227 acres are managed by the State (Table 1), not under a lease.

The bulk of the adjacent uplands are privately owned, primarily by five entities: BP Petroleum, Pacific International Terminals, Intalco Aluminum Corporation, Conoco Phillips, and Cherry Point Industrial Park. The remainder is in private residential lots with the exception of a small county-owned public access area just east of Point Whitehorn.

Table 1 Aquatic Land Ownership in Planning Area[4]

Public Land Ownership (acres)			Private Land Ownership	Total Ownership
Public Bedlands	Public Tidelands	Leased Areas	Private Tidelands	Total acreage
4,411	227	282	69	4,989

Table 2 Uplands Ownership

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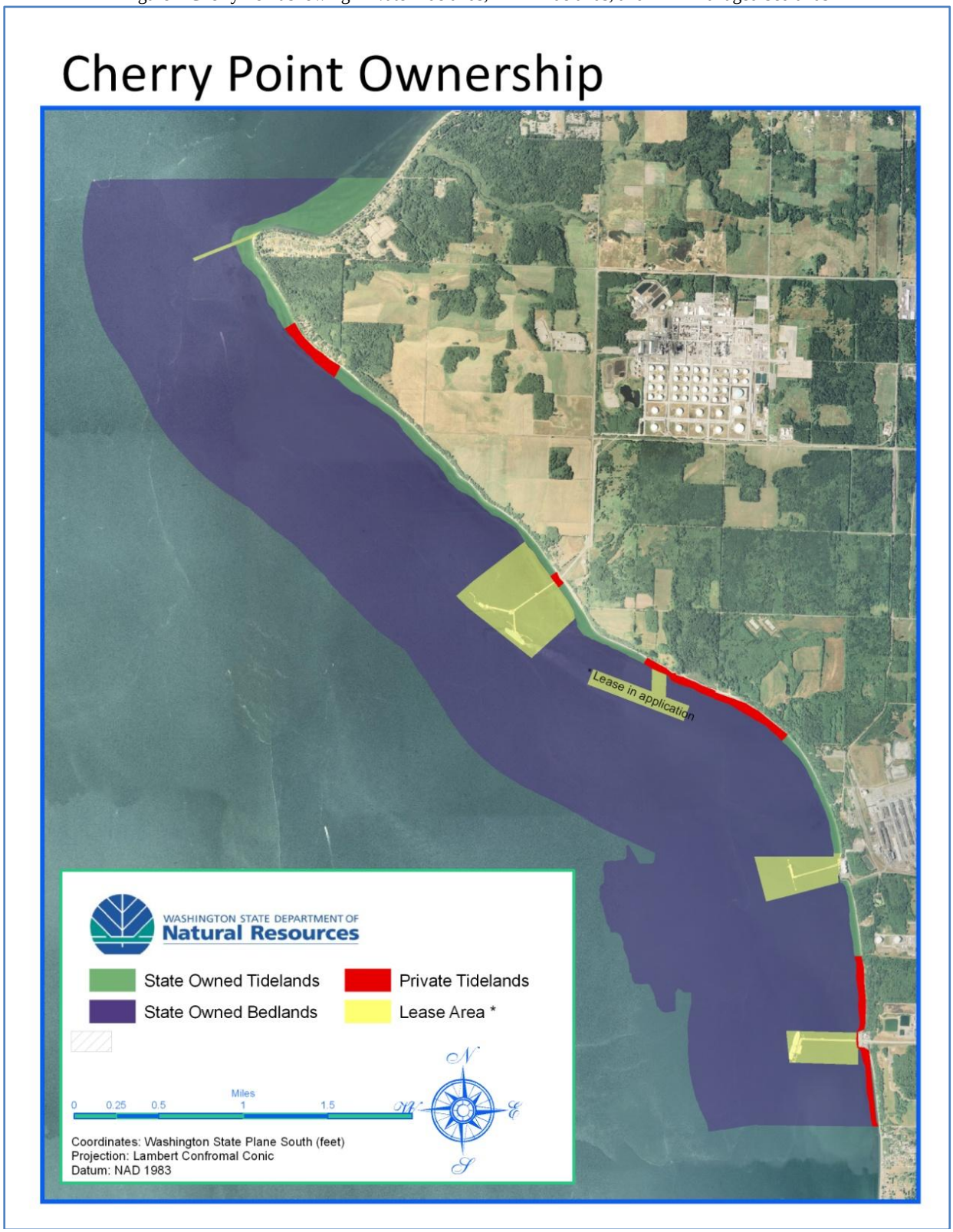
[4] The proposed pier is being considered under bedlands since the lease has not been finalized

Figure 2 Cherry Point showing Private Tidelands, DNR Tidelands, and DNR managed bedlands



2.2 Land Use and Management at Cherry Point

2.2.1 Industrial Land Use

Currently, much of Whatcom County maintains a rural character, with large tracts of commercial forest lands and agricultural land used for pasture and commodity crops. Whatcom County population increased by 100% between 1950 and 1990 and was 184,300 in 2006. These large population increases experienced by the County will result in a transition to more residential, commercial and industrial uses. (Kyte et al, 1999; OFM, 2006).

Between 1954 and 1971, three industries moved into the Cherry Point vicinity. In 1954, General Petroleum Corporation constructed an oil refinery near Cherry Point, which was subsequently managed as the Ferndale, Mobil, BP, and Tosco refinery. On September 17, 2001, the Tosco company was bought by Phillips 66. On August 30, 2002, Phillips merged with Conoco, to become ConocoPhillips. In 1966, Intalco Aluminum built an aluminum smelter north of ConocoPhillips. The aluminum smelter is now owned by Alcoa-Intalco Works . In 1971 Atlantic Richfield Company (ARCO) constructed another oil refinery even further north, later selling it to British Petroleum (please see Table 2, and Appendix B: *Existing Encumbrances and Applications within the Management Area*, for further details on these facilities). This is the northernmost pier along the Cherry Point.

Whatcom County has designated 6,000 acres as “Heavy Impact Industrial” along Cherry Point to support the requirements of heavy manufacturing uses that require water deep enough to accommodate large vessels (Kyte, et al 1999; Whatcom County, 2006). There are currently 7 existing leases or easement and one proposed use on state-owned aquatic lands within the Resource Area. These include:

- BP (lease and outfall easement),
- Intalco (lease and outfall easement),
- ConocoPhillips (lease and outfall easement),
- Birch Bay Water and Sewer District (outfall easement)
- Gateway International Terminal (proposed use; no use authorization with DNR has been developed/approved)

These facilities manage uses in the immediate vicinity of the Resource Area and have already provided important resource monitoring data. Partnerships with existing facilities will be important for implementing many potential management activities.

2.2.2 History of Land Use in the Cherry Point Resource Area

The following timeline provides a chronological summary of major construction events, land use decisions and proposals, fisheries management decisions, and selected dates of laws and rules with specific importance at Cherry Point.

Table 2: Timeline of Major Events at Cherry Point

Date	Event	Type
1954	The General Petroleum Corporation begin operation of the Ferndale refinery, pier, and outfall.	Major construction
1966	The Intalco Aluminum Corporation builds a second pier and outfall at Cherry Point.	Major construction
1971	The ARCO refinery constructs a third pier and outfall at Cherry Point now owned by British Petroleum.	Major construction
1972	Washington's Shoreline Management Act was enacted.	State law
1972	Federal Water Pollution Control Act is enacted.	Federal law
1974	State herring sac roe fishery is opened.	Fishery management
1975	Whatcom County Water District Number Eight constructs a secondary wastewater effluent outfall at Point Whitehorn.[5]	Major construction
1976	Cherry Point uplands rezoned as "conservancy," from a previous designation of "industrial."	Land use
1976	Chicago Bridge and Iron (CBI) proposes to build offshore oil drilling rigs at Cherry Point.	Land use
1977	Federal Clean Water Act is enacted, by amending the 1972 Water Pollution Control Act.	Federal law
1982	State herring sac roe fishery permanently closed.	Fishery management
1982	CBI's proposal to build oil drilling rigs is ended by governor's veto of legislation that would have exempted CBI from provisions of the Shoreline Management Act.	Land use
1983	Kiewit proposes to build offshore oil drilling rigs on the Cherry Point uplands	Land use
1984	Kiewit's permits denied by Ecology and DFW	Land use
1987	Cherry Point uplands rezoned as "industrial."	Land use
1987	State herring spawn-on-kelp fishery are opened.	Fishery management
1992	Joseph Schecter proposes to build the Cherry Point Industrial Park (CPIP), including a shipping pier.	Land use
1992	PIT proposes to build the Gateway Pacific Terminal (GPT) pier at Cherry Point.	Land use
1995	Letter from Commissioner of Public Lands states that DNR will consider at most one additional pier at Cherry Point.[6]	Land use
1996	State herring spawn-on-kelp fishery is closed.	Fishery management
1996	State sediment management standards become effective.[7]	State rule
1998	The CPIP proposal is abandoned.	Land use

[5] The operator of this outfall is now the Birch Bay Water and Sewer District.
[6] The letter, dated October 5, 1995, was written by then-commissioner Jennifer Belcher to Tim Winn, District Engineer, US Army Corps of Engineers. Copies filed in CPIP Negotiations with DNR file.
[7] State sediment management standards are codified at WAC 173-204. They are administered by Ecology.

Date	Event	Type
2000	Second wing is added to the ARCO pier.	Major construction
2000	National Marine Fisheries Service (NMFS) decides Cherry Point herring do not merit listing under the federal Endangered Species Act.[8]	Fishery management, federal law
2000	Commissioner's Order establishes Cherry Point as an Aquatic Reserve	Land Use/Order
2001	Washington Department of Health re-opened 1.5 miles of beaches around Pt. Whitehorn previously closed to recreational shellfishing, reducing the closure zone from 2,640 feet to 1,380 feet.	Land Use
2002	New leases are issued for middle pier (Intalco/Alcoa) and wastewater outfall.	Land use
2002	Birch Bay Water and Sewer District withdraws its proposal for wholesale service to Blaine, who has chosen to construct reclaimed water plant instead.	Land use
2003	Williams Pipeline (also known as Georgia Strait Crossing) proposes placement of a natural gas pipeline across the Cherry Point Withdrawn Area. Proposal later withdrawn.	Land use
2003	The Cherry Point Withdrawn Area scheduled for review, determining whether the area will remain an aquatic reserve.	Land use
2005	The authorization for the Birch Bay Water and Sewer District outfall expires. DNR postpones the application.	Land use
2006	ConocoPhillips lease is renewed with DNR	Land use
2007	Cherry Point BP lease is modified by DNR to accommodate required spill control structures	Land use
2008	Trillium sells large parcel west of BP facility to BP	Land use
2008	Whatcom County Parks purchase of Trust lands	Land use

[8] The notice, Endangered and Threatened Species: Puget Sound Populations of Copper Rockfish, Quillback Rockfish, Brown Rockfish, and Pacific Herring, Notice of determination of status review was published in the Federal Register, Volume 66, Number 64, April 3, 2001, pp. 17659 – 17668.

3 Management and Regulatory Framework

This plan is promulgated under DNR's management authority for state-owned aquatic lands. However, a number of other federal, state, local and tribal authorities regulate aquatic and upland activities within the Cherry Point Resource Area.

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

The successful management of these activities and resources in the Cherry Point Resource Area requires coordination and collaboration with public and private entities as well as local, state, federal, and affected Tribal governments, and non-government organizations. The following provides information regarding ongoing management interests at Cherry Point.

3.1.1 Tribal Interests

Tribes are co-managers with the State of Washington, and are responsible for cultural and natural resources located within their Usual and Accustomed areas, and on their reservation lands. DNR is obligated to conduct government-to-government consultations with all federally recognized tribes, under the 1989 Centennial Accord.

The DNR will continue to engage in a government-to-government dialog with the affected tribes to ensure the plan's conformance with treaty rights, and that tribal historical and cultural ties to the Cherry Point Resource Area are maintained**.** DNR will work cooperatively with the tribes to protect archaeological sites, and allow access to cultural sites; and allow for treaty-protected hunting and gathering of resources in a manner that fosters the sustainability of those resources. 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) 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 (NWIFC memo, 2003). In line with this policy, one of the primary goals of this resource protection and management plan is to help demonstrate where there is a need for protecting and sustaining resources.

Cherry Point is located within the usual and accustomed areas of several tribes and is within the homeland of the aboriginal Lummi Tribe whose sole successor is the present-day Lummi Nation. Cherry Point contains homelands of the Lummi Tribe that were ceded to the United States in the Point Elliot Treaty for considerations, including the right to fish in common with the citizens of

the territory at their usual and accustomed fishing grounds and station. It is essential that conservation goals and management standards be established in cooperation with these Tribes.

HOLD FOR LANGUAGE FROM NOOKSACK TRIBE

3.1.1.1 Cultural Protection

Cherry Point is located within the usual and accustomed areas the Lummi, Nooksack, Swinomish, Suquamish, and Tulalip tribes. Each of these tribes has cultural resources departments with specific interests in the long-term cultural resource protection and management of this area. Tribes exercise their interest based on the specific location and particular impacts associated with local planning processes and project proposals. The Federal government is obligated to protect the long-term interests of tribes by limiting permits that impact cultural objectives of tribes. All projects and plans for this area shall require government-to-government consultation with appropriate tribal governments under the State Centennial Accord. Local entities are strongly advised to consult regarding permitted activities and local plans. Regular discussions should be planned with affected tribes to ensure that this plan remains consistent with cultural resource goals and Treaty rights of the Tribes.

3.1.2 Regulatory and Proprietary Framework

This sections provides a brief description of the regulatory and management authorities associated with Federal, State and local authorities who oversee activities within and adjacent to the Cherry Point Resource Area.

3.1.2.1 U.S. Coast Guard

The U.S. Coast Guard manages vessel activity and responds to pollution reports within Puget Sound through the Marine Safety Office. The Coast Guard also helps ensure the safety of vessels during transit and while in port. The U.S. Coast Guard (USCG) manages commercial vessel traffic throughout Washington’s waters, including at Cherry Point, and is responsible for reviewing designated anchorage sites

3.1.2.2 U.S. Army Corps of Engineers

The Corps of Engineers 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 constructed waterward of the Mean Higher High Water mark. Like all federal agencies, the Corps of Engineers is a trustee for all federally recognized tribal governments prior to taking any action that could potentially affect treaty-protected resources, including cultural or traditional cultural properties.

3.1.2.3 U.S. Environmental Protection Agency

Lead federal response agency for oil spills occurring in inland waters and jointly administers Section 404 of the Clean Water Act with the Corps of Engineers.

3.1.2.4 U.S. Fish and Wildlife Service

The Fish and Wildlife Service 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.

3.1.2.5 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 is also responsible for consultation under the Magnuson-Stevens Fishery Conservation and Management Act.

3.1.2.6 Washington State Department of Health

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

3.1.2.7 Washington State Department of Ecology

The Washington State Department of Ecology (Ecology) influences 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. Ecology 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. Vessel traffic in Washington State is tracked by Washington State Department of Ecology's spill program and published in Vessel Entries and Transits (VEAT) for Washington Reports.

3.1.2.8 Washington State Department of Fish and Wildlife

The Department of Fish and Wildlife staff has authority over the management of commercial and recreational shellfish harvesting and fisheries. The Department of Fish and Wildlife also plays an important role in oil spill response, ballast water monitoring and Natural Resources Damage Assessments. The Department also helps protect natural resources from development through its Hydraulic Project Approval (HPA) process.

The State Legislature gave the Department of Fish and Wildlife the responsibility of 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 a permit (called the *Hydraulic Project Approval-HPA*) issued by the Washington State Department of Fish and Wildlife. The purpose of the permit is to address any damage or loss of fish and shellfish habitat which is considered to result in direct loss of fish and shellfish production (WDFW website, 2008).

3.1.2.9 Washington Department of Natural Resources

Has proprietary responsibility to manage state owned aquatic lands for the benefit of the general public. The department is obligated to balance environmental protection, public access, water dependent uses and the sustainable use of natural resources. In addition, the DNR may collect rent from uses of state owned lands that is used to provide management of these lands and to enhance environmental quality and public access.

3.1.2.10 Washington State Parks and Recreation

The State Parks and Recreation Commission also plays a vital role in educating the public regarding appropriate recreation. Washington State Parks manages the Birch Bay State Park and has an existing lease for aquatic lands offshore of the state park. Birch Bay State Park is a 194-acre camping park with 8,255 feet of saltwater shoreline on Birch Bay and 14,923 feet of freshwater shoreline on Terrell Creek. The park is rich in archeological significance and offers panoramic views of the Cascade Mountains and Canadian Gulf Islands. The Birch Bay State Park is one of the largest recreational shellfish areas in the State. Mixed eelgrass (*Zostera marina*) and *Sargassum* extend along most of the Resource Area (94 percent), with sparse kelp (*Nereocystis*) beds beginning to appear at the edge of the Resource Area near Point Whitehorn. *Sargassum* is a non-native subtidal kelp that herring often spawn upon (Pentilla, 2001). Eelgrass beds in this Reach also support herring spawning, and Pacific sandlance (*Ammodytes hexapterus*) and surf smelt (*Hypomesus pretiosus*) spawning occurs along the beach to the west of Terrell Creek mouth. Terrell Creek is mapped as a pocket estuary that provides feeding, refuge, and osmoregulatory functions for juvenile salmonids (Washington State Department of Parks and Recreation, 2007; Whatcom County Shoreline Characterization Inventory June 2006).

3.1.2.11 Puget Sound Partnership

In 2007, the Legislature created 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. DNR is a member of the Ecosystem Coordination Board that advises the Partnership's Leadership Council. The exact impact on DNR as the manager of state-owned aquatic lands has not been identified.

3.1.3 Whatcom County

Whatcom County is the manager of upland land uses through the Whatcom County Comprehensive Plan and the Whatcom County Shoreline Management Plan. In addition, the county regulates building and provides pollution control though their management of stormwater runoff and their regulation and inspection of onsite septic systems.

3.1.3.1 County Growth Management Planning

Under the latest Comprehensive Growth Management Plan issued by Whatcom County, Cherry Point is described as an Urban Growth Area (UGA) containing approximately 7,000 acres of industrial land. An Urban Growth Area is an area that must include cities and other areas characterized by urban growth or adjacent to such areas, and are to be designed to accommodate the projected population growth for twenty years. Any growth that occurs outside the areas cannot be urban in nature.

The County has designated land within the Urban Growth Area for future industrial development. The existing industrial developments occupy about 4,100 acres of the total Cherry Point industrial lands and added a new 1,100 acre shipping port. Land consumption at Cherry Point has been about 1,000 acres per facility on the average which includes sufficient land to avoid wetlands and provide buffer areas. Based on this consumption figure, Whatcom County concluded in their County Growth Management Plan (p. 2-57, 2005) that there is only sufficient remaining land in the Cherry Point industrial area to support two additional industrial complexes of the character of those presently located there.

Whatcom County states that Cherry Point has special characteristics, and regional significance for the siting of large industrial facilities. The County predicts that this demand will most likely result in the remaining undeveloped acreage being absorbed by the end of the 20 year planning period (Whatcom County, 2005). Characteristics that make Cherry Point attractive include the fact that the area has a history of operating as a major industrial area in Whatcom County since the 1960's. This has developed the infrastructure to support not only these industries, but future industries as well. Other attractive characteristics include:

- Port Access – Marine deep water access is present for shipping. This was a major consideration for the three major industries currently located at Cherry Point (Whatcom County 2005).

- Rail Access – Burlington Northern has long served Whatcom County, and access to the Burlington Northern mainline serving western Washington from Blaine to Portland is available. Rail service is particularly important in relation to many types of water borne commerce; for example, the BP refinery at Cherry Point uses the railroad to ship calcined coke to U.S. markets and to other port facilities for transshipment to foreign markets (Whatcom County 2005).

- Proximity to Canada, Alaska and Foreign Ports - Cherry Point occupies a unique location for the siting of industry because of its close proximity to Canada and because of its shorter travel distance than other regional port facilities for shipping to Alaska and to other Pacific Rim locations. The Cherry Point industrial area benefits from proximity to Canada, as trade between the U.S. and Canada grows in response to the lifting of trade barriers under the Free Trade Agreement of 1989. An increase in vessel traffic is being noted through the Strait of Juan de Fuca, as vessels move towards Vancouver (VEAT, 2008). Marine terminals at Cherry Point could serve a portion of the potential growth in Canadian marine cargo (Whatcom County 2005).

Whatcom County considers these industries a substantial part of the economic base of Whatcom County, with the region and the economic welfare of the county strongly tied to the health of these industries and their ability to flourish and expand as opportunities present themselves. The County has designated the area Urban Growth, permitting only Heavy and Light Industrial Uses, with compatible secondary uses. This protects the area from incompatible uses that would prevent their ability to expand, particularly residential development (see Whatcom County Code Chapter 20.74, revised March 2008).

3.1.3.2 County Shoreline Management Program

For purposes of local shoreline planning, Whatcom County places Cherry Point in the Birch Bay Watershed Management Unit (WMU), a 31 square mile coastal watershed between Drayton Harbor and Lummi Bay. It includes the marine shoreline from the north end of Semiahmoo Peninsula, and includes Birch Point, Neptune Beach, Birch Bay State Park, Point Whitehorn, and Cherry Point. The WMU extends inland to the City of Ferndale, and includes Lake Terrell and Terrell Creek. The Birch Bay and Cherry Point UGAs make up a significant percentage of the watershed. Shorelines of the state include the marine shoreline, the lower 3.1 miles of Terrell Creek and Lake Terrell. The marine shoreline from Birch Point to Point Whitehorn is a shoreline of statewide significance. Whatcom County submitted their updated Shoreline Management Plan (SMP) in 2007, and under Whatcom County Code (WCC) 23.100.17, zoned and adopted the Cherry Point Management Area. This plan has been accepted by the Washington State Department of Ecology.

According to Whatcom County (WCC 23.100.17.A.1) the Cherry Point Management Area can be described as follows:

> The purpose of the Cherry Point Management Area is to provide a regulatory framework which recognizes and balances the special port, industrial and natural resource needs associated with the development of this marine resource…Washington State natural resource agencies and Whatcom County have identified certain portions of the Cherry Point Management Area as providing herring spawning habitat that warrant special consideration due to their importance to regional fisheries and other elements of the aquatic environment…Development of the Cherry Point Major Port/Industrial Area will accommodate uses that require marine access for marine cargo transfer, including oil and other materials. For this reason, water-dependent terminal facilities are encouraged as the preferred use in the Cherry Point Management Area. Due to the environmental sensitivity of the area, it is the policy of Whatcom County to limit the number of piers to one (1) pier, in addition to those in operation or approved as of January 1, 1998 (p. 181).

3.1.3.3 Whatcom County: Point Whitehorn Marine Park

Proposed to open to the public in the summer of 2008, the 51-acre Point Whitehorn Park will focus on the site's abundant natural attributes comprised of wildlife, forests, bluffs, natural shoreline and magnificent views of the San Juan Islands. A joint project between the Whatcom Land Trust and Whatcom County, the site will provide parking and walking trails to wetlands, overlooks and over one third of a mile of beach along the Strait of Georgia. Point Whitehorn Marine Park is envisioned to be the first phase of a larger regional park at this site (Whatcom County, personal communication, 2008).

4 Cherry Point Resource Characterization

The Cherry Point Resource Area contains a marine ecosystem that supports a variety of natural resources, fish and wildlife. Salmon species that migrate through the Resource Area include sockeye, Chinook, coho, chum and pink. Groundfish have been surveyed offshore, and herring, sand lance, and surf smelt reported in the nearshore. Cherry Point Resource Area supports a Dungeness crab fishery, and a smaller pot shrimp fishery is located offshore to the west. Vegetation along Cherry Point includes extensive kelp beds mixed with eelgrass, algae and saltmarsh. The substrate varies, from coarse substrate interspersed with cobble, to large boulders interspersed with sandy beaches (Whatcom County MRC, 2001).

This section will provide a resource characterization that discusses Cherry Point's distinctive ecological zones, habitats, species, and archaeological, cultural, and historical resources found within or adjacent to Cherry Point.

4.1 Geographic Location

Washington's marine ecosystems can be divided into three primary systems - the Columbia River Littoral Cell, the Olympic Coast and the Puget Sound. The Cherry Point Resource Area is within the Puget Sound biogeographic region, a region delineated as the marine waters of Washington to the east of the entrance to the Strait of Juan de Fuca. This biogeographic region can be further subdivided into nine subregions or basins; Cherry Point Resource Area is in the southeastern portion of the Georgia Strait Basin (Georgia Basin).

The Georgia Basin was created about 150 million years ago when colliding continental plates created the Georgia Depression. The Puget Sound and the Strait of Georgia were created by the repeated advance and scouring of glacial ice-sheets, the most recent of which moved into the area around 15,000 to 13,000 years ago (Easterbrook 1999). This glaciation, referred to as the Fraser, flowed through the Fraser Valley and formed the Strait of Juan de Fuca. The Fraser Glaciation moved as far south as Olympia, with huge glaciers forming the hills and valleys that characterize the Georgia Basin today and depositing the Vashon Till that covers much of the region (Williams et al. 2001).

4.2 Hydrology

Today, the Strait of Georgia is fed by the 850-mile long Fraser River to the north, which moves large amounts of silt and fresh water long distances. This river drains over one quarter of British Columbia and has the largest salmon runs in North America (Georgia Strait Alliance, 2007). The Fraser River has a profound influence on the water flow and quality within the Strait of

Georgia. Over 80 percent of the freshwater entering the Strait of Georgia comes from the Fraser River; run-off is driven by glacier melt, occurring during June and July. Other rivers drain into the Strait of Georgia, from Vancouver Island during periods of intense precipitation, around November (Waldichuck 1957). For comparison, the annual amount of freshwater entering Puget Sound is only 10-20 percent of the amount entering the Strait of Georgia, most of it via the Fraser River.

4.2.1 Freshwater

The Puget Sound receives freshwater runoff from the encircling Olympic Mountains to the west and the Cascade Mountains to the east (Whatcom County 2006). The Nooksack River has been redirected into Bellingham Bay, leaving the Fraser River as the primary source of freshwater for the Strait of Georgia. The Fraser brings a high level of fine sediment to Cherry Point. This sediment, when combined with the Nooksack input to the south of the Resource Area, and constant erosion of feeder bluffs along the shoreline, have created a habitat conducive to supporting submerged vegetation and Pacific herring (Center of Biological Diversity et al, 2004).

Three freshwater streams discharge in or near the Cherry Point Resource Area. Terrell Creek discharges just north of Cherry Point through Birch Bay State Park, and two unnamed freshwater creeks identified as streams 01.0100 and 01.0101. Terrell Creek is 8.7 miles in length and supports fair to good populations of coho plus some chum utilization. Terrell Creek helps support the Birch Bay great blue heron colony, located north of the creek and west of Jackson Road. The Birch Bay great blue heron colony is the third largest in the region, supporting over 300 breeding pairs (U.S. Department of Energy, 2004).

Stream 01.0100 is 1.25 miles long and drains 800 acres. The stream is characterized (according to WAC 222-16-030) as a Type 4 water below Henry Johnson Road (water may be intermittent) and a Type 5 above (water is intermittent) (Shapiro and Associates 1994). Field surveys suggest that few fish species use this stream. Based on previous reports the only anadromous fish likely to use the stream are cutthroat (Shapiro and Associates 1994). Less is known about stream 01.0101 and its ability to support anadromous fish is unknown. Stream 01.0101 drains through the Cherry Point saltmarsh, a nine-acre Category 1 wetland that includes 3.5 acres of estuarine emergent saltmarsh that is tidally controlled.

4.2.2 Riparian Areas

Riparian areas are generally defined as the interface between terrestrial and aquatic ecosystems. The riparian area within the Cherry Point Resource Area includes feeder bluffs, forests, meadows, streams, and a brackish wetland. The primary functions and processes within the marine riparian zones include nutrient and sediment input, maintenance of water quality, soil/slope stability, shade/temperature control, and recruitment of large woody material. Characteristic species of concern include peregrine falcon, bald eagle, great blue heron, and coho salmon (e.g. Gulf Road stream and wetland).

Sections of Cherry Point are also highly influenced by saltwater, as evidenced by salt marshes and brackish marshes. These habitats thrive in areas influenced by tides. Often, salt marshes are

located above mean high high water (MHHW), and in locations where sediment accretion or supply is high. Examples include spits, bays, or along river deltas. These habitats have been found along Gulf Road, at Cherry Point (Whatcom County, 2006).

Sand and mudflat habitats are also found at Cherry Point, often surrounded by salt marsh communities and supporting a high biomass of aquatic invertebrates, such as clams, shrimp, and worms, and dense mats of microalgae, such as diatoms. They are highly productive areas and are a significant food source for shorebirds, fish, otters, and raccoons. Sand and mudflat communities are extremely vulnerable to damage from scour or erosion, increases in temperature associated with a loss of riparian vegetation, changes in substrate composition due to shoreline armoring, as well as increased nutrient and sediment loads.

4.2.3 Marine Divisions

The marine environment can be divided into two large units – the ocean water or *pelagic* environment, and the seafloor, or *benthic* environment (see Figure 3). These two environments are further divided based upon characteristics such as depth, oxygen, nutrients, and sunlight penetration (Thurman, 1990). Dethier (1990) provides an extensive classification for marine and estuarine systems that can be applied to smaller areas beneath the larger divisions discussed here.

For purposes of this document, the Cherry Point Resource Area will use only those divisions that occupy the planning area, based upon DNR GIS bathymetry layers. Divisions have been defined using measurable units that can be used to track changes in resources over time.

According to bathymetric data, the deepest portions of the Cherry Point Resource Area are located just southwest of the BP pier at approximately 160 feet (50 meters) in depth. This depth acts as the outer boundary for defining the following divisions:

Pelagic: Marine water – Subdivisions of the pelagic marine environment within the 160 ft (50 m) depth of Cherry Point Resource Area (see Figure 3):

- *Neritic*: Extends from the shore seaward, includes all water overlying an ocean bottom less than 660 feet (200 meters) in depth.
- *Euphotic*: Also called the epipelagic. From the surface down to 660 feet (200 meters), defined specifically by the boundaries of sunlight and photosynthesis (Thurman, 1990).
- *Nearshore*: The nearshore zone extends waterward from the ordinary high water line to the tidal elevation of -70 feet mean low low water (MLLW). The nearshore ecosystem is dynamic and is maintained by physical forces such as wind, waves, and precipitation, which drive coastal processes that redistribute sediment, woody material, and nutrients. Valued ecosystem components of the nearshore zone include submerged aquatic vegetation (SAV) and reproductive, rearing, foraging, and migratory habitats for fish, marine mammals, birds, and invertebrates. Characteristic species of concern include eelgrass, Pacific herring, surf smelt, Puget Sound Chinook, Dungeness crabs, marbled murrelet, and killer whales.

Nearshore environments also provide for a wide range of commercial, navigational, and residential activities such as marinas, ferry docks, and log storage. Due to the ecological sensitivity of the nearshore environment and its value for human activities, protecting nearshore processes and functions is a critical component of this management plan.

Benthic: Seafloor - Subdivisions of the benthic seafloor environment that occur within 160 ft (50 m) depth of Cherry Point Resource Area (see Figure 3):

The benthic environment can be divided into two larger units, the subneretic *province* which extends from spring high tide shoreline to a depth of 660 feet, or the continental shelf, and the *suboceanic province*, which includes the entire benthic environment below 660 feet. Only the subneritic province appears in the Cherry Point Resource Area (Thurman, 1990).

The *subneretic province* is further broken down into the following zones:

- *Littoral zone*: From low tide to about 660 feet (200 m) the littoral zone extends out into the water and is broken down into 3 smaller areas:

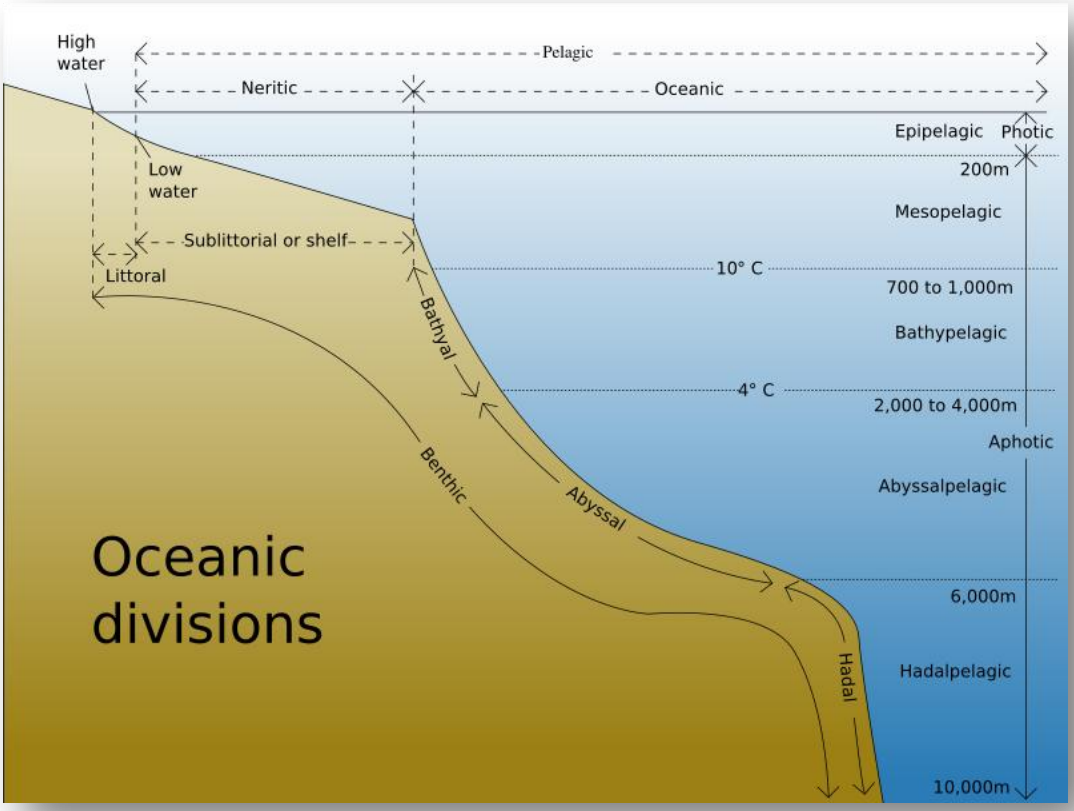
- *Supralittoral zone* The supralittoral, or spray, zone is only underwater during unusually high tides or during storms. It starts at the high-tide line and goes toward dry land. This zone is distinct in that it is only covered with water during short periods of time, such as extremely high tides. This area may potentially be the first to be affected by sea level rise or tsunamis (Thurman, 1990).

- *Intertidal zone* is between the high-tide and low-tide lines. The intertidal may also be called the foreshore. In the intertidal zone, wave action and turbulence of recurring tides shapes and reforms cliffs, gaps, and caves, offering a huge range of habitats for sedentary organisms. Protected rocky shorelines are often located in this zone. The rocky intertidal zone at Cherry Point Resource Area between Point Whitehorn and Sandy Point contains a wide variety of biological habitats, with the most common being boulders of various sizes, cobble, gravel and sand. Large boulders are prevalent north of Cherry Point, near the Intalco facility, and immediately south of the ConocoPhillips refinery, providing substrate shelter for mobile and sessile organisms (ENSR 1992a). The rocky intertidal habitats within the intertidal zone mix with high tide beaches created from sandy gravel. Moving from intertidal and transitioning towards the sublittoral zone, boulders and sandy patches become more prevalent. Many of these sand patches support eelgrass (*Zoestra marina*) and/or assemblages of marine algae (ENSR 1992a).

Sublittoral zone The sublittoral zone extends from the low-tide line out to 200 meters. The sublittoral refers to areas where sunlight reaches the ocean floor; that is, the water is not deep enough to remove the photic zone. The primary producers are higher in the sublittoral zone than in other zones. This zone typically extends towards the end of the continental shelf. The benthic zone in the sublittoral is comparatively more stable than the intertidal zone as temperature, water pressure and sunlight tend to remain fairly constant. For example, sublittoral corals do not have to deal with as much fluctuation as intertidal corals and corals are more common in the sublittoral zone. At Cherry Point Resource Area, the sublittoral zone

is generally depositional, with fines, silt and mud prevailing. Some boulders are present, covered in silt. Sediment in the upper sublittoral zone immediately below the intertidal zone are generally sandy mud (ENSR 1992a). The inner sublittoral extends out to about 160 feet, the boundary of Cherry Point Resource Area. However, the actual seaward limit of the sublittoral will vary because it is determined by that depth at which we find no plants growing on the ocean bottom. It is determined to a major extent by the amount of solar radiation that penetrates the surface water. This could be influenced, in part, by turbidity (Thurman, 1990) and any type of spill.

Figure 3. Oceanic Divisions and Subdivisions.[9]



4.2.4 Coastal Processes

Throughout the coastal areas of Whatcom County, feeder bluffs have eroded to create beaches and large areas of accretions, composed of glacially derived sediment. In the southern portion of the county, the bedrock does not erode as easily. Consequently, beaches are narrower and there are fewer backshore areas. Because of this, the feeder bluffs play an important role in shoreline erosion. The bluffs are composed of glaciomarine drift in the upper two-thirds of the bluff,

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which is a pebbly, silty, clay termed “Bellingham Drift” deposited during the last glaciation (Fraser). Beneath this lies the commonly found Vashon outwash sand, combined with silt and clay lower in the bluff. Whatcom County has identified these bluffs, along with sandy and cobble beaches, as a protective measure against shoreline erosion in their 2006 Shoreline Characterization and Inventory (Whatcom County, June 2006).

These bluffs help feed the constant river of sand and gravel that flows along beaches. Shore drift or "littoral drift" can move materials from eroding bluffs and streams to shorelines miles away. Weather and waves pick up particles in one area and drop them off in another area. The direction of shore drift is determined by the prevailing direction of the waves and currents in the drift cell.

4.2.4.1 Littoral Drift (Shore Drift) and Drift Cells

A drift cell, or littoral cell, is a partially compartmentalized zone along the coast that acts as a somewhat closed system with respect to shore drift. Waves that approach the shore at an angle rush diagonally up the beach. The water then returns directly down the beach under the force of gravity. Sand grains carried by the rush and backwash of the waves are moved along the beach in a sawtooth fashion. This type of movement of sand grains along the beach by wave forces, is called “longshore drift.” The material found in a drift cell, or littoral cell, can be moved by other forces, such as weather (Ecology website, 2008).

Longshore currents and longshore drift are generally considered to be constructive processes. Unlike storm waves, they are not significant in coastal erosion. They are the continuing processes that nourish the beach and carry sand along the shore of a barrier spit to deposit it at the end of the spit so that the spit grows in length (Ecology website, 2008).

Drift cells are important because they are the mechanism that supplies nearshore environments with the majority of the sediments they require. Drift cells nourish beaches, and provide fine sediments to flats, and maintain sand spits and other coastal landforms. Drift cells in the Puget Sound-Georgia Strait region range in length from five or more miles to just a few hundred feet. Whatcom County alone contains twenty net shore-drift cells and twelve regions of negligible net shore-drift. According to the Whatcom County 2006 Shoreline Characterization and Inventory, there are three drift cells located at or in the immediate vicinity of Cherry Point (1) Birch Bay, (2) Point Whitehorn, and (3) Cherry Point. Blocking supplies of sand to downdrift beaches, flats and sand spits by structures such as marinas and groins can erode and damage beach habitat (Ecology website, 2008).

4.2.4.2 Birch Bay Drift

Shore drift moves from Birch Point south and east towards the jetty located at Birch Bay Village Marina. A second drift cell starts east of the Marina and extends to the northeastern corner of Birch Bay (Whatcom County, 2006).

4.2.4.3 Point Whitehorn Drift

A drift cell originates at Point Whitehorn, drifting northeast to converge with a cell in the northeast corner of Birch Bay. Bluff erosion at Point Whitehorn is substantial and significantly

contributes to the drift cell. Visible evidence of this dynamic process at Point Whitehorn includes broad sand flats, spits, and protruding shorelines. Beaches at Point Whitehorn mark the start of a large accretionary beach, which forms around Birch Bay, just to the north. Ninety-four percent of the beaches in this Reach are considered accreting beaches (compared to eroding beaches) (Whatcom County, 2006).

4.2.4.4 Cherry Point Drift

A northwesterly fetch from the Strait of Georgia moves sediment south, through a narrow divergence zone located at Point Whitehorn. This cell includes the Cherry Point area and terminates at the spit at Sandy Point. The cell has an abundance of sediment, and accounts for approximately 54 percent of the Cherry Point Resource Area, while feeder bluffs make up an additional 9 percent. The Cherry Point Resource Area is also characterized by recent landslides, representing over 18 percent of the shore reach. Toe erosion was identified along 38 percent of the Resource Area. Human modifications that directly affected geomorphic processes were identified along 9 percent of the Cherry Point Resource Area. (Whatcom County, 2006).

The character of the beach at Cherry Point is described as consisting of moderate to high feeder bluffs, with broad storm berms, which likely buffer wave erosion. The berm crest is composed of pebble and granula with minor cobble, and the upper foreshore of the beach is dominated by pebble and cobble with substantial amounts of sand in most locations. The lower foreshore/high tide beach is cobble and pebble dominant with sand and boulders. Beach material along the low tide terrace is typically composed of finer sediment with cobble and boulder lag deposits. Active bluff erosion contributes large woody debris to the upper beach (Whatcom County Shoreline Characterization Inventory, 2006).

4.3 Plants

4.3.1 Submerged Aquatic Vegetation

In addition to being a key component in marine primary productivity rates, submerged aquatic vegetation provides shelter for spawning and rearing organisms. Eelgrass beds of both native and non-native species (*Z. marina and Z. japonica*) are found along the sand bars in southern Birch Bay and are then interspersed with a diverse algal community from Point Whitehorn to Neptune Beach. Eelgrass is a subtidal grass that spreads by rhizomes and prefers sandy/silt substrates. Eelgrass beds also protect shorelines from wave and current driven erosion, while their root systems help anchor sediments and keep shallow subtidal environments moist and cool during low tides. Bladed kelps such as *Laminaria saccarhina* and *Costaria costatum*, filamentous kelps such as *Desmarestia*, and a variety of red foliose and filamentous algae dominate the algae community.

Both eelgrass and kelp provide food, habitat and shelter for a variety of organisms including salmonids, forage fish, phytoplankton, zooplankton and macroinvertebrates. In addition to being

an important component of nearshore primary production rates (Nybakken 2001), kelp beds are critical habitat for a number of organisms including grazers such as snails and sea urchins, filter feeders like anemones, scavengers (i.e. crabs), predators such as rockfish and starfish, and a variety of smaller algae. Out-migrating smolts spend considerable time in nearshore eelgrass and kelp beds feeding and adapting to marine conditions as they mature. As a result, impacts to submerged aquatic vegetation and the communities they support also threaten rearing salmonids. These vegetated communities are also an important part of the terrestrial food web and help support a variety of bird and mammal species. *Sargassum*, a non-native subtidal kelp that herring often spawn upon, is also found extensively (Pentilla, 2001).

4.3.1.1 Submerged Vegetation Monitoring Points (SVMP)

The DNR Nearshore Habitat Program randomly selected and monitored one site within the Cherry Point region since the inception of the SVMP in 2000. The location of the site, sampled in August 2001, is shown in Figure 4.

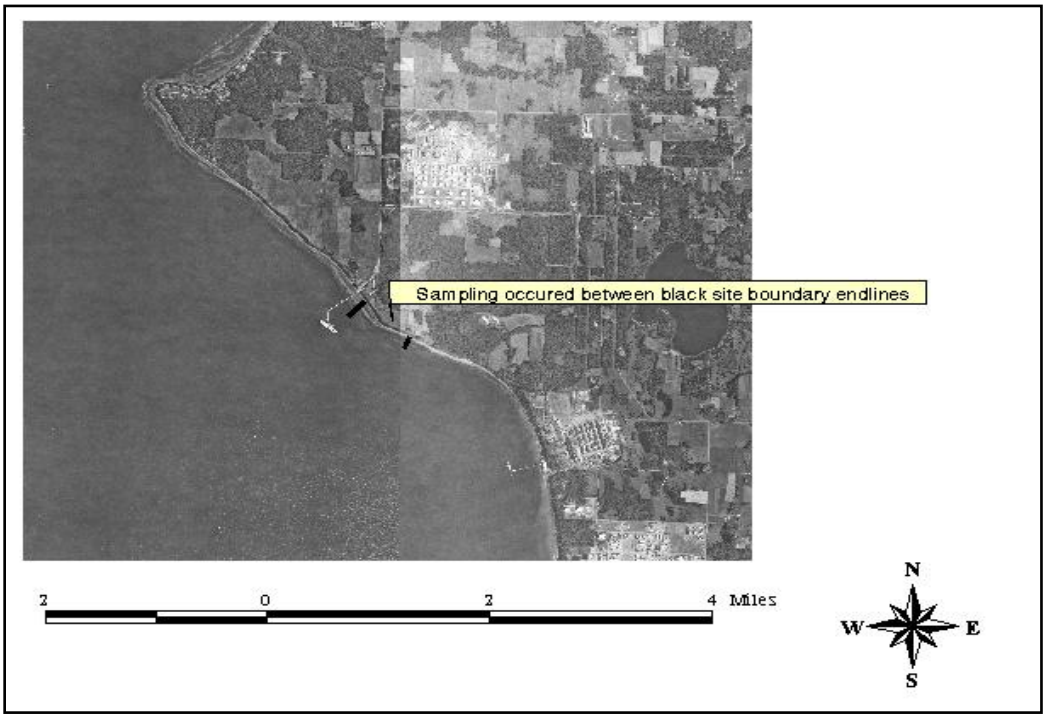

Figure 4: 2001 SVMP Cherry point site

Within the 2001 SVMP Cherry Point site, Nearshore Habitat Program scientists used underwater video and multiple transects through the intertidal and subtidal zones to collect data necessary to estimate basal area coverage of *Z. marina*, patchiness index, and maximum and minimum depth characteristics. Nearshore Habitat Program scientists then conducted nine meandering underwater video transects to delineate the eelgrass bed. A large bed of floating kelp (*Nereocystis luetkeana*) and many boulders prevented boat access into a portion of intertidal area. The kelp bed surrounds the eelgrass bed, which is located in the northwest section of the

transect (Figure 5) While this site is no longer being monitored, it provided important insight into the character of submerged vegetation along the nearshore zone of Cherry Point.

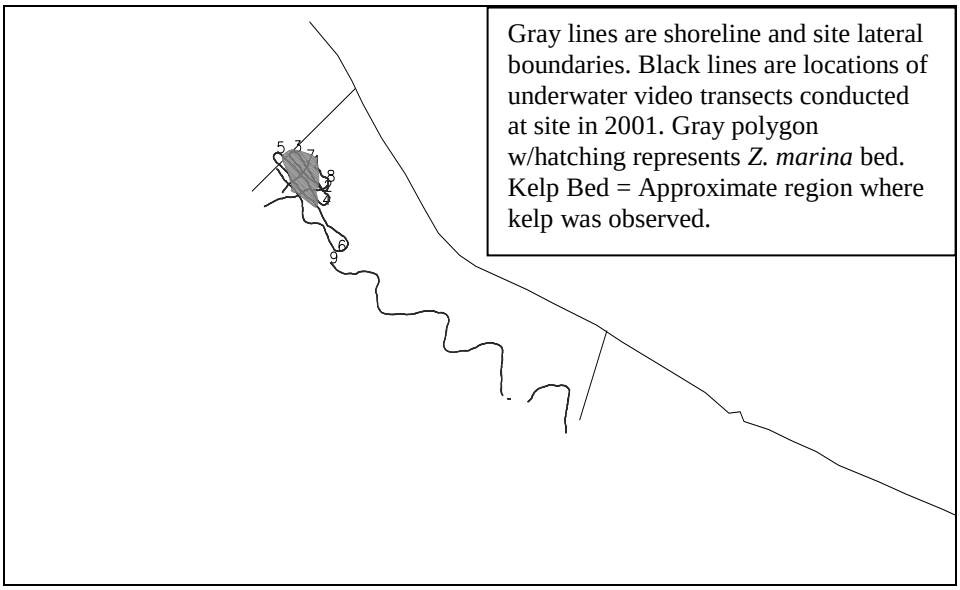

Figure 5- 2001 SVMP Cherry Point Transect Locations

In 2000, Fairbanks and Terra described four successive bands of vegetation observed along a portion of Cherry Point. These include:

Band 1: Marine vegetation extending from a depth of +2 feet to –1 foot MLLW that is uniform. Observed vegetation includes green algae (*Ulva* and *Enteromorpha*), which is colloquially called sea lettuce. Substrates along Band 1 are primarily composed of boulders and cobbles.

Band 2: Marine vegetation extending from a depth of –1 foot to –5 feet MLLW. From a depth of –1 foot to –3 feet MLLW, observed vegetation includes bull kelp (mixed with brown algae (*Laminaria* and *Alaria*), and red algae (*Gracilaria, Porphyra, Iridaea*, and *Ondonthalia*). A few patches of eelgrass (*Zostera*) are also observed. The substrate in this zone can be either cobbles and gravel with some boulders, or finer sediment. Between a depth of –3 feet and –5 feet MLLW, diatoms were generally observed covering the substrate with no large vegetation.

Band 3: Marine vegetation extending from a depth of –5 feet to –12 feet MLLW and uniform throughout. Vegetation is dominated by eelgrass (*Zostera*), with some macroalgae mixed in the bed where a boulder was found. The eelgrass bed identified is between 120 and 200 feet wide and is moderately dense with more than 84 turions per square yard. The substrate in band 3 was composed of sand and silt.

Band 4: Marine vegetation extended from a depth of –12 feet to –18 feet MLLW. Large plants such as bull kelp mixed with brown algae were observed. Macroalgae was observed attached to boulders. Substrate at this depth is composed primarily of silt and sand with a few boulders and cobbles.

It is expected that similar vegetation and substrate bands can be found throughout the Cherry Point Resource Area. To the north of Point Whitehorn vegetation bands appear to shift such that eelgrass beds are the dominant vegetation feature with occasional spit/berm vegetation along the shoreline. This area is less turbid and does not experience as much wave energy as Cherry Point. Cherry Point and areas to the north and south will be re-surveyed for submerged aquatic vegetation by DNR's Nearshore Team in 2008. Until that time, county surveys from 2004 have shown the following (see Tables 3.0 and 4.0):

Table 3.0 Area SAV coverage observed at Cherry Point in August, 2004

	Low Density (sq ft)	High Density (sq ft)	Low Density (sq meters)	High Density (sq meters)
Turf Algae	1,894,772.2	1,615,010.8	176,024.3	150,034.5
Canopy Algae	3,142,068.7	1,271,794.0	291,898.2	118,149.7
Bull kelp	2,329,223.2	0.0	216,384.8	0.0
Sargassum	2,089,646.6	0.0	194,128.2	0.0
Eelgrass	2,736,898.9	102,639.6	254,257.9	9,535.2

Table 4.0 Comparison of DNR1995 data with Whatcom County data.

DNR 1995 (sq ft)			Whatcom County (sq ft)		
Brown algae	356,245.2	3.7%	13.8%	2,089,646.6	Sargassum
Eelgrass	419,888.1	4.3%	18.7%	2,839,538.4	Eelgrass
Green algae	209,110.4	2.1%			component of turf algae
Kelp	7,719,611.6	79.3%	44.4%	6,743,085.9	Bull kelp + canopy algae
mixed algae	1,033,752.3	10.6%	23.1%	3,509,783.1	turf algae
Total:	9,738,607.6	100%	100%	15,182,054.0	

4.4 Species

This section describes species that are supported by the Cherry Point Resource Area. These species may or may not be found elsewhere, and can be located at, near, or migrating through the area.

4.4.1 Salmonids

Salmon are medium to large size anadromous fish that share life history requirements including cold water spawning habitat (45 to 65^0 Fahrenheit, 7 to 18^0 Celsius) with silt free gravel substrates. Adult salmon migrate to spawn in the gravel of freshwater streams. Substrate size is important for spawning, and as shelter for fry. Juvenile salmon rear for a few weeks to several years in freshwater before heading to the estuary, where they may feed and adjust to saltwater (a process called smoltification) for a period of only days to as much as a year before continuing on to the ocean. In estuaries and freshwater, complex, meandering channels provide a network of riffles, pools and side channels for shelter and rearing. Juveniles are dependent upon native riparian vegetation for shading and cooler water temperatures, as well as a source of food from terrestrial insects, and shelter under/in large woody debris. Juvenile salmon experience the highest growth rates of their lives while in these highly productive estuaries and nearshore waters. Stable flows and high dissolved oxygen content ($\geq$ 7.0 mg/L) are also critical for the survival of both returning adults and rearing juveniles. Out-migrating smolts spend considerable time in nearshore eelgrass and kelp beds feeding and adapting to marine conditions as they mature. As a result, impacts to submerged aquatic vegetation and the communities they support also threaten rearing salmonids.

Over the last several decades, a number of factors have lead to significant declines in both the diversity and abundance of salmon populations in Puget Sound. These factors are often summarized as: loss of habitat; hatchery management; hydropower impacts; and, harvest.

4.4.1.1 Salmon at Cherry Point Resource Area

A large number of salmon and migratory trout species have been historically or currently located along or adjacent to the Cherry Point Resource Area, and the area has been designated as habitat for listed species, including Chinook, and bull trout. Cherry Point and the adjacent areas historically supported a flourishing salmon canning industry. Threats to vegetative communities within Cherry Point from shading, shoreline armoring, increased nutrients loads, and damage from anchors and buoys have combined with natural and anthropogenic stressors outside of Cherry Point to decrease shelter and food supplies for smolts, juveniles, and migrating adults.

Berger and Adam (2000) found large numbers of pink salmon (*Onchorynchus gorbuscha*), chum (*O. keta*), coho (*O. kisutch*), and Chinook (*O. tshawytscha*) in cobble habitat located along the Cherry Point shoreline and in the protected eelgrass beds of Birch Bay. Juvenile sockeye salmon (*O. nerka*) were also found in Birch Bay, but were generally less abundant than other species (Berger/Abam, 2000). Adult Chinook, pink, coho, and chum salmon migrating to the Fraser and

Nooksack rivers, Terrell Creek, and natal streams in Drayton Harbor can be expected to transit and feed along the Cherry Point shoreline (Berger/Adam 2000). Whatcom County has mapped Terrell Creek as a pocket estuary that provides feeding, refuge, and osmoregulatory functions for juvenile salmonids (Whatcom County Shoreline Inventory, 2006). Adults of all these salmon species migrate though the Cherry Point Resource Area and are harvested for ceremonial, subsistence, and commercial purposes.

4.4.1.2 Bull Trout (*Salvelinus confluentus*)

The marine habitat along Cherry Point is considered critical offshore habitat for the Coastal-Puget Sound bull trout population (*Salvelinus confluentus*). In marine waters, bull trout seek out surf smelt and other schooling fish, such as herring. They are often found throughout the nearshore and estuarine habitat (USFWS 2004).

Puget Sound and Washington coastal bull trout populations were listed as threatened in November 1999 by the U.S. Fish and Wildlife Service (USFWS), which in 2005 designated critical habitat in a final rule (September 26) for all bull trout populations in the lower 48 states. The Bull Trout Recovery Plan (USFWS 2004) identifies the Nooksack as one of 8 identified core areas considered a Recovery Target. The Whatcom County WRIA 1 Salmon Recovery Plan lists bull trout species as “current presumed” and “presumed potential/historic” in waterbodies draining directly to Cherry Point (2007).

Historically the greater Nooksack delta included natural branches from the main channel to both Lummi Bay and Bellingham Bay, south of Cherry Point, with extensive estuarine and riverine-tidal freshwater wetlands. Lummi Bay was closed off from the river in the mid-1880’s and diking closed delta distributaries and blind tidal channels, cut off meanders from the lower Nooksack, and ditches filled in tributaries (USFWS 2004). Bull trout typically have wide ranging feeding, migrating and over-wintering habitats and can use non-natal watersheds. In freshwater, bull trout forage on salmonid eggs, fry and smolts, whitefish, and sculpin (USFWS 2004). Spawning continues in all three forks of the Nooksack River and its tributaries (Shared Strategy for Puget Sound, 2005).

The USFWS divided marine habitat into 5 regions for Coastal Puget Sound bull trout, with Cherry Point located in the North Puget Sound region. This region is noted by the USFWS for its high density of submerged vegetation compared to the rest of Puget Sound (USFWS 2004). The marine habitat along Cherry Point is considered critical offshore habitat for the Coastal-Puget Sound bull trout population. In marine waters, bull trout seek out surf smelt and other schooling fish, such as herring. They are often found throughout the nearshore and estuarine habitat. The maintenance of a healthy estuary and nearshore ecosystem is seen as key to maintaining fluvial and anadromous populations of Puget Sound Bull Trout (USFWS 2004).

Bull trout are easily affected by anything that impacts the 4 “C’s” of their habitat requirements: cold water, clean water, complex habitat structure, and connected habitats. When considering a management resource protection and management plan and alternative, this approach may be the first step in analysis. In addition, to the protections Coastal-Puget Sound bull trout received

under the federal ESA as a threatened species, it is listed as a state candidate species by Washington Department of Fish and Wildlife.

4.4.1.3 Onchorhynchus species

4.4.1.3.1 Chinook salmon (*O. tshawytscha*)

Chinook, or king salmon, are anadromous and the largest of the Pacific salmon species (Myers et al. 1998). The Puget Sound Evolutionary Significant Unit (ESU) for Chinook salmon (*O. tshawytscha*) includes the Cherry Point site and major waterbodies. The Puget Sound Chinook ESU was listed as a federally threatened species in March of 1999 and includes runs from the North Fork Nooksack River in northeast Puget Sound to the southern Puget Sound watersheds, Hood Canal and the Strait of Juan de Fuca. Puget Sound Chinook are currently estimated to be at only ten percent of historic numbers. The species' eastern historic range extends from the Ventura River in California, to Point Hope in Alaska, and westward to northeastern Asia and northern Russia (Healey 1991). Over 2,300 miles of nearshore habitat in Puget Sound, including the Cherry Point Resource Area, has been designated critical habitat for Puget Sound Chinook under the ESA (70 CFR 52630, September 9, 2005.)

4.4.1.3.1.1 Nooksack Chinook salmon

Chinook salmon in the Nooksack River basin are distinctive from Chinook salmon in the rest of Puget Sound in their genetic attributes, life history, and habitat characteristics, indicating support for the geographical evidence of independence of these fish. Although some Chinook salmon from the Nooksack River basin may sometimes stray into other Puget Sound rivers (based on releases from Kendall Creek Hatchery), the low numbers probably have not had a significant effect on the population dynamics of other populations (Ruckelshaus et al, 2006), and this population remains distinct.

The Puget Sound Technical Recovery Team (TRT) identified two existing independent populations in the Nooksack River basin: (1) North Fork Nooksack River (including Middle Fork Nooksack River) and the (2) South Fork Nooksack River. The TRT found that the South Fork Nooksack stock was one of two populations most at risk, when asked to identify recovery priorities (the other was Cedar River) (Puget Sound TRT, 2006). The Nooksack salmon populations are the only two populations in the Strait of Georgia region of Puget Sound, and they are two of only six Chinook runs left in Puget Sound that return to their rivers in the spring (as opposed to fall spawning). For these reasons, the Nooksack populations are considered by the TRT to be essential to recovery of the ESU. Identification of priority estuarine and nearshore areas for protection and restoration is one of seven key recovery strategies towards recovery of the Nooksack salmon.

For further information, please see Independent populations of Chinook salmon in Puget Sound. NOAA Tech. Memo. NMFS-NWFSC-78, developed by Ruckelsaus, et al., July 2006.

4.4.1.3.2 Steelhead (*O. mykiss*)

Steelhead are rainbow trout that spend part of their life cycle in marine environments. Unlike other salmonids, steelhead can spawn more than once. Typically, anadromous steelhead can be

divided into summer (stream-type) or winter (ocean-type) stocks. Spawning steelhead can be identified by the pink to red striping along their sides.

In Puget Sound the majority of steelhead populations are winter-run, meaning adults normally return to freshwater from November to December, and the peak of spawning occurs between March and May of the following year. Puget Sound Steelhead were listed as threatened by NOAA Fisheries in 2007; federal critical habitat has not been designated at the time of this document (Whatcom County 2003; NOAA 2007).

Four separate steelhead stocks are found in the Nooksack region. Three are native winter stocks found on each fork of the Nooksack and the fourth is the summer stock of the upper South Fork. The South Fork Nooksack summer stock has typically been a smaller population than the winter runs; however, the population status for all stocks in the region is unknown pending further study (Whatcom County 2003).

4.4.1.3.3 Chum Salmon (*O. keta*)

The chum salmon, also known as the dog salmon for its distinct doglike teeth, is the most abundant of salmon species in Washington State. Chum are anadromous and generally mature between three and five years of age, with a high proportion of Washington stocks maturing at age three. The majority of chum stocks in the Puget Sound are fall runs. Peak spawning migration occurs in October through November and continues as late March (Johnson et al. 1997).

In 1993 the Washington Department of Fisheries identified forty-five fall chum populations in Puget Sound, including nine in the northern area (Canada-Washington border to the Stillaguamish River), thirty in the southern area (Snohomish River watershed south and Hood Canal), and six in the Strait of Juan de Fuca. The status was unknown for thirteen of these populations and healthy for all others. Hood Canal populations of chum were listed as threatened in 1999.

Native chum can be found throughout the Nooksack watershed, but since they are not strong jumpers, will be found predominantly in the lower reaches of the river system. They migrate into the system August through December, but do not spawn until late October through early February.

As of 1998, Whatcom Creek supported the largest recreational chum catch in the Puget Sound region, and the Nooksack River was also listed in the top ten rivers for recreational chum catch (Whatcom County, 2003).

4.4.1.3.4 Coho Salmon (*O. kisutch*)

Coho salmon are also known as Silver salmon due to their bright silvery coloring. They can be differentiated from chinook by their gray gums and a lack of black spots on the lower lobe of the tail. They are known for their early return to freshwater.

Coho salmon were historically distributed along the Pacific coast from Chamula Bay, Mexico, to Point Hope, Alaska, through the Aleutians, and from the Anadyr River in Russia, south to Hokkaido, Japan (Scott and Crossman 1973). Coho migrate starting in July, with spawning in late October through January. After hatching, coho fry prefer areas of calm water such as beaver ponds, lakes and pools with plenty of large woody debris where they will stay for up to two years.

Weitkamp et al. (1995) noted that while populations of the Puget Sound coho evolutionarily significant unit (ESU) are abundant and that runs and natural spawning escapement are generally stable, there are substantial risks to the remaining native stocks. Coho are remarkably adaptable and can be found spawning in significantly degraded streams; the success of this adaptive behavior is questionable. Wild populations appear to continue to decline (Wydoski and Whitney 2003) as most coho returning to Puget Sound are hatchery reared. In the Nooksack basin, hatchery fish have been released for decades, and the coho of this region are considered to be of mixed original (native and hatchery) (Whatcom County 2003).

Listed as a Candidate Species in 1995, Puget Sound coho is currently listed as a Federal Species of Concern. The coho in Nooksack WRIA 1 are a candidate for listings under the Endangered Species Act.

4.4.1.3.5 Coastal Cutthroat Trout (*O. clarki clarki*)

The coastal cutthroat trout (*Oncorhynchus clarki clarki*), also known as the sea run cutthroat, or harvest trout, are a subspecies of cutthroat trout with an anadromous life history. The anadromous form (migratory – or "Sea Run") develop as juveniles in fresh water for two to seven years, migrate to estuaries where many live for varying portions of their lives, and return to freshwater for annual feeding runs and for spawning, most often at age three to five (Jauquet 2003). Sea-run cutthroat develop a greenish blue color on their back, with silver sides. The non-migratory (resident) form of coastal cutthroat include fish generally found in small streams and headwater tributaries near spawning and rearing sites. They typically grow more slowly than the other life history forms of cutthroat, are smaller when they reach maturity and normally do not live longer than two to three years (Nicholas 1978; June 1981; Pauley et al, 1989).

In all, coastal cutthroat trout exhibit all four salmonid life histories - adfluvial, fluvial, resident, and anadromous (Wydoski and Whitney 2003). Not only do different individuals from the same population exhibit different life histories, but individuals can also be capable of repeated spawning over as much as six years (Johnson et al. 1999).

A federal status review was completed on the cutthroat trout. The Biological Review Team (BRT) reviewing this species divided cutthroat habitat into four regions, placing Cherry Point in the Puget Sound Region. The BRT found that within the Puget Sound region, coastal cutthroat trout smolt at a smaller size and younger age, and are genetically different from populations in southwest Washington and further south (Johnson et al 1999).

Both the resident and anadromous forms can be found in the Nooksack River and its tributaries, and resident cutthroats can be found in Lake Whatcom as well. The anadromous, sea-run stock is

considered wild. The resident, freshwater stock is considered of mixed origin (hatchery and wild). The anadromous cutthroat spawn from January through July and the resident cutthroat spawn from January through June. All cutthroat prefer to spawn in small tributaries and rear in ponds, side channels and wetland areas.

For the sea-run cutthroat, most likely to use the Cherry Point management area, a nearshore diet often consists of a wide variety of small marine fish, invertebrates and terrestrial insects, indicating that the highly predaceous cutthroat are opportunistic feeders. In south Puget Sound, studies indicate a high reliance on (other) salmonids as part of the diet (Jauquet 2003), particularly chum salmon and salmon eggs.

4.4.1.3.6 Sockeye salmon (*O. nerka*)

Sockeye salmon returning to the rivers are bright to dark red on their backs and sides with pale green heads. Most sockeye spawn in or near lakes with the juveniles using the lakes for rearing.

Sockeye inhabit diverse physiographic regions throughout Washington, ranging from the Pacific Ocean to Puget Sound, the Cascade Mountains, portions of the Columbia River, and the Strait of Georgia, where Cherry Point is located. At least one section of the Nooksack system supports a small run of sockeye salmon. It is a half-mile-long side channel of the North Fork, located 3.5 miles upstream from the town of Glacier. Other stream sections, and some tributaries, in both the North and South Fork Nooksack, also receive limited sockeye runs. Sockeye migrate into the river beginning in April and spawn from August through early November (Gustafson, et al. 1997; Whatcom County, 2003).

4.4.1.3.6.1 Kokanee

Kokanee are resident sockeye that reside year-round in lakes, often land-locked ones. Generally these sockeye are smaller in size because of the limited food sources in lakes compared to rivers, estuaries and the ocean. In Whatcom County, the native Lake Whatcom kokanee stock is maintained and enhanced using hatchery stock. Eggs from this stock are used for other lakes throughout the United States (Gustafson, et al. 1997; Whatcom County, 2003).

4.4.1.3.7 Pink salmon (*O. gorbuscha*)

Pink salmon have primarily been used as a commercial canning food product and is the smallest of the Pacific salmon. The adult males can be distinguished by the pronounced hump that develops prior to spawning. Juvenile pinks are entirely silver in color, and because of the short amount of time spent in freshwater, show none of the parr (spots) marks that other juvenile salmon have for camouflage in freshwater. Pinks also spend little time in the estuary. Once in the ocean, they swim close to the beach just below the water surface in large schools. At about one year of age, they move farther out to feeding grounds in the ocean waters, returning to spawn in their natal waters as two-year olds (Whatcom County 2003).

Native pink salmon are found throughout the Nooksack watershed. In odd-numbered years (e.g., 2003, 2005), two-year-old pinks enter the system beginning in July and spawn from late August through October. The young fry return almost immediately to the ocean. The odd-runs in the

North Fork Nooksack are currently listed as healthy. Listing under the Endangered Species Act was determined "not warranted" for the pink salmon of the Nooksack region, because sufficient numbers are returning to spawn and sustain the population (Whatcom County 2003).

4.4.2 Forage fish

Forage fish are an important and abundant fish species in Washington. As the name implies, the significance of forage fish is related to the critical part they play as the prey base for a large variety of other marine organisms, their popularity as recreational fishing bait, and their significance to commercial and subsistence fisheries. The more common fish species identified as forage fish within Washington include Pacific herring (*Clupea pallasii*), surf smelt (*Hypomesus pretiosus*), Pacific sand lance (*Ammodytes hexapterus*), and northern anchovy (*Engraulis mordax*). Cherry Point supports spawning habitat for these four types of forage fish: Pacific herring, sand lance surf smelt, and northern anchovy, all of which are described next.

4.4.2.1 Pacific Herring (Clupea pallasii)

Pacific herring (*Clupea pallasii*) are widely distributed around the Pacific Rim, with a range that includes northern Baja California to the Bering Sea, north into the seas of the Arctic Ocean and west to Japan, Korea, and the Yellow Sea. Major concentrations of herring are found off the coast of British Columbia, the Bering Sea, and the Yellow Sea (Mitchell, 2006).

Adult herring stocks are often classified based upon their migratory behavior: migratory populations that move between oceanic feeding grounds in the summer and inshore spawning grounds in the winter, and resident populations that remain in coastal bays and inlets year-round. Cherry Point and Discovery Bay are also believed to be migratory stocks (Stout et al 2001; Stick et al, 2005), and recent genetic studies have suggested that the Cherry Point herring stock is genetically distinct from other Washington and British Columbia stocks (Beacham et al. 2002; Small et al. 2005, Mitchell 2006).

Pacific herring use the nearshore environment extensively and are often considered an "indicator" species of the overall functioning of a nearshore ecosystem. Pacific Herring, including Cherry Point Pacific herring, are centrally located in the food web, acting as a prey species for marine mammals, birds, copepods and larval fish. Herring are also a commercially valuable species for Washington (Piening et al. 2001). Commonly grouped together with surf smelt and sand lance under the generic terms "forage fish", herring do not utilize beach substrates to deposit their eggs. Instead, they deposit transparent adhesive eggs on intertidal and shallow subtidal sea-grasses and marine algae (Sikes et al. 2002).

4.4.2.1.1 Cherry Point Pacific Herring

In Washington State, Pacific herring consist of 21 isolated spawning stocks that are thought to return to the same area to spawn each year: 2 coastal stocks at Willapa Bay and Grays Harbor, 2 stocks in the Strait of Juan de Fuca, 6 stocks in the southern Strait of Georgia, and 11 stocks in the South and Central Puget Sound (Stick 2005, Mitchell 2006). Herring spawning grounds are

very specific in location and the peak of spawning generally does not vary more than 7 days from year-to-year. Within Puget Sound, some herring stocks highly variable in number from year to year and between locations (WDFW 1998). The Cherry Point herring stock is one that has experienced a drastic decline in abundance while other Washington stocks have maintained or increased abundance. Since the 1970s, the size of the Cherry Point stock has shrunk from approximately 15,000 tons to a low of about 800 tons in the 2000 spawning season to an estimated 2,100 tons for 2007, followed by a decrease to 1,352 tons in 2008 (Figure 6) (WDFW unpublished data, 2008).

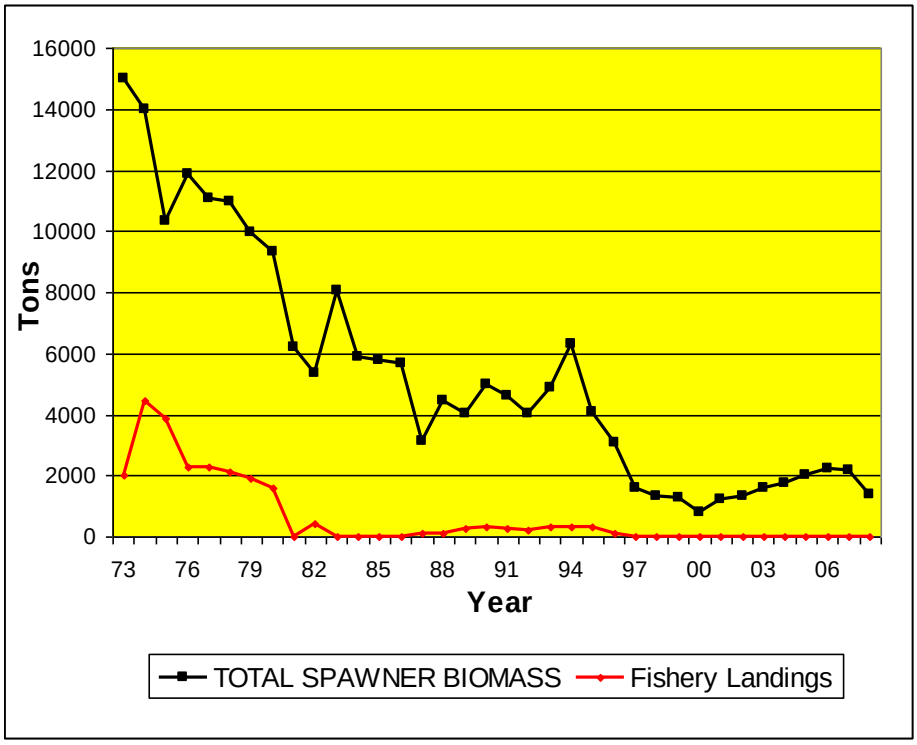

Figure 6. Cherry Point herring stock spawning biomass and fishery landings (short tons), 1973-2008 (WDFW unpublished data).

Herring require both spawning grounds and a pre-spawning holding area. The purpose of the pre-spawner holding area is for adults to congregate approximately 3- to 4-weeks prior to spawning. Generally this area is located near the spawning habitat. After this time, the adults migrate towards suitable spawning habitat, called spawning ground. For herring, suitable spawning ground for depositing eggs is located primarily on lower intertidal and shallow subtidal areas containing eelgrass and marine algae. In Washington most spawning activity takes place between 0 and -10 feet MLLW (0.0 to 3 meters) in tidal elevation (See Figure 7) (Stick 2005).

Cherry Point herring spawn from early April to mid-June, with peak spawning activity the first or second weeks of May. Spawn deposition can occur between +3.0 feet tidal elevation to the lower limit of algal growth, around -20 feet, with most occurring between 0 and -10 feet MLLW. Preferred spawning substrate includes eelgrass and more than 25 species of rock-dwelling marine algae (WDFW, 2007). Within the boundaries of the Cherry Point Resource Area, herring spawn has been found most frequently found on native eelgrass (*Zostera marina), Desmerestia sp., Botryoglossum sp., Laminaria saccarhina, Odonthalia sp., Ulva fenestrata, Nereocystis leutkeana,* and *Sargassum muticum* (WDFW, unpublished data, 2008).

Spawning is followed by a ten to fourteen day incubation period, and then emergence, after which larvae drift on prevailing nearshore currents for 2 to 3 months, followed by metamorphosis into juveniles. Following metamorphosis, Puget Sound herring are thought to spend their first year in Puget Sound. Some stocks of Puget Sound herring spend their entire lives within Puget Sound while other stocks summer in the coastal areas of Washington and southern British Columbia (Trumble 1983). Little is known about herring movements until they appear as 2 or 3 year olds in pre-spawner holding areas prior to spawning.

4.4.2.1.1.1 Genetics of Cherry Point Herring

Cherry Point herring are distinct in their spawning time. Other Pacific herring stocks in Washington spawn between early January through early April, with each stock generally spawning for approximately a 2-month period during this time period (Stick 2005). Most spawning in Puget Sound peaks in late February or early March, though herring at Cherry Point peak in mid-May (Figure 8). Historically, Cherry Point herring use unprotected shoreline along Cherry Point, as well as adjacent areas, such as Hale Passage, Birch Bay, Drayton Harbor, and Semiahmoo Bay, when the abundance of the stock was much larger and spawning was laterally spread out north and south of the core Cherry Point spawning area (Stout et al, 2001; Meyer and Adair, 1978).

The question of genetic divergence of Cherry Point herring from other Pacific herring stocks has been addressed in research. Work by Beacham et al (2002), Small et al (2005) and Mitchell (2006) have concluded that Cherry Point herring are genetically divergent and isolated from all other sampled Washington and B.C. herring stocks. Relatively unique (late) spawning timing is thought to be the primary cause of the observed genetic divergence of the Cherry Point herring stock.

The recent genetic studies previously mentioned indicate the genetic uniqueness of the Cherry Point herring stock, and support the continued management of this stock as a discrete management unit.

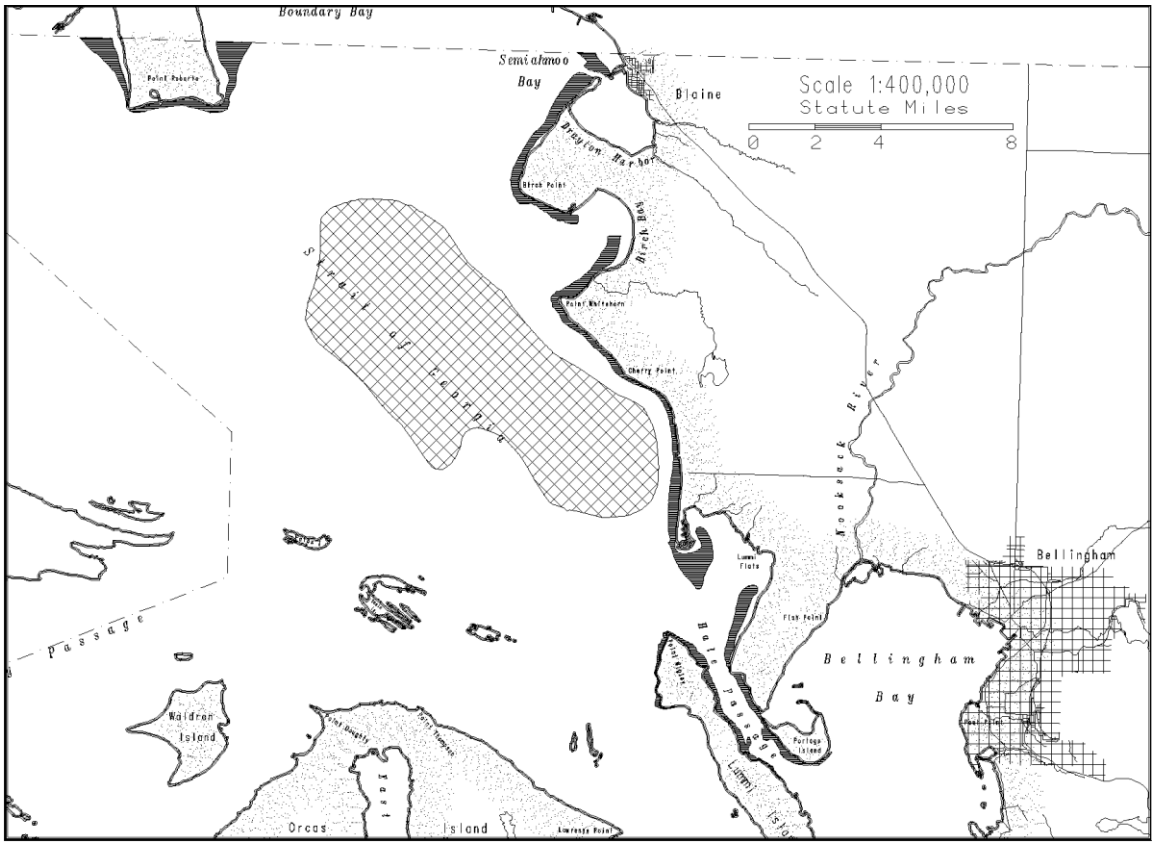

Figure 7. Documented spawning grounds and prespawner holding area for Cherry Point herring stock.

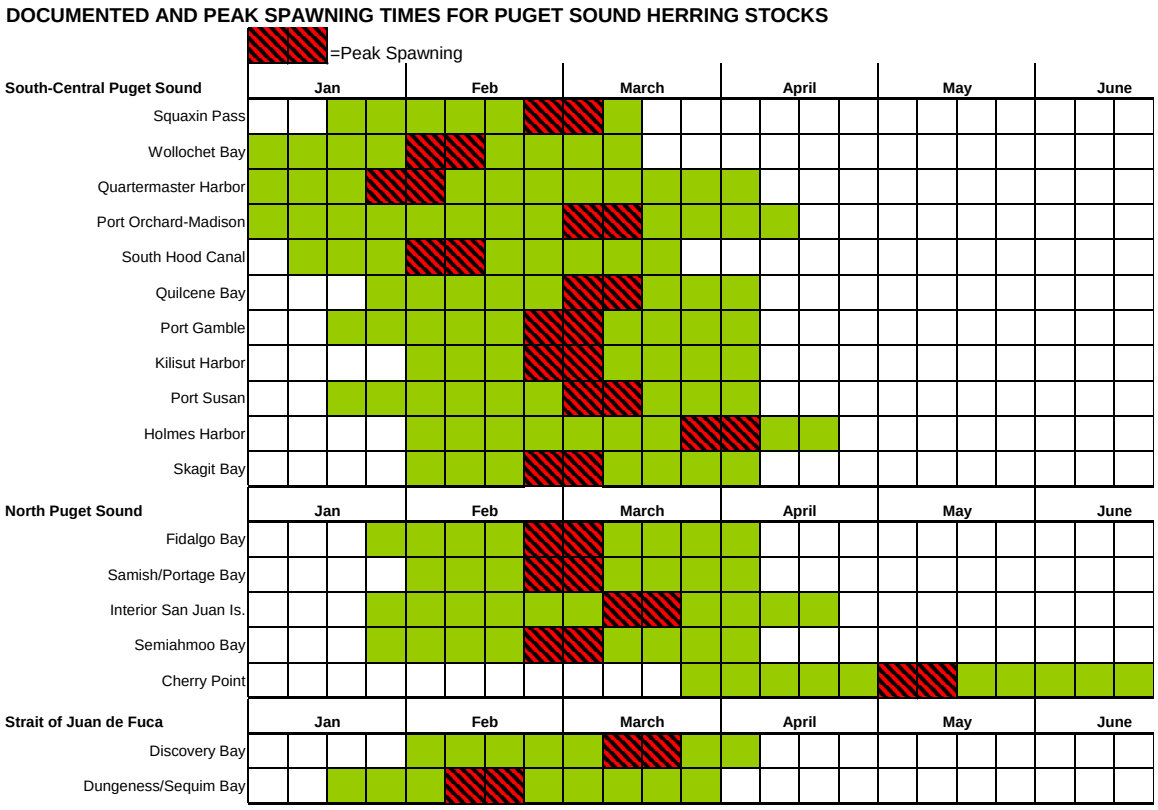

Figure 8. Documented and peak spawning times for Puget Sound herring stocks (WDFW unpublished data).

4.4.2.2 Surf Smelt *(Hypomesus pretiosus)*

Surf smelt occur throughout the marine waters of Washington, from the Columbia River to the Canadian border and southernmost Puget Sound. An abundant schooling fish that can reach up to nine inches in length, surf smelt are found in the nearshore environment, where they feed and spawn (Whatcom County MRC, 2007).

Interestingly, surf smelt and salmon are members of the same taxonomic order, *Salmoniformes*. Other members of the smelt family include the Columbia River and Longfin smelt, both of which are anadromous, running up rivers to spawn in freshwater (Longfin smelt are located in the Nooksack River, upland of Cherry Point). Surf smelt can be distinguished from other forage fish such as herring, sand lance and anchovy, by a green back, with a silver or yellow band, and the presence of an adipose fin (WDFW, 1997).

Adult surf smelt feed on a variety of zooplankton and epibenthic organisms, including planktonic crustaceans and fish larvae (Emmett et al. 1991; Fresh et al. 1981) and in turn become food for seabirds, marine mammals, and a variety of fishes including salmon. While genetic studies have not been undertaken, a number of distinct stocks are thought to occur in the Puget Sound basin.

Surf smelt spawn in the upper intertidal zones of mixed sand and gravel beaches, generally within a few feet of the high tide line. Adhesive and semitransparent eggs are deposited on beaches with this preferred mix of sand and pea gravel, and can occur in areas where there are seeps or shade, which increases the egg survival time in the summer (Wildermuth, D. pers. comm. 2008). Adults do not die after spawning. Surf smelt spawning occurs in Whatcom County primarily in the summer months (Point Roberts, Cherry Point, Birch Bay, Bellingham Bay). Spawning may occur almost year-round in Semiahmoo Bay (Wildermuth, D. pers. comm. 2008).

The Whatcom County shoreline characterization inventory (2006) found that surf smelt spawning areas are located in the higher intertidal beaches along the west shore of Point Roberts, Semiahmoo Spit to Birch Point and extending east to the northwest corner of Birch Bay. Additional areas include small stretches of shore between the mouth of Terrell Creek and Point Whitehorn, near Cherry Point, north of Neptune Beach, along the eastern shore of the Lummi Peninsula, along the shoreline near Little Squalicum Creek, north of Padden Creek, and along the beach at Post Point. Shorelines along the Cherry Point Resource Area have been documented as surf smelt spawning areas with the area from Gulf Road south to Neptune beach as being the largest contiguous stretch of spawning habitat (Figure 9). Smaller spawning areas have been documented just to the north of the northern BP Pier and just to the south of Birch Bay State Park.

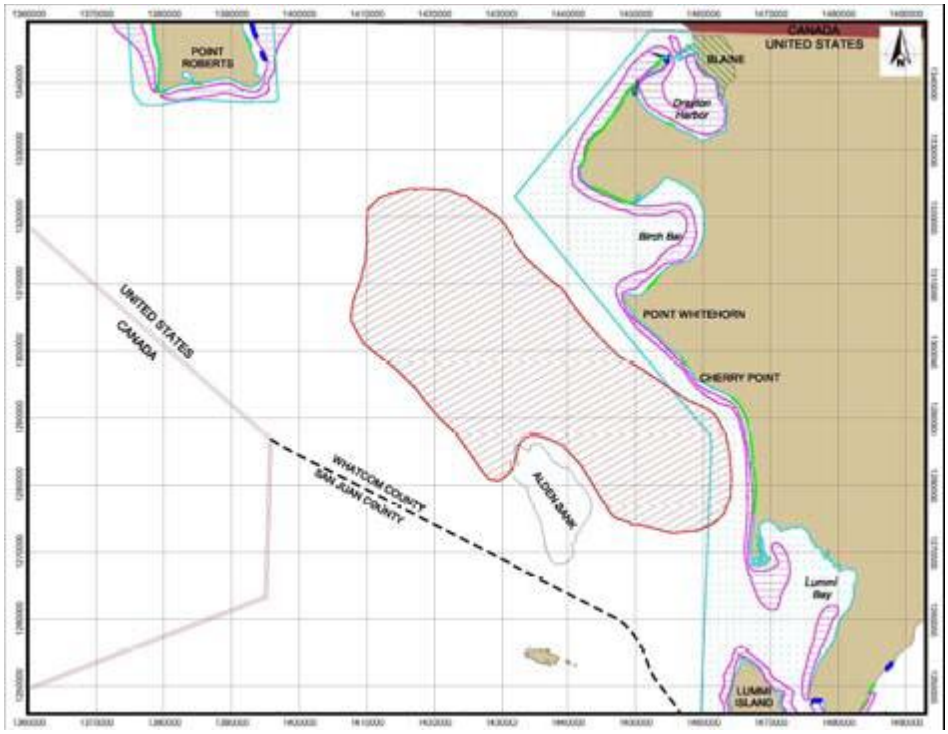

Figure 9 - Surf Smelt spawning areas (solid green)

4.4.2.3 Sand Lance (*Ammodytes hexapterus*)

Pacific sand lance occur throughout the coastal northern Pacific Ocean from the Sea of Japan to southern California and across Arctic Canada. Populations are widespread within Puget Sound, the Strait of Juan de Fuca and the coastal estuaries of Washington, commonly noted in more localized areas, such as the eastern Strait and Admiralty Inlet. The sand lance is abundant throughout British Columbia and Puget Sound in a variety of habitats (Hart 1973), including the upper intertidal zone along the Cherry Point Management Area. A schooling fish, sand lance are well known for their "balling" behavior, thought to be a mechanism to avoid or confuse predators. The sand lance can be easily identified by its slender body, pointed snout and long dorsal and anal fins, sand lance reach a maximum length of about 37 centimeters (cm).

Spawning occurs from November through February in Puget Sound (Penttila, 1995b). About 200 miles of sand lance spawning beaches are now known to exist along Puget Sound. This is recent information, as spawning habits were not known in Puget Sound prior to 1989, and many spawning areas remain un-surveyed (Ecology 2003). Spawning sites are scattered evenly over the Puget Sound Basin, to such a degree that hypothetical geographical stock boundaries are not apparent (Penttila, 2007).

In Whatcom County, sand lances are documented to spawn in Bellingham Bay, Gooseberry Point (Hale Passage), around Blaine, and on the eastern shore of Point Roberts. As with surf smelt (*Hypomesus pretiosus pretiosus*) sand lance deposit their eggs on upper intertidal beaches consisting of sand and gravel (Penttila 1995b) and have specific habitat requirements. The eggs are deposited at high tide in shallow water on a rather broad range of beach surface substrates, from soft, pure fine sand beaches to beaches armored with gravel up to 3 cm in diameter, although most spawning appears to occur on the finer grained substrates. Spawning activities occur in sand-gravel or sand beaches, normally higher than 3 feet (1.5 meters) in tidal elevation. Tidal elevation has been recorded at +5 feet to about the mean higher high water line. The eggs acquire a partial coat of sand grains which adhere during deposition. The sand coating may serve to assist in capillary moisture retention when the eggs are exposed during the low tide. The coated sand lance eggs are dispersed along the beach with each tide exchange (Penttila 1995b).

Beaches meeting the requirements are used annually. Spawning occurs during high tides and repeated spawning events may occur. The incubation period is about four weeks. before the larvae enter the nearshore environment. Planktonic sand lance larvae are common during the late winter in nearshore waters. Juveniles rear in bays and nearshore waters, with adults probably moving into estuarine waters during spring and summer for feeding (Whatcom County Shoreline Inventory, 2006; Lemberg et al. 1997; Emmett et al. 1991). Juvenile sand lance may burrow into unconsolidated, sandy subtidal sediments at night to escape predators. (Emmett et al. 1991).

Unlike other Puget Sound forage species, sand lance actively burrow into nearshore unconsolidated, sandy subtidal during parts of their diurnal and seasonal cycles of activity (Field, 1988, Quinn, 1999). While most burrowing behavior may occur sediments at night to escape predators (Emmett et al. 1991), they may also burrow at or below mean lower low water in the upper, oxygenated segment of the intertidal sediments (Quinn and Schneider, 1991, Quinn, 1999).

Although sand lance feed on a variety of small organisms, by far the most important in their diet is copepods, particularly *Calanusfnmarchicus* which, in one study, occurred in 95 per cent of fish examined and formed 65 per cent of total stomach contents (DFO, 2004).

Sand lances create a trophic link between zoolplankton and larger predators in the local marine food webs. Like all forage fish, sand lance is a significant component in the diet of many economically important resources in Washington. On average, 35 percent of juvenile salmon diets are comprised of sand lance. Sand lance is particularly important to juvenile Chinook, where 60 percent of their diets are sand lance. Other economically important species, such as Pacific cod (*Gadus macrocephalus)*, Pacific hake (*Merluccius productus*) and dogfish (*Squalus acanthias*) feed heavily on juvenile and adult sand lance (WDFW 2008).

4.4.2.4 Northern Anchovy (*Engraulis mordax*)

The northern anchovy has resident populations throughout the Puget Sound basin, generally secondary in abundance to those of co-occuring herring. This species releases its distinctly oval eggs directly into the plankton, where they hatch within three days. The anchovy spawning season in Puget Sound is May-September. Anchovy eggs have been found in plankton samples from throughout western Whatcom County, from Semiahmoo Bay to Bellingham Bay, including the Cherry Point area.

4.4.3 Other fish species

Fishes characteristic of sand and cobble habitats persist in the shallow nearshore habitats of the Strait of Georgia. Species include sturgeon poacher (*Agonus acipenserinus*), buffalo fish (*Ictiobus cyprinellus*), roughback sculpin (Chitinotus pugetensis), Pacific staghorn sculpin (*Leptocottus armatus*), and ribbed sculpins (*Triglops pingelii*) white-spotted greenlings (*Hexagrammos stelleri*), and big skate (*Raja binoculata)*. Semi-pelagic species consisted of spiny dogfish (*Squalus acanthias*), walleye Pollock (*Theragra chalcogramma)*, Pacific cod (*Gadus macrocephalus*), and Pacific tomcod (*Microgadus proximus*).

At Cherry Point, WDFW found that flatfish dominated the catch at a site with Dover (*Solea sole*a), English sole (*Parophrys vetulus*), rock soles (*Lepidopsetta bilineata*), starry flounder (*Platychythyus stellatus*), and Pacific and speckled sanddabs (Palsson, personal communication). This is consistent with the results of earlier trawls by Kyte (1990), who also found that the majority (more than 90%) of flatfish taken in samples were juveniles less than 100mm in length. Occasionally, adult butter sole (*Isopsetta isolepsis*) have been seen along the diving transects or caught in the trawls (Hanson, D.K. and H.A. Van Gaalen 1993).

4.4.4 Invertebrates, Shellfish and Crabs

Many invertebrate species observed along Cherry Point include species that rely partially upon herring in their diet. Examples include an amphipod (*Anisogammarus pugetensis*), crab, the ochre sea star (*Pisaster ochraceus*), and unspecified sea anemones.

4.4.4.1 Various Benthic Invertebrates, Bivalves[10] and Malacostracans[11] of Cherry Point

Benthic invertebrate assemblages along the Cherry Point Resource Area are determined by substrate type. In the uppermost, loose, sand-gravel berms, near the mean high water level, amphipod species are found often inhabiting drift vegetation. Cobble and boulder beds of the intertidal area along Cherry Point provide habitat for species such as barnacles (*Balanus glandula*, *Chthamalus dalli*), snails (*Nucella lamellosa*, *Littorina scutulata*), chitons (*Mopalia muscosa*), limpets (*Collisella strigatella*), mussels (*Mytilus edulis*), and seastars (*Leptasterias hexactis*, *Pisaster ocbraceus*, *Evasterias trocheli*). Red rock crab (*Cancer productus*) are also present on the surface of cobbles. Under and between cobble and boulders are found small shore crabs (*Hemigrapsus* spp.), polychaete worms (*Nereis* spp., *Neanthes* spp.,) and shrimp (families *Crangonidae* and *Hippolytidae*) (EVS 1999; Whatcom County 2006).

Invertebrates living in the sediment of the mixed cobble and sandy eelgrass habitats are dominated by annelid worms (capitellid polychaetes and oligochaetes), burrowing anemones (*Anthopleura artemisia*), amphipods, variety of bivalves, including cockles (*Clinocardium nuttallii*), native littleneck clams (*Protothaca staminea*), and butter clams (*Saxidomus giganteus*) (EVS 1999, Whatcom County 2006).

Seastars (*Pisaster brevispius*, *E. trocheli*), red rock crabs, small shrimp and a wide variety of infauna such as polychaetes and bivalves dominate the subtidal habitat, which contains kelp beds and gravelly substrate.

Softer mud subtidal habitat includes the sea pen (*Ptilosarcus guerneyi*), nudibranchs, Dungeness crabs (*Cancer magister*), tanner crabs (*Chinocetes* spp.), sea cucumber (*Eupentacta pseudoquinquesemita*), and small crangonid shrimp. Geoduck clams (*Panope abrupta*) have been identified in the area (EVS 1999).

The cobble and fine sandy beaches, combined with undeveloped tidal sand and mud flats are important habitat for shellfish. Beaches along Cherry Point are characterized by habitat that could potentially support large numbers of shellfish, particularly bivalves such as manila, native littleneck, horse and butter clams. The nearby Birch Bay State park is classified as a "Land Access Beach with Abundant Clams and Oysters" for public shellfish sites of Puget Sound. Washington State Department of Health has closed many of these shellfish beds due to water quality problems (Whatcom County 2006). Closed or open, shellfish beds perform a number of important ecological functions including nutrient cycling, substrate stabilization, habitat structure (e.g., oyster reefs), water quality enhancement (filtering and retention), and provide food for a wide variety of marine invertebrates, birds, fish and mammals.

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[10] *Bivalves* are a class under the Phylum *Mollusca* characterized by two-part shells secreted by a mantle that extends in a sheet on either side of the body. The class has 30,000 species, including scallops, clams, oysters and mussels.
[11] *Malacostraca* are a large diversified group of crustaceans under the Phylum *Arthropoda*, and include the Order Decapoda - crabs, lobsters and shrimp. Source: Animal Diversity Web, University of Michigan Museum of Zoology; http://animaldiversity.ummz.umich.edu/site/accounts/pictures/Malacostraca.html

4.4.5 Birds

Cherry Point is considered one of 18 areas of significant bird habitat identified for the Strait of Juan de Fuca and Georgia Strait (Wahl et al. 1981). The area from Sandy Point to Point Whitehorn possesses important habitat during all seasons, supporting high numbers of fish-eating loons, grebes and alcids, along with diving ducks. Among the many terrestrial bird species that are found along the Cherry Point Resource Area are great blue herons, bald eagles, and peregrine falcons. Peak avian activity levels occur in late winter through early spring, coinciding with herring spawning activities in March through May when huge concentrations of birds, particularly scoters and gulls, feed along the shoreline.

For marine migratory species, the Puget Sound Ambient Monitoring Program (PSAMP) conducted surveys between 1992 and 2006 for both winter and spring species. Among other species, the following species were recorded within the boundaries of Cherry Point, and are considered representative of the nearshore ecosystem at Cherry Point:

Winter Species (survey seasons 1993 – 2006)

- Ancient Murrelet (*Synthliboramphus antiquus*) – Not listed (Federal or State).
- Bufflehead (*Bucephala albeola*) - Not listed (Federal or State).
- Common Loon (*Gavia immer*) - Listing Status: Washington State – Sensitive.
- Harlequin Duck (*Histrionicus histrionicus*) - Listing Status: Federal - Species of Concern.
- Long-tailed Duck (*Clangula hyemalis*): Not listed (Federal or State).
- Pacific Loon (*Gavia pacifica*): Not listed (Federal or State).
- Pigeon Guillemot (*Cepphus columba*): Not listed (Federal or State).
- Red-throated Loon (*Gavia stellat*a): Not listed (Federal or State).
- Western Grebe (*Aechmophorus occidentali*s): Listing Status: Washington State – Candidate.
- Black Scoters (Melanitta nigra) Not listed (Federal or State).
- Surf Scoters (Melanitta perspicillata) Not listed (Federal or State).
- White-winged Scoters (Melanitta fusca) Not listed (Federal or State).

Summer Species (survey seasons 1992 – 1999)

- Harlequin Duck (*Histrionicus histrionicus*) Listing Status: Species of Concern (Federal).
- Pigeon Guillemot (*Cepphus columba*): Listing Status – Not listed (Federal or State)
- Rhinoceros Auklet (*Cerorhinca monocerata*): Listing Status – Not listed (Federal or State).

The proposed resource protection and management plan for the Cherry Point requires considering impacts to all avian species, listed or non-listed. A list of 108 species documented in

riparian or upland areas at or adjacent to Cherry Point is located in Appendix D representing approximately 32% of all bird species found in Whatcom County. This is not a complete list.

4.4.5.1 Bird surveys at Cherry Point

Two large-scale bird surveys have covered Cherry Point. One was the Marine EcoSystems Analysis (MESA) during the late 1970s and early 1980s. The Puget Sound Ambient Monitoring Program (PSAMP) conducted surveys between 1992 and 2006 to compare many of these bird counts to the MESA results. Survey transects were designed so that they were nearly identical to transects flown during the MESA Puget Sound Project, allowing for a statistical analysis of bird species and numbers over a 30-year period (Marine Bird Density Atlas, WDFW, 2006).

In 1978, Cherry Point registered the highest counts of birds per square kilometer in Puget Sound. MESA observers counted more than 13,000 birds per square kilometer at and adjacent to Cherry Point. Herring spawn-related flocks of surf scoters included 22,400 at Pt. Whitehorn (23 April 1978); 22,135 off Lummi Bay (30 April 1978) and 16,037 at Cherry Point on 27 April 1979 (Wahl et al. 1981).

PSAMP comparisons revealed significant findings for marine birds throughout Puget Sound and the surrounding area. Many populations appeared to be decreasing - grebes, loons, scoters, scaup, oldsquaw, pigeon guillemot, marbled murrelet, cormorants, and black brant. Some populations appeared stable or slowly decreasing - rhinoceros auklets, goldeneyes, bufflehead, and gulls species. There may be some degree of increase in harlequin ducks and probably mergansers (Nysewander, D.R. et al. 2005). Many of these species rely upon or have been documented at Cherry Point.

During the MESA surveys, Wahl et al. (1981) recognized Lummi Bay to the south as significant bird habitat, while Birch Bay to the north was also considered a highly important area with the second highest bird use rating. Both Lummi, and to a lesser extent Birch Bay, were recognized for their importance as shallow bays with extensive eelgrass beds that support wintering populations of diving and surface-feeding ducks, gulls and shorebirds in addition to migrating Black Brant. These adjacent areas should be considered when developing management actions for migratory species that may move from Lummi and Birch Bay into or through Cherry Point Resource Area.

4.4.5.2 Bird species representative of Cherry Point

A large number of birds are located at, or migrate through, Cherry Point. Certain species are considered indicator species of a healthy nearshore system, by relying upon habitat functions or food sources found in the nearshore. These species are discussed next. See Appendix D for a list of more species documented in Whatcom County and at Cherry Point.

4.4.5.2.1 ***Order Anseriformes*** - Sea ducks and cavity nesting ducks

Family: Anatidae
Surf Scoter (*Melanitta perspicillata*)

The surf scoter is a large dark grey or black sea duck. The male sports a distinctive black-and-white head, distinctive white eyes, and a brightly colored bill. Surf scoters are often seen diving synchronously to locate small invertebrates such as mollusks, crustaceans, and polychaetes in the nearshore area. At night, they often rest in large flocks outside bays and estuaries in which they feed during the day. Surf scoters are typically present along the Cherry Point Resource Area in winter; PSAMP winter surveys counted 10 – 50 scoters/km2 in the northern portion of the reach, and upwards of 50 – 250 scoters/km2 in the central to southern portion (Nysewander, D.R., et al 2005). Numbers of scoters at Cherry Point increase dramatically when herring spawn is available, although the size of these aggregations of scoters has declined concurrently with declines in spawning herring at Cherry Point (see below).

Many thousands of surf scoters spend the period of wing molt during August and September in Puget Sound, including especially Padilla Bay (Anderson, E.M. unpublished data). Most scoters that winter in Washington arrive in Washington in October and November. Wintering grounds on the Pacific Coast extend from central Baja California to the Aleutian Islands in Alaska. Their preferred winter habitat consists mainly of shallow bays and estuaries. During spring, surf scoters build fat for migration and perhaps reproduction by feeding opportunistically on diverse seasonal foods, including especially herring spawn (Lacroix et al. 2005, Anderson and Lovvorn 2008, Anderson et al. 2008). Large flocks have been seen gathering and taking off from Saltspring Island in British Columbia. This staging area is thought to take advantage of the large spawning event of herring that occurs there during early spring migration for scoters (Seattle Audubon Society's BirdWeb, 2008). By late April to May, most scoters depart the heavily-used wintering areas of the Puget Sound-Georgia Bain (Anderson, E.M. et al., unpublished manuscript, 2008). Surf scoters migrate to Canada and Alaska, where they fly inland to large lakes and open wetlands of the boreal forest to nest under brush or grass. Preferred foods on breeding areas include aquatic and larval stages of aquatic invertebrates.

Anderson et al. (unpublished manuscript, 2008) studied the role of herring spawn in movements and energetics of scoters, focusing on differences in the value of spawn to surf scoters versus white-winged scoters (*M. fusca*). Their research indicated four main results:

1) Both surf and white-winged scoters gain mass by consuming spawn during late winter and spring.
2) The number of each scoter species that aggregates to consume spawn is positively related to the size of the spawning event (i.e., the biomass of spawning herring).
3) Numbers of surf scoters are especially abundant at spawning sites that occur later in spring (April to May), because migrating surf scoters use these sites as staging areas.
4) Spawn is a preferred food for white-winged scoters, but appears critical to surf scoters because they often lose fat reserves over winter.

The second and third results are particularly relevant to spawning events at Cherry Point. Specifically, spawning activity occurs later in spring at Cherry Point (late March through May) than at other spawning sites in the Puget Sound-Georgia Basin (January to mid-April). Thus, spawn at Cherry Point is used by surf scoters to acquire reserves for migration and breeding. However, concurrent with declines in the biomass of spawning herring at Cherry Point, numbers of scoters observed foraging on spawn there declined from about 60,000 to 6,000 in the period 1980–1999 (Nysewander, D. R., unpublished data). During spring migration of Surf Scoters in

late-April to May, no feeding opportunities equivalent to historical levels of spawn at Cherry Point are known to exist in the Puget Sound-Georgia Basin.

Herring spawn is profitable to scoters for two main reasons: (1) it is highly aggregated and thus reduces foraging effort (Lewis et al. 2007), and (2) spawn has no shell matter, which likely increases nutrient and energy gain[12] relative to some foods scoters consume earlier in winter (Anderson, E.M. et al., unpublished manuscript, 2008).

Although less well studied than scoters, predators ranging from invertebrates, to marine birds, fish, and whales likely benefit from spawning events of herring (Willson and Womble 2006). Moreover, such benefits generally occur during the critical period of the year when many predators are preparing for migration and reproduction. For this reason, Anderson et al. (unpublished manuscript, 2008) suggest that management of Pacific herring include protections for spawning areas that preserve feeding opportunities for these diverse predators.

Harlequin Duck (*Histrionicus histrionicus*)

The Harlequin Duck is a small sea duck easily identifiable by its paintbrush-like markings. The males are slate blue with chestnut sides and white markings including a white crescent at the base of the bill. Adult females are less colorful, with brownish-grey plumage and a white patch on the head around the eye. Both adults have a white ear patch. The Sea Duck Joint Venture (SDJV) recommends considering Harlequin Ducks as two distinct populations – western and eastern (SDJV, 2003). For purposes of this paper, information is limited to descriptions of western Harlequin Duck.

During winter, harlequins forage and use boulder-strewn shores, points, gravel substrates, and kelp beds; most of this bird's prey species can be located on rock or gravel substrate. Wintering harlequins are generally found close to shore in saltwater areas, within 164 feet, or 50 meters, close to favorite food sources (Lewis and Kraege, 1999). Distributions of harlequin ducks can be associated with the abundance of many intertidal and subtidal invertebrates, such as crustaceans, amphipods, isopods, and barnacles. Harlequins also forage on mollusks (snails, periwinkles, limpets, chitons, and blue mussels) and small fish such as small scuplins and gunnels. Herring is even a potential food source, as Vermeer (1997) noted that aggregations of harlequins were coincidental with some Pacific Herring spawning locations. However, whether these birds were feeding or simply staging has yet to be verified.

Spring migratory routes have not been established for the harlequin. This small duck is known to prefer breeding near cold, clean water that supports a healthy benthic invertebrate community, and avoid locations near disturbance. In general, forested settings with fast-flowing streams and abundant woody debris are preferred. Harlequin ducks breed in the mountain ranges of the Cascades and the Olympics in Washington State; whether they move beyond to the Blues is currently being discussed. Some individuals move outside of the state, to breed in interior British Columbia, Alberta, Idaho, Wyoming, and Montana (Lewis and Kraege, 1999).

[12] Mussel soft tissue and herring spawn have approximately the same nutritional value. However, 85 – 90% of a whole mussel is shell, which must be processed and excreted because scoters ingest whole bivalves.

The PSAMP summer marine bird surveys also documented high numbers in the northern portion of Cherry Point – between 50 – 65 animals/km^2, and 0 – 5 in the central portion of the nearshore area (Nysewander, D.R. et al. 2005). Overall, for the entire survey, comparison of nearly identical transects surveyed during the MESA time period (1978 – 79) and the PSAMP time period (1992 – 99) indicate this species show fluctuating numbers in this species.

Habitats identified as important wintering areas for harlequin are located at Cherry Point, and were identified as such during the PSAMP marine bird surveys, including the eelgrass and kelp beds combined with rocky and cobble substrates, supporting the diverse mix of benthic invertebrate species that make up a prey base for this bird.

Cavity nesting ducks

Cavity nesting ducks breed in the uplands within or adjacent to the Cherry Point Resource Area. These species nest almost exclusively in tree cavities, which protect the birds from weather and predators. They are secondary cavity nesters, and use cavities created by large woodpeckers or by damage or decay (Shay, 2007). Cavity use is often dependent upon the proximity of suitable brood habitat, predator levels in the area, and competition from other cavity nesters. Population levels of these birds are linked to availability of cavities (Lewis and Kraege, 2000).

Buffleheads *(Bucephala albeola*), Barrow's goldeneye (*B. islandica),* Common Goldeneye (B. clangula), Wood Duck - *Aix sponsa* and the Hooded Merganser (*Lophodytes cucullatus*) are all classified as cavity-nesting ducks. Of these species, all have used Cherry Point Resource Area habitat during migration, and the Wood Duck and Hooded Merganser include Whatcom County in its breeding range (Lewis and Kraege, 2000; Bohannon, J. WDFW, pers. comm., 2008).

According to Lewis and Kraege (2000), in Washington, cavity-nesting ducks nest primarily in late-successional forests and riparian areas adjacent to low gradient rivers, sloughs, lakes, and beaver ponds. Animal matter can comprise over 75% of the diets of the hooded merganser, bufflehead, common goldeneye and Barrow's goldeneye. These species feed primarily on aquatic insects, mollusks, crustaceans, and small fish – all of which are located in the nearshore environment at Cherry Point (Lewis and Kraege, 2000).

The PSAMP winter marine bird surveys documented buffleheads along the northern and central nearshore of Cherry Point at densities of 10 – 25 and 25 - 50 animals/km^2 (Nysewander, D.R. et al. 2005). The PSAMP winter marine bird surveys documented goldeneyes along the northern and central nearshore of Cherry Point at densities of 10 – 25 and along the southern nearshore at 0 – 10 animals/km^2 (Nysewander, D.R. et al. 2005).

4.4.5.2.2 ***Order Charadriiformes*** – Alcids, auks, murres, guillemots

Family: Alcidae

Alcids (or auks) fill a similar ecological niche in the northern hemisphere as penguins do in the southern hemisphere, except alcids can fly, and they fly very long distances. Alcids are not related to penguins, but are an example of convergent evolution.

Common Murres (Also called the Common Guillemot, *Uria aalge*)

The Common Murre is a large auk that spends most of its life at sea, coming to land only to breed on rocky cliff shores or islands. Breeding colonies are located south, from Clallam county to Grays Harbor County (WDFW 2005). These birds can be seen outside of breeding areas year round, including deep-water, inland and marine habitats (BirdWeb, 2008).

Common Murres are fast in flight, but not agile in air. Underwater they are very good divers, and can maneuver well into depths of 30 – 60 meters (100 – 200 feet). Depths of up to 180 meters (600 ft) have been recorded (BirdWeb 2008).

The PSAMP summer marine bird surveys documented the presence of Murres off the north shore of Cherry Point, at 10 - 25 Murres/km^2. Along the nearshore birds were counted at 0 – 5 Murres/km^2 (Nysewander, D.R. et al. 2005).

Pigeon Guillemot (*Cepphus columba*)

Pigeon Guillemots are stocky birds with rounded wings and bodies and straight bills. In breeding plumage, adults are solid black with white wing patches. Non-breeding adults and juveniles have white bellies and are mottled gray-and-white above. In all plumages, the birds have bright red feet (BirdWeb, 2008).

Pigeon Guillemots are common year round along rocky shores and inshore waters along the Pacific coast from Alaska to California, including Washington's rocky coastline and in Puget Sound. They are more common and widespread in winter. They nest throughout the salt-water coastlines of Washington in practically every small island or coastline habitat throughout the State.

Pigeon Guillemots breeding habitat consists of rocky islands and mainland cliffs that are protected from predators, as well as on a variety of man-made structures. When in the water, they remain close to rocky shorelines where the water depth ranges from 30 – 90 feet. The nesting practices of Pigeon Guillemots vary from those of other alcids. They regularly lay two eggs, rather than one, and, while they will nest in loose colonies, they also nest singly. Males select a nesting location in a crevice or cave, among boulders, under driftwood, or in a man-made structure such as a wharf or pipe. Or, the pair may excavate their own nest, or use the abandoned burrow of another animal. Nest sites are reused from year to year. The nest is a shallow scrape in a pile of soil, pebbles, or shell scraps. Incubation lasts for about four weeks, and the young leaves the nest about 4 – 6 weeks after hatching (BirdWeb, 2008).

Washington's breeding population of Pigeon Guillemots does not appear to migrate. However, more birds are present in Puget Sound in the winter, and these birds may have migrated north from farther south. The population of Pigeon Guillemots in Washington is not well known, and has probably declined in recent decades (BirdWeb, 2008).

Pigeon Guillemots forage underwater, propelled mostly by their wings, but, unlike most alcids, they also use their feet for propulsion. They search along the bottom for food, diving up to 150 feet. Preferred foots are small fish and a variety of other aquatic creatures, including mollusks and crustaceans (BirdWeb, 2008).

The PSAMP summer marine bird surveys documented birds along the nearshore at 0 – 5 pigeon guillemots/km^2 (Nysewander, D.R. et al. 2005).

Marbled Murrelet (*Brachyramphus marmoratus*)

The marbled murrelet is a small and chunky auk with a slender black bill. It has pointed wings, and its plumage varies seasonally, with non-breeding colors typically white underneath with a black crown, nape, wings and back. The marbled murrelet forages within 2 to 5 kilometer of shore in coastal and nearshore waters, and within the top 50 meters of the water. Generally solitary, individuals have been documented where Pacific herring are spawning (USFWS, 2006; Speich and Wahl 1989).

Marbled murrelets are unlikely to nest in the immediate vicinity of Cherry Point Resource Area because most forests are extensively fragmented, small, and of second-growth class. ENSR (1995) documented marbled murrelets flying into forests near the Canyon Creek drainage of the North Fork Nooksack River, near the United States-Canadian border and about 37 miles (60 km) from Cherry Point. This was considered to be the nearest known murrelet nesting area to Cherry Point for quite some time (ENSR 1995). Marbled murrelets have been later documented off of central and southern Cherry Point, approximately 5 to 10 kilometers offshore. The 2005 PSAMP surveys observed 1 – 2 animals off the northern boundary of Cherry Point, in the Point Whitehorn vicinity, during summer surveys (Whatcom County, 2006; Nysewander, D.R. et al. 2005). Considerations will need to be taken to account for their presence. Earlier surveys along Cherry Point have consistently noted use of the offshore area for feeding by small numbers (2 to 35 birds) of marbled murrelets.

Rhinoceros Auklets (*Cerorhinca monocerata*)

Closely related to the Tufted Puffin, the Rhinoceros Auklet is a large alcid with a wedge-shaped head. It is drab-gray overall, darker above than below. In breeding plumage, the Rhinoceros Auklet has a bright orange-yellow bill adorned with a whitish horn. It also has two light feather tufts on each side of its head, going in a line back from the eye and the corner of the mouth (BirdWeb, 2008).

The Rhinocerous Auklet feeds primarily in the marine or nearshore environment, particularly where tidal currents near islands create upwellings and concentrations of food. At night, the Rhinocerous Auklet enters protective bays. For nesting, the auklet looks for grassy, vegetated slopes that contain soil for burrowing, and areas where birds can take flight easily (BirdWeb 2008). Some of the predominant species in a diet include Pacific sandlance, Pacific herring, night smelt, Pacific saury, rockfish, anchovy, juvenile salmon (NatureServe 2008).

Collecting data on behavior while on land is difficult since the Rhinoceros Auklets are nocturnal at their nesting colonies. During the day, in water, the birds are noted to be excellent divers, swimming underwater using their wings like flippers and remaining submerged for up to two minutes. They feed on fish, crustaceans, and cephalopods (BirdWeb 2008).

The PSAMP summer marine bird surveys documented presence off the north and south shores of Cherry Point, at 5 – 10 auklets/km^2. Along the nearshore birds were counted at 0 – 5 auklets/km^2 (Nysewander, D.R. et al. 2005). Rhinoceros Auklets are found both in coastal habitats and far from land and are located year round off of Cherry Point (BirdWeb, 2008).

4.4.5.2.3 ***Order Gaviiformes*** - Loons

Family: Gaviidae
Common Loon (*Gavia immer*)

Common Loons are large waterbirds that have very distinctive vocalizations, including a yodel used by males to guard territory and the more distinctive, long, drawn out wail. The common loon has a black bill and a red eye. In summer it is a spotty black and white with a black/iridescent green head. In fall a "winter coat" that's gray above and white below replaces its summer plumage. Loons generally do not breed until they are 3 – 4 years old.

Common loons winter primarily on coastal and inland marine waters, (Richardson, S. et. al., 2000). During winter migration, Common loons move to shallower marine waters, where they form small feeding flocks in habitat with clear water. This bird forages primarily on fish between 10 and 70 grams in size, other aquatic vertebrates, some invertebrates and occasionally vegetation. Adults are flightless during a few weeks in mid-winter (February) and are therefore vulnerable to environmental disturbances (McIntyre and Barr 1997).

Prior to their migration during April and again in late October to early December, this species aggregates on low-gradient valley rivers and in littoral or limnetic zones of larger lakes and reservoirs. These staging areas are concentrated in habitats that combine abundant food with shelter from wind-generated waves (McIntyre and Barr 1997).

Breeding generally occurs on forest lakes; nesting Common Loons have been documented in Whatcom County at Hozomeen and Whatcom Lakes, Lake Terrell and the Diablo Reservoir (Richardson, S. et al, 2000). Lake Hozomeen is one of only a handful of lakes in western Washington documented as a confirmed nesting location for Common Loons. This species prefers secluded shorelines of lakes larger than 30 acres (Bohannon, J. WDFW, pers. comm.. 2008).

Common loons forage for prey in the top five meters of the water column, although they can dive up to 60 meters. Foraging during the day, Common Loons peer underwater for fish and other aquatic species (Richardson, S. et al, 2000).

Washington State has listed the Common Loon as a Sensitive species (Nysewander, D.R. et al. 2005). Because this bird is reliant so heavily on nearshore resources during the winter months, and is flightless during winter, therefore possibly more susceptible to impacts in the marine and nearshore environment, this species is being considered under this plan. This bird also uses freshwater resources adjacent to Cherry Point, linking the aquatic resources to the adjacent upland area.

4.4.5.2.4 ***Order Pelecaniformes*** – Comorants

Family: Phalacrocoracidae
Cormorants
Three species of cormorants inhabit the waters off of Cherry Point, and two are located there year round. Cormorants (family *Phalacrocoracidae*) are the large, social, fish eating birds, found in both fresh and salt water locations around the United States.

Adult Double-crested Cormorants (*Phalacrocorax auritus*) are black or dark brown and have an orange-yellow patch of skin at the base of their bills. In breeding plumage, adults have two whitish tufts behind their eyes, hence the description 'double-crested.' Double-crested Cormorants are found on both coastal and inland waters and consider the Cherry Point Resource Area part of their year round habitat. They often perch on rocks, sandbars, or pilings near fishing sites and forage at ponds, lakes, slow-moving rivers, estuaries, and open coastlines. Breeding colonies are often on small rocky or sandy islands, or on the exposed tops of offshore rocks. Double-crested Cormorants are considered opportunistic feeders, and may feed on a variety of available prey, principally on slow-moving or schooling species of fish, and they occasionally consume insects, crustaceans, and amphibians. Population numbers declined dramatically in the 1960s and 1970s due to contaminants acquired from fish. Since the ban of DDT, populations have been increasing. The population of double-crested in Washington along the outer coast increased slightly from 1978 to 1994, but has declined since 1995, most likely because of unfavorable ocean conditions (BirdWeb, 2008).

Brandt's Cormorants (*Phalacrocorax penicillatus*) are large cormorants with long, slender necks. Adults are almost solid black. Juveniles are buff-brown and black. Birds of all ages and phases have light-colored cheek patches. Brandt’s Cormorants can almost always be found on salt or brackish water, inhabiting rocky shorelines and open ocean. Nesting colonies are typically located on slopes rather than cliff ledges, although some Washington colonies are located on steep cliffs, however, Brandt’s considers Cherry Point non-breeding habitat. The Brandt’s Cormorant has a wide variety of fish species in its diet, as well as shrimp and crabs. Local populations in Washington fluctuate, but overall numbers are probably stable (BirdWeb, 2008).

The smallest cormorant in Washington, the Pelagic Cormorant (*Phalacrocorax pelagicus*) is slender, with an especially slender neck and beak. Both males and females are solid black, except during the breeding season when adults have white rump patches that show in flight. Exclusively marine, Pelagic Cormorants can be found in Washington year round in bays and sounds and on the coast (although usually fairly close to shore). They breed on small, offshore islands and rocky cliffs with deep water at the base. Small fish make up most of the diet, with crustaceans and other marine animals making up a small portion as well. Much of the foraging is close to rocks. In Washington, significant increases in the population were recorded between 1976 and 1992 (BirdWeb, 2008).

4.4.5.2.5 ***Order Podicipediformes*** - Grebes

Family: Podicipedidae
Western Grebe (*Aechmophorus occidentalis*)

Western Grebes are the largest grebe in North America, black and white, with a slender, swan-like neck and distinct red eyes. Western Grebes are found in large numbers through marine waters, preferring deeper waters with relatively low currents such as bays or inlets, in Puget Sound during winter and summer; flocks often return to the same general area each year (Nysewander, D.R. et al., 2005).

Grebes prefer to winter in sheltered, ice free waters with large supplies of forage fish. Although almost 100% of the bird's diet is fish, they also eat crustaceans, worms and insects. The birds migrate north beginning in late April and return to the site during September and October (Nysewander, D.R. et al., 2005). Breeding habitat consists of freshwater wetlands with a mix of open water and emergent vegetation, and stretches from Canada to Baja California (BirdWeb 2008).

Cherry Point is located in the northern portion of the Western Grebes non-breeding winter habitat, and adjacent to migratory routes (BirdWeb 2008). The PSAMP winter marine bird surveys documented Western Grebes in moderate to high densities (ranging from 25 to 1,954 animals per square kilometer) along the intertidal and nearshore area of central and southern Cherry Point, extending to approximately 5 kilometers offshore (Nysewander, D.R. et al. 2005). Comparison of nearly identical transects surveyed during the MESA time period (1978 – 79) and the PSAMP time period (1992 – 99) indicate this species could potentially be decreasing by as much as 95%, a conclusion further supported by the 2004 study funded through Washington Sea Grant study on marine bird population in western Washington (Bower, et al, 2005).

4.4.5.3 Terrestrial Bird Species representative of Cherry Point

4.4.5.3.1 ***Order Ciconiiformes*** – Wading birds

Family: Ardeidae
Great blue heron (*Ardea herodias*)
The Great Blue Heron has remained strong in numbers in Washington. They are included here because of a very large heron nesting area, called a "rookery", at Cherry Point. This population, and the status of the rookery, are monitored closely, and can be considered representative of the health of the Cherry Point ecosystem.

There are five recognized sub-species of Great Blue Heron. The Pacific subspecies (*Ardea herodia fannini*) is non-migratory and ranges from the coast of southeastern Alaska south to Puget Sound, Washington. The Great Blue Heron forage in a variety of habitats, including large eelgrass meadows, along rivers, and in estuarine and freshwater marshes.
A study of the heron rookery at Lake Terrell by British Petroleum found that foraging areas include marine shorelines, the intertidal zone, wetlands, streams, riparian areas, and upland fallow fields. Prey sought by herons include fish (marine and freshwater), crustaceans (marine and freshwater), amphibians (freshwater and upland), and small mammals (upland). The primary prey species of great blue herons identified by regional researchers include: marine - crescent gunnel (*Pholis laeta*), saddleback gunnel (*Pholis oranta*), marine sculpins (various species), shiner perch (*Cymatogaster* aggregate), and smelt (*Hypomesus* spp., *Thaleichtys* spp.); freshwater - sculpins, frogs (*Hyla* spp., *Rana* spp.), and crayfish; and upland - Townsend's vole

(*Microtus townsendii*). The most concentrated foraging during the nesting season occurs in the intertidal areas near the colony (British Petroleum, 2003).

The large heron rookery is located approximately one mile east of Birch Bay State Park on a riparian corridor along Terrell Creek (Eissinger 1994). This colony, first identified in 1983, is one of the largest in the Pacific Northwest, and over the last 10 years has supported an average of more than 300 breeding pairs. Additionally, this colony contains the unique Pacific Northwest subspecies, *Ardea herodias fannini*, and resides in the area year-round. Based on observations, the areas utilized most frequently by the herons of the Birch Bay colony are Birch Bay, Drayton Harbor, Semiahmoo Bay, Lummi Bay, and Lake Terrell, although with less concentration (Eissinger 1994). The Birch Bay colony abandoned at the start of the nesting season in 2008 and a new colony was discovered about four miles north near Drayton Harbor (Bohannon, J. WDFW, pers. comm. 2008).

4.4.5.3.2 ***Order Falconiiformes*** – Birds of prey

Family: Accipitridae
Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is a state sensitive species. Bald eagles use shorelines for feeding and nesting, often building large stick nests in dominant trees near water. Common nest tree species include Douglas Fir (*Pseudotsuga menziesii*), Grand Fir (*Abies grandis*), and Black Cottonwood (*Populus Balsamifera*) (Bohannon, J. WDFW, pers. comm. 2008). In Washington, bald eagle nests are most numerous near marine shorelines, but nests are also found on many of the lakes, reservoirs, and rivers. Fish are usually the most common prey taken by breeding bald eagles throughout North America, but bald eagles also capture a variety of birds (Stalmaster 1987). Birds, including gulls (especially glaucous-winged, *Larus glaucescens*), ducks (at least 15 species, especially scoters [*Melanitta* spp.], mallards [*Anas platyrhychos*], and mergansers [*Mergus* spp.]), western grebe (*Aechmophorus occidentalis*), common murre (*Uria aalge*), great blue heron (*Ardea herodias*), and pelagic cormorant (*Phalacrocorax pelagicus*) were among the most common prey remains in two studies of bald eagle diets in Washington (Knight et al. 1990, Watson and Pierce 1998). Fish and mollusks tend to comprise the balance of the bald eagle diet (Stinson et al. 2001).

Bald eagles are present in the Georgia Straits, and were documented during the 1992 – 99 PSAMP summer marine bird surveys as “Other species observed.” (Nysewander, D.R. et al. 2005). Bald eagles are sometimes seen disrupting cormorant and heron colonies in marine and nearshore areas.

The Washington Department of Fish and Wildlife has identified seven eagle nest locations comprising three distinct territories along Cherry Point. Whatcom County references the value of this habitat to bald eagles in their Shoreline Characterization and Inventory Plan (see section 3.3: *Terrestrial Wildlife Habitat* - Whatcom County, 2006; Bohannon, J. WDFW, pers. comm., 2008). In addition to resident breeding pairs observed nesting along Cherry Point, upland of Lummi Bay, and along Terrell Creek, sub-adult non-breeders occur year-round. Migratory and wintering eagles are found in seasonally higher numbers along the Cherry Point’s shoreline

where they scavenge along the intertidal areas, fish in open water or hunt ducks and gulls (Eissinger, 1994).

Family: Falconidae
Peregrine falcon (*Falco peregrines*)

The Peregrine Falcon is considered by many to be the most impressive bird of prey. It is larger than the American Kestrel and Merlin, similar in size to the Prairie Falcon, but smaller than the Gyrfalcon. The Peregrine Falcon is built for speed, with long pointed wings and a narrow tail. Adults have slate-gray upperparts and a gray 'helmet' that extends below their eyes. The Peregrine Falcon is the world's fastest bird. These aerial hunters are known for their steep power-dives, or stoops, sometimes reaching speeds up to 200 miles per hour. They dive from above to grab their prey out of the air with their strong talons. They also hunt closer to the ground, or from perches, overtaking their prey in flight (BirdWeb, 2008).

The Peregrine Falcon's diet is composed mostly of other birds, and the Peregrine is considered a territorial predator of pigons, doves, shorebirds, waterfowl, seabirds and other birds. (WDFW 2005; BirdWeb, 2008).

Peregrine Falcons are typically found hunting in open areas, especially along the coast and near other bodies of water that provide habitat for their prey. Whatcom County, and Cherry Point, is located directly along the migratory corridor between Alaska and Washington. Knowledge of the peregrines that use this corridor, often during fall, is somewhat limited (Hayes, G. E. and J. B. Buchanan 2002), but it is thought that the Peregrine Falcon considers Cherry Point foraging habitat.

The range of the Peregrine Falcon appears to be changing rapidly as new breeding locations are found every year. In western Washington, Peregrine Falcons nest along the coast, in the San Juan Islands, in Puget Sound, and even in downtown Seattle and Tacoma. They are also nesting on the western slope of the Cascades as far inland as Ross Lake. In winter, Peregrines occur in open habitat such as low-lying agricultural land and estuaries that support high densities of prey such as shorebirds and waterfowl (WDFW 2005; Hayes, G. E. and J. B. Buchanan 2002; Bohannon, J. WDFW, pers. comm. 2008).

Family: Accipitridae
Osprey (*Pandion haliaetus*)
The Osprey is a species currently on the State Monitor list. It is a unique bird, the only species in its family, and it is found worldwide (WDFW 2005). The head is distinctive with a white crest, a face bisected by a dark eye-stripe, and yellow eyes (BirdWeb, 2008).

Ospreys are migratory, the majority wintering south of the US border. When they return, generally in March or April, the osprey will search out breeding habitat consisting of rivers, estuaries, salt marshes, lakes, reservoirs, and other large bodies of water, often surrounded by forested habitat. They can be found near fresh or salt water, as long as the water can sustain medium-sized fish. The vast majority of the Osprey's diet is fish, typically 5-16 inches in size. Only occasionally, when fish aren't available, will the Osprey eat small mammals, birds, or

reptiles. However, the Osprey is highly specialized for eating fish and does not stray from this diet unless necessary (BirdWeb, 2008). Waterbodies (e.g., Nooksack River) surrounding Cherry Point support breeding habitat for the Osprey and necessary food resources, such as salmon.

Ospreys are known for building large nests made of sticks on living or dead trees, or artificial structures, such as windmills, chimneys, utility or nesting poles. The nests are located near a fish-bearing waterbody for foraging. Often Ospreys reuse nests year after year and continue to add sticks each year (NatureServe, 2008; BirdWeb, 2008).

4.4.5.3.3 ***Order Piciformes*** - Woodpeckers

Family: Picidae
Pileated Woodpecker (*Dryocopus pileatus*)

Pileated Woodpeckers are the largest woodpeckers in North America, and are crow-sized and black, with bright red pointed crests, the red more extensive on the crests of males. A broad white stripe on each side of their faces below their eyes continues down along each side of their necks. Males have red moustachial stripes, females black (Lewis and Azzerad, 2003; BirdWeb, 2008).

Pilated Woodpeckers are very dependent upon forest types (broadleaved, coniferous, or mixed) that contain trees large enough for roosting and nesting. Pileated Woodpeckers are often associated with mature and old-growth forests but can breed in younger forests if they contain some large trees (WDFW, 2005; BirdWeb, 2008).

Pileated Woodpeckers eat wood-boring insects and insects that nest in trees, including long-horned beetles and especially carpenter ants. They eat some fruits and nuts as well. Pileated Woodpeckers play an important role within their ecosystems by excavating nesting and roosting cavities that are subsequently used by many other birds and by many small mammals, reptiles, amphibians, and invertebrates. These birds provide nesting sites for the many cavity nesting ducks that come to Cherry Point.

4.4.6 Marine Mammals

Marine mammals that use the Cherry Point Resource Area, or could use the habitat based upon their presence in the southeast Strait of Georgia (Calambokidis and Baird 1994, WDFW 2007) include harbor seals (*Phoca vitulina*), Pacific harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), Steller sea lions (*Eumetopias jubatus*), California sea lions (*Zalophus californianus*), Gray whales (*Eschrichtius robustus*), Pacific Minke Whale *(Balaenoptera acutorostrata)* and the orca (*Orca orcinus*) (Calambokidis and Baird 1994*)*.

For purposes of analysis, only those that are either state and/or federally listed will be considered, and this section is arranged in that order. Other priority animals that may occur in the immediate vicinity are also described for reference.

4.4.6.1 Sea Lion, Steller (*Eumetopias jubatus*)

The Steller (or Northern) sea lion is the largest of the eared or otariid seals found in Washington waters and uses haulout sites primarily along the outer coast from the Columbia River to Cape Flattery, as well as along the Vancouver Island side of the Strait of Juan de Fuca. Although breeding rookeries are located along the Oregon and British Columbia coasts, no breeding rookeries are found in Washington (Jefferies et al. 2003).

Haul out sites are found on jetties, offshore rocks and coastal islands. This species may also be found occasionally on navigation buoys in Puget Sound as well. Both sexes are found in Washington waters, with males considerably larger (to 2,200 lbs) than females (to 700 lbs). Coloration varies from tawny through yellowish brown to dark brown. Vocalizations from adults can be described as a deep growling sound (Yates, 1988; Everitt, 1980).

Studies disagree as to the priority of salmon in the diets of pinnipeds; a 1997 NOAA working group described how the level of salmon in pinniped diets varied, by location and season, with areas of conflict occurring around hydropower dams. A more recent investigation indicated that, at least for the diet of the Northern sea lion, Pacific Whiting was the primary component (Gearin, 1999).

Over its range, Steller sea lion population numbers have declined significantly over the last 15 years. In Washington, Steller sea lion numbers vary seasonally with peak counts during the fall and winter months. In 1980 a report was compiled on marine mammal population for the Marine Ecosystems Analysis project (MESA). This study found 10 known haulout sites in Washington and adjacent waters for Steller seals at that time, including Sucia Island, Sombrio Point, and Race Rocks. However, the study also noted a decline in number at favored haulout sites over the study period, noting that no more than 20 animals were observed at a haulout site between 1978 and 1979. The total count for the study period, including coastal and inland animals, reached a maximum of around 500 (Everitt, 1980). Again, one potential reason for this low number is that no rookeries currently exist in Washington; eastern population Stellar sea lions give birth in Oregon, California, and British Columbia.

The USFWS divides the population into two sub-species (see Figure 10), with the dividing line located at Cape Suckling, Alaska (144°W). Washington Stellar sea lions are east of this line.

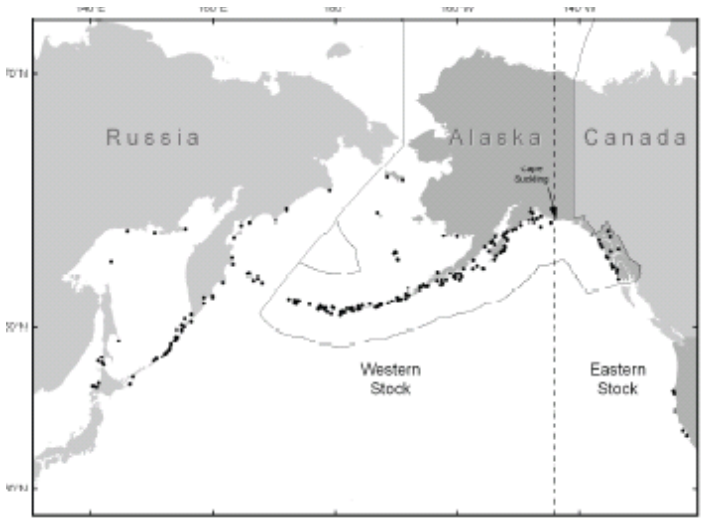

Figure 10 Western and Eastern Populations of Northern (Stellar) Sea Lion

The USFWS has listed the eastern population as threatened and the western population as endangered. Washington State has also listed the species as state threatened (USFWS, 2007). Everitt (1980) reported that sea lions in Washington are most abundant in winter, and thus most susceptible environmental perturbations at this time at favored haul out locations, such as in the eastern Strait of Juan de Fuca.

4.4.6.2 Orca (*Orcinus orca*)

The orca the largest dolphin (25 to 30 feet) in the world, and is well recognized throughout the Pacific Northwest. Males of this dramatically patterned black and white marine mammal can grow up to 10 tons and have a tall, triangular shaped dorsal fin. Females are around 8 tons, and are identified by a sickle-shaped fin (Flaugherty, 1990).

In general, there are three groups of orcas – *transients, residents* and *offshore* orcas. It is possible for any of these groups to use habitat along the Strait of Georgia, near Cherry Point. However, the resident orca group is the most likely, as this group uses inland waters most frequently. The division of these groups is based upon mitochondrial DNA (mDNA) samples combined with visual identification of over 73 samples collected from orcas ranging from California to Alaska. Significant genetic differences have been demonstrated between 'transient' orcas from California through Alaska, 'resident' orcas from the inland waters of Washington, and 'resident' orcas ranging from British Columbia to the Aleutian Islands and Bering Sea (Carretta, J.V. 2007). Another significant difference between resident and transient orcas is their choice of food; the term "*Killer Whale*" was earned by the transients, who are well known for incorporating other marine mammals into their diet. Transients have been seen chasing gray whales, and over 22 different species of marine mammals have been identified from the stomach of transient orcas. However, Northern residents orcas appear to prefer Chinook (*Oncorhynchus tshawytscha*), and follow the runs of these salmon in their area. Resident orcas are divided into two communities, a northern and southern, and rarely come in contact with each other (NMFS, 2005; Flaugherty, 1990).

NMFS recognizes five orca stocks that can occur within the waters of the Exclusive Economic Zone (EEZ) of the Pacific Ocean, United States:

- Eastern North Pacific, Resident Stock – British Columbia through Alaska;
- Eastern North Pacific, Southern Resident Stock – inland waters of Washington and southern British Columbia;
- Eastern North Pacific, Transient Stock – Alaska through California;
- Eastern North Pacific Offshore stock – neither transient or resident, from Southeast Alaska through California; and
- Hawaiian stock.

The orcas most likely to occur near the Cherry Point Management Area are those from the *Eastern North Pacific, Southern Resident Stock* (often called the Southern Resident orcas), which habituate the inland waters of Washington and southern British Columbia (Figure 11) (Carretta, J.V. 2007).

Figure 11 Range of the Southern Resident Orca (shaded area)

Three pods make up this stock – J1, which is commonly found inshore during the winter months, and the K1 and L1 pods, often located farther offshore, even as far as Monterey Bay, California. NMFS (2005) describes the home range for all three pods in the conservation plan for the Southern Resident orca. Most information is gathered from late spring to early fall, when weather is best. During this period, all three pods are regularly present in the Georgia Basin, which is defined as the Georgia Strait, San Juan Islands, and Strait of Juan de Fuca (NMFS, 2005).

During the warmer months, all three pods concentrate around major salmon migration corridors, including Haro Strait, Boundary Passage, the southern Gulf Islands, the eastern end of the Strait

of Juan de Fuca, and several localities in the southern Georgia Strait The pods expand into Puget Sound in early fall, following chum and chinook salmon runs (see Figure 12)**.**

Figure 12 Primary area of occurrence for Southern Resident orcas when present in Georgia Basin and Puget Sound (NMFS, 2005)

There is a limited amount of data on the Southern Resident orca's feeding preferences, although it appears they prefer Chinook salmon as much as their Northern cousins. This assumption was supported by toxicology studies, which found that the ratio of DDT and other contaminants in the blubber of the orca most closely matched that of salmon, compared to other fish species (see Kraughn, et al 2002).

A substantial amount of data exists on this stock's structure, behavior and movements, as a result of photo-identification of individual whales through the years. The first complete census of this stock occurred in 1974. Between 1974 and 1993, the stock increased by 35%, to 96 individuals. However, a substantial decline to 79 individuals by 2001 led to concern. By 2005, the stock had risen slightly again, to 91 individuals (Carretta, J.V. 2007). The stock was listed as endangered in 2005 by the NMFS.

Prey availability, environmental contaminants, impacts from vessels and sound (including aircraft), oil spills, and disease are discussed in length by NMFS as potential stressors to the Southern Resident orca (2005) and should be addressed by DNR in any management plan.

NMFS has listed the orca as federally endangered. Washington State has also listed the species as state endangered (NMFS, 2005).

4.4.6.3 Gray Whale (*Eschrichtius robustus*)

The gray whale (*Eschrichtius robustus*) is the sole member of the family *Eschrichtiidae*. A medium size whale of 45 feet, the gray whale can be recognized by a narrow, rectangular head that is often covered with barnacles and lack of a dorsal fin (Yates, 1988).

The species is represented by two extant stocks, eastern Pacific and western Pacific. The western North Pacific ("Korean") population is nearly extinct, and two Atlantic stocks have gone extinct (Angliss and Outlaw, 2005).

The eastern North Pacific, or California, population is found in Washington. Northbound gray whales pass through Washington waters traveling between Alaska feeding areas and Mexican breeding grounds from March through May. The southward migration is concentrated in December and January (Richardson, 1997). The gray whale can stray into inland waters during migration; breeders feed in the Strait of Juan de Fuca in the summer, non-breeders have been recorded during many seasons (Yates, 1988). Other nearshore waters locations include Willapa Bay, Grays Harbor and Puget Sound. These whales may stay over during summer and move among Washington and British Columbia (Richardson, 1997). Washington waters provides an important source of food for this species. It was discovered that the density of gray whale prey in the bottom sediments of areas of northern Puget Sound are higher than in their feeding areas in Alaska (Calambokidis and Baird 1994).

Although gray whales have become regular summer residents in the enclosed marine waters of Washington since the species recovery, early records do not document historical numbers of gray whales for these inland and coastal waters. These resident feeding whales have yet to be adequately studied (Calambokidis and Baird 1994).

Often restricted to shallow coastal waters during these times, where feeding activities involve squirting water into mud to stir up sediment and benthic invertebrates, which are then strained. Because of the way gray whales feed, this species has the potential to ingest toxic contaminants in nearshore areas of Puget Sound and Georgia Straits (Richardson, 1997; Yates 1988). Potential impacts to the food source – benthic invertebrates - should source should be taken into consideration. Impacts to gray whale habitat include sounds generated for oceanographic research, disturbances related to oil and gas exploration, contaminants in the benthos, and onshore and nearshore development (Richardson, 1997).

Despite the reduction in stock abundance, the population of gray whales in the eastern Pacific is estimated to have increased compared to commercial exploitation in the mid-1800's. Numbers are around 23,000 and the U.S. Fish and Wildlife Service removed the species from the list of threatened and endangered species in 1994. The Washington State Department of Fish and Wildlife also down listed from "state threatened" to "state sensitive." (Angliss and Outlaw, 2005; Richardson, 1997).

4.4.6.4 Pacific Minke Whale (*Balaenoptera acutorostrata*)

Minke whales are solitary, small whales, with a crescent shaped dorsal fin. These are the smallest of the baleen whales in North America, and strain water for prey, including Herring balls. Minkes have been seen in the Strait of Juan de Fuca or near San Jan or Canadian Gulf Islands (Yates, 1988).

Three stocks of Minkes are recognized by the International Whaling Commission (IWC). Of these three, only one occurs in American waters – the "Remainder" stock, located east of 180'N in the Pacific. Recently, the U.S. National Marine Fisheries Service subdivided the eastern part of the Remainder Stock into an three stocks – an Alaskan, Hawaiian, and a California-Oregon-Washington (CA-OR-WA) Stock (Carretta, J.V. 2007**).** See Figure 13.

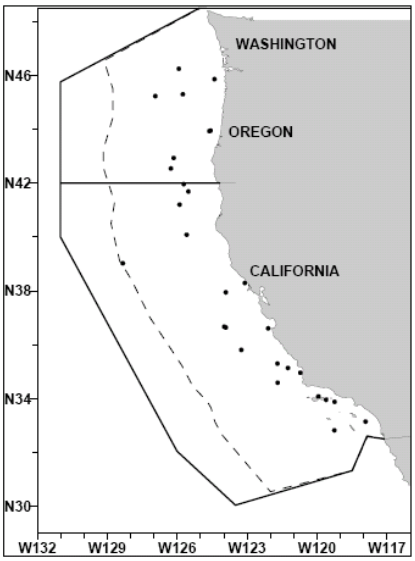

Figure 13 Minke whale sightings from 1991 - 2001; dashed line is EEZ (Carretta, J.V. 2007)

Minke whales in the inland waters of Washington and central California are distinct from their cousins in the extreme North in that they appear to establish home ranges. Minke whales are found year round in California, and in the Gulf of California. These somewhat isolated populations appear to be behaviorally district from migratory cousins further North, supporting the distinction between the Alaskan stock and those Minke whales located in the coastal waters of California, Oregon, and Washington (including Puget Sound) (Carretta, J.V. 2007; Northeast Pacific Minke Whale Project, ongoing research).

Little is known about the CA-OR-WA stock of the Pacific Minke Whale. There has not been an active effort to collect population data on this species, so no trend data is available and an accurate estimate of the population size is not possible. No growth data can be produced. From ship sightings alone, there appears to be around 585 or so individuals (Carretta, J.V. 2007).

Minke whales are not listed as "endangered" under the Endangered Species Act and are not considered "depleted" under the MMPA. However, documented instances of commercial gillnet entanglement and ship strikes combined with the lack of data on population numbers led to the

recommendation by Carretta (2007) that this status be listed as "unknown." The Washington State Department of Fish and Wildlife classifies this species as "State Monitor."

4.4.6.5 Pacific Harbor Porpoise (*Phocoena phocoena*)

Harbor porpoise are small, dark gray to brown porpoise with white bellies. Once common in South Puget Sound, now considered rare. Harbor porpoise have been located at various times during the year in the vicinity of the inland trans-boundary waters of Washington and British Columbia, Canada (Osborne et al. 1988), and along the Oregon/Washington coast (Barlow 1988, Barlow et al. 1988, Green et al. 1992). Harbor porpoise feed on squid, octopus, herring, and small schooling fish (Yates, 1988).

NMFS recognizes two stocks off of the coast of Washington (see Figure 14): the Oregon/Washington Coast stock (between Cape Blanco, OR, and Cape Flattery, WA) and the Washington Inland Waters stock (in waters east of Cape Flattery). The recognition of two stocks is a risk averse management strategy, based primarily on restrictions noted in the intermixing rates within the eastern North Pacific harbor porpoises and the significant decline in harbor porpoise sightings within southern Puget Sound since the 1940s (Carretta, J.V. 2007).

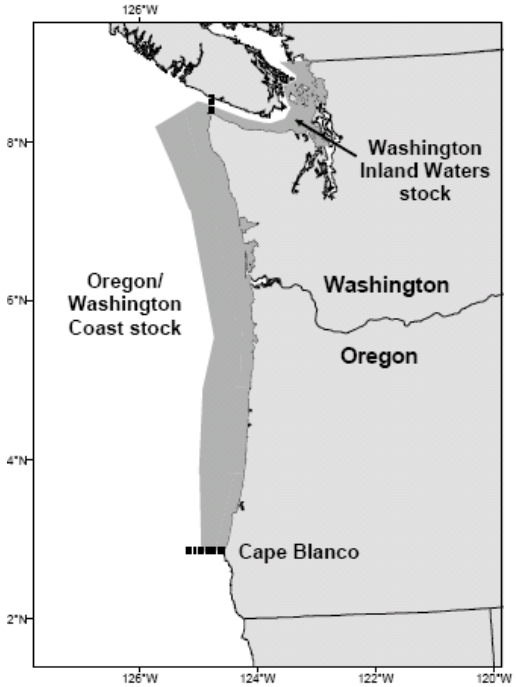

Figure 14 - Stock boundaries and approximate distribution of harbor porpoise along Oregon and Washington (Carretta, J.V. 2007)

NMFS states that no reliable data on the long-term population trends of harbor porpoise for most waters of Oregon, Washington, or British Columbia, exists. NMFS provides an uncorrected estimate of abundance in Washington inland waters for the 2002/2003 year, stating that it had significantly increased compared to the previous stock assessment (3,123 vs. 1,025; Z=6.16, P<0.0001) (Calambokidis et al. 1997 in Carretta, J.V. 2007).

In South Puget Sound, harbor porpoise are rarely observed, in contrast to 1942 when they were common in those waters (Scheffer and Slipp 1948). The NMFS stock assessment reports that based upon marine mammal survey efforts, stranding records, and harbor porpoise surveys, indications exist to support the conclusion that harbor porpoise abundance has declined in southern Puget Sound. In 1994, there were zero sightings. Reasons for the apparent decline are unknown. This area is however, outside of the footprint of the Cherry Point Resource Area.

This species is considered a State Candidate by the Washington State Department of Fish and Wildlife. Harbor porpoise are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. The latest stock assessment states that the status of both coastal and inland stocks relative to its Optimum Sustainable Population (OSP) level and population trends is unknown (Carretta, J.V. 2007).

4.4.6.6 Dall's porpoise (*Phocoenoides dalli*)

The Dall's porpoise is black with a white belly and a white patch on its dorsal fin. This small porpoise is known for its great speed and is often seen riding the bow waves of ferries or powerboats. The Dall's porpoise can also bend backwards 90 degrees before submerging, earning it the nickname "Broken-Back". This porpoise remains year round in the Strait of Juan de Fuca, San Juan and Canadian Gulf Islands, and Admiralty Inlet and feeds on squid and small schooling fishes. The Dall's porpoise is known to possess very high powered sonar, but this ability has not prevented it from becoming frequently entangled with in gill nets (Yates, 1988).

The Dall's porpoise appears to migrate up and down the west coast in response to changing conditions in the ocean, on seasonal and annual scales. NMFS has divided the Dall's porpoise into two stocks: (1) California, Oregon and Washington and (2) Alaska. It was noted that individuals may also spend long periods of time outside the EEZ (Carretta, J.V. 2007). Shipboard surveys were conducted along the coast between 1997 and 2001, resulting in a population estimate of 98,617 for the California, Oregon and Washington waters. In 1996, aerial surveys were conducted for inland waters of Washington, and Dall's porpoise were estimated to be at 900 individuals, for a total estimated population of 99,517 individuals (Carretta, J.V. 2007).

NMFS states no information in available about population trends, current or maximum net productivity, and there are insufficient data to evaluate potential trends in abundance. They are not listed as "threatened" or "endangered" under the Endangered Species Act nor as "depleted" under the MMPA (Carretta, J.V. 2007). The Washington State Department of Fish and Wildlife classifies this species as "State Monitor."

4.4.6.7 Sea Lion, California (*Zalophus californianus californicanus*)

The California sea lion is also an otariid, or eared seal. The USFWS divides the California sea lion into three stocks, only one of which is found in the United States. The United States stock has a range that extends along the west coast of North America, from Baja California to Vancouver Island (Carretta, J.V. 2007). In Washington and adjacent waters, California sea lions have been reported at 11 haul out sites, including but not limited to Race Rocks, British Columbia and a beached barge at Port Gardner, Washington (Everitt, 1980).

Like Steller sea lions, California sea lions are most abundant in winter, and thus most susceptible environmental perturbations at this time at favored haul out locations. Interestingly, the high number of sea lions sighted on the barge at Port Gardner was during spring, not winter. The reason is unknown, and some suggest this was the beginning of a change in sea lion distribution – with animals moving inland in response to a local abundance to prey (Everitt, 1980). Since the initial sighting at Port Gardner in 1979, increasing numbers of California sea lions have been seen on Seattle beaches. This sea lion is also well known for preying on incoming wild salmon in the Lake Washington Ship Canal (Yates, 1988).

A NOAA study in southern California investigated the diet of California sea lions, and found that the most common prey items included forage fish, and were (in order of abundance): Northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), Pacific whiting (*Merluccius productus*), Pacific mackerel (*Scomber japonicus*), jack mackerel (*Trachurus symmetricus*), shortbelly rockfish (*Sebastes jordani*), and market squid (*Loligo opalescens*). The study suggests that population numbers are highly responsive to prey availability, particularly when these resources decline in El Nino years, and suggests that the increase in seal population numbers will eventually reach carrying capacity during an El Nino year (Lowry, M. unpublished).

The California sea lion is not listed as threatened or endangered under the ESA, and it is not listed as depleted or a strategic stock under the MMPA. The population of the United States stock appears to be growing around 5 – 6% per year, but is heavily influenced by El Niño events, which affects adult female survivorship (Carretta, J.V. 2007).

4.4.6.8 Harbor Seal (*Phoca vitulina richarsi*)

The harbor seal is a true seal, lacking external ears with a grayish pelt and a doglike face. Males and females are similar in size (to 250 lbs) and coloration. Pelage patterns are typically a light colored base pelage with dark spots, although some individuals have a pelage which is reversed in coloration (dark colored base with light spots).

This small, stocky seal is found throughout the temperate and arctic waters of the northern hemisphere, and has the widest distribution of any pinniped. It is considered a non-migratory species, breeding and feeding in the same area throughout the year. Harbor seals can stay submerged for 20 minutes, diving to depths measured at 300 feet to search for flounders, herring, walleye, cod, sculpin, perch and rockfish, among other species (Yates, 1988)

The habitat of the harbor seal encompasses coastal and estuarine waters off Baja California, north along the western coasts of the continental U.S., British Columbia, and Southeast Alaska, west through the Gulf of Alaska and Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands. The harbor seal is the most common, widely distributed pinniped found in Washington waters, and is frequently sighted using one of its hundreds of resting or haul out sites located along Washington’s coast or inland waters. The harbor seal uses intertidal sand bars and mudflats in estuaries, intertidal rocks and reefs, sandy, cobble, and rocky beaches, islands, logbooms, docks, and floats in all marine areas of the state. Group sizes typically range from small numbers of animals on some intertidal rocks to several thousand animals found seasonally in coastal estuaries (Yates, 1988; Jefferies et al. 2003).

Population counts are completed during the pupping season (mid-June through mid-August for Georgia Strait. and annual molt (August through October for Georgia Strait). Females produce one pup per year, beginning at age four or five. Pups are precocious at birth, capable of swimming and following their mothers into the water immediately after birth. Pups typically remain with their mothers until weaning at 4-6 weeks of age. Pups call for their mothers until weaned with a sheep-like *ìm-a-a-aî*; adults utter a variety of sounds including grunts, growls and barks (Jefferies et al. 2003).

As managed by NMFS, harbor seals along the western continental United States have been divided into three coastal and inland stocks based upon differences in cranial morphology, pupping phrenology, and genetics (Jefferies, 2003; Carretta, J.V. 2007): (1) Washington inland waters (including Hood Canal, Puget Sound and the Strait of Juan de Fuca out to Cape Flattery), (2) Outer coast of Oregon and Washington, and (3) California (Carretta, J.V. 2007).

Jeffries et al. (2003) report that 8949 harbor seals were detected during inland stock haul-out counts in 1999. Correct population estimates are difficult because the seal pups are precocious. The 2006 stock assessment for this marine mammal reports that the Oregon/Washington population of harbor seals is declining (Carretta, J.V. 2007). Harbor seals are not considered to be “depleted” under the MMPA or listed as “threatened” or “endangered” under the Endangered Species Act. The Washington State Department of Fish and Wildlife classifies this species as “State Monitor.”

Harbor seals use the rocky beaches south of Point Whitehorn for hauling out and pupping for approximately 8500 feet along the shoreline.

4.4.7 Non-native species

As a major shipping port, the Cherry Point industries receive most of their vessel traffic from ports in Alaska, and California with additional vessel visits from other Pacific Northwest ports and some Asia or Australian ports. Ballast and fouling organisms arriving with visiting vessels represent a potential invasion vector for numerous species. The United States Environmental Protection Agency has identified ballast water as one of the most “universal and ubiquitous vectors” for the transport and discharge of non-native species in marine and coastal areas (EPA 2008).

The composition of non-native organisms that have established at Cherry Point has not been adequately characterized. The only invasive organism known to have a widespread distribution along Cherry Point is the Japanese kelp *Sargassum muticum* that was first detected in Puget Sound in 1948. However, the following table documents aquatic exotic (non-native) organisms established and introduced throughout Puget Sound. Not all species were introduced in ballast water.

Table 5. Exotic Organisms Established in Puget Sound

Exotic Organisms Established in Puget Sound	
Organism	Records
Phaeophyceae	
Sargassum muticum (Yendo, 1907, Fensholt, 1955)	Native to Japan and introduced with oyster aquaculture. First recorded on Pacific Coast in 1944 and in Puget Sound in 1948; present throughout Puget Sound by the early 1960s (Scagel 1956; Thom & Hallum 1991).
Anthophyta	
Cotula coronopifolia (Linnaeus, 1753)	Native to South Africa and probably introduced in solid ballast. First recorded on the Pacific Coast at San Francisco in 1878 and now spread from southern California to British Columbia, including Puget Sound. Often occurs as an ephemeral colonizer in newly restored salt marshes (Frenkel 1991).
Spartina alterniflora (Loiseleur-Deslongchamps)	Native to the northwestern Atlantic and first reported on the Pacific Coast in Puget Sound, where it was planted in the 1930s for duck habitat. It probably arrived earlier in Willapa Bay, where it may have been introduced in solid ballast, as seeds accidentally transported with oysters imported for culturing, or possibly as packing material for ship-transported goods.
Spartina anglica C.E. (Hubbard, 1968)	A new species derived from accidental hybridization in southern England and northern France in the 1800s, Introduced to Puget Sound in Susan Bay for shoreline stabilization and cattle forage in 1961 (Frenkel 1987).
Spartina patens (Aiton)	Native to the northwestern Atlantic. Probably introduced as packing material for ship-transported goods, or possibly in solid ballast or as seeds accidentally transported with oysters imported for culturing.
Zostera japonica (Ascherson and Graebner, 1907)	Native to the western Pacific and introduced with oyster aquaculture. First recorded on the Pacific Coast in 1957 and in Puget Sound in 1974 (Harrison & Bigley 1982).
Foraminifera	
Trochammina hadai (Uchio 1962)	Native to Japan, and probably introduced either in ballast water, in hull fouling or with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1971 (McGann *et al.* 2000).
Cnidaria: Hydrozoa	
Cladonema radiatum (Dujardin, 1843)	Native to the Northwestern Atlantic. First collected on the Pacific Coast in Puget Sound in 1988 (Mills 1998).
Cordylophora caspia (Pallas, 1771)	Native to the Black and Caspian Seas. Either an early introduction with ballast water or possibly introduced in hull fouling. First recorded on the Pacific Coast in Puget Sound around 1920. Reported in some literature as *Cordylophora lacustris*.
Cnidaria: Anthozoa	
Diadumene lineata (Verrill, 1869)	Native to Asia. First recorded on the Pacific Coast in San Francisco Bay in 1906, and in Puget Sound in 1939. Either introduced in hull fouling from Asia, or with shipments of oysters from the Atlantic, where it had been introduced (probably in hull fouling) in the late 1880s. Reported in some earlier literature as *Haliplanella luciae*.
Platyhelminthes	
Pseudostylochus ostreophagus (Hyman, 1955)	An oyster pest native to Japan and introduced in oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1953.
Annelida: Polychaeta	
Hobsonia florida (Hartman, 1951)	Native to the northwestern Atlantic, and first recorded on the Pacific Coast in Puget Sound in 1940.
Neanthes succinea (Frey and Leuckart, 1847)	Native to the Atlantic and introduced by oyster aquaculture to San Francisco Bay by 1896. First recorded in Puget Sound around 1995.

Pseudopolydora kempi (Southern, 1921)	Native to Japan and probably introduced with oyster aquaculture, or possibly in hull fouling or ballast water. First recorded on the Pacific Coast at Nanaimo on the east coast of Vancouver Island in 1951, and in Puget Sound on San Juan Island in 1968. Has generally been listed as exotic on the Pacific Coast (Carlton 1979; Cohen & Carlton 1995; T N & Associates 2002); but was reported as cryptogenic in the Columbia River (Draheim et al. 2003).
Pseudopolydora paucibranchiata (Okuda, 1937)	Native to Japan and introduced with oysters, in hull fouling or in ballast water. First recorded on the Pacific Coast in southern California in 1950, and in Puget Sound in 1993.
Mollusca: Gastropoda	
Batillaria attramentaria (Sowerby, 1855)	A Japanese oyster pest introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1924, or possibly 19i8-19. Reported in some Pacific Coast literature as *B. zonalis* or *B. cumingi.*
*Crepidula fornicata (*Linnaeus, 1758)	An oyster pest native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1905.
Crepidula plana (Say,1822)	Native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in San Francisco Bay in 1901, and in Puget Sound in 1949.
Myosotella myosotis (Draparnaud, 1801)	Occurs on both coasts of the North Atlantic, but may be native only to Europe. First reported on the Pacific Coast in San Francisco Bay in 1871, where it was probably introduced with oyster aquaculture, although possibly carried in solid ballast or hull fouling. The first record in Puget Sound is from 1936, or possibly a 1927 specimen labelled "Juan de Fuca." It has since been reported from many locations in the Sound.
Nassarius fraterculus (Dunker, 1860)	Native to Japan and introduced with oyster aquaculture. First collected on the Pacific Coast in Puget Sound, in Padilla Bay in 1960 and Samish Bay in 1963 (Carlton 1979: 412).
Ocinebrellus inornatus (Recluz, 1851)	An oyster pest native to Japan and introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1924. Reported in some literature as *Ocenebra japonica* or *Ceratostoma inornatum*.
Urosalpinx cinerea (Say, 1822)	An oyster pest native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in San Francisco Bay in 1890-91 and in Puget Sound in 1929.
Mollusca: Bivalvia	
Crassostrea gigas (Thunberg, 1793)	Native to Japan and introduced for aquaculture. First planted on the Pacific Coast in Puget Sound in 1875. It is cultured extensively in South Puget Sound and reproduces successfully in Dabob Bay (Emmett *et al.* 1991).
Musculista senhousia (Benson, 1842)	Native to Asia and introduced with oyster aquaculture. First recorded on the Pacific Coast in Samish Bay on planted Japanese oysters, and found in the wild in central California in 1941 and in Puget Sound at Olympia in 1959. Reported in some literature as *Musculus senhousia*.
Mya arenaria (Linnaeus, 1758)	Native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in 1874, and in Puget Sound in 1888-89, where it is widely established (Emmett *et al.* 1991).
Nuttallia obscurata (Reeve, 1857)	Native to the northwestern Pacific and probably introduced in ballast water. First recorded on the Pacific Coast in 1991 and in Puget Sound in 1993 (Forsyth 1993).
Venerupis philippinarum (Adams & Reeve, 1850)	Native to the northwestern Pacific, accidentally introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1924, where it is both widely cultivated and established in the wild (Emmett *et al.* 1991). Reported in some earlier literature as *Ruditapes philippinarum*, *Tapes japonica* or *Venerupis japonica.*
Arthropoda: Crustacea: Copepoda	
Mytilicola orientalis (Mori, 1935)	Native to Asia and introduced in oyster aquaculture. First recorded on the Pacific Coast in Willapa Bay in 1938, and in Puget Sound in 1943.
Arthropoda: Crustacea: Cumacea	
Nippoleucon hinumensis	Native to Japan and introduced in ballast water. First recorded on the Pacific Coast in

(Gamo, 1967)	1979, and in Puget Sound in the mid-1990s. Reported in some earlier literature as *Hemileucon hinumensis*.
Arthropoda: Crustacea: Tanaidacea	
Sinelobus stanfordi (Richardson, 1905)	Origin unknown. Possibly introduced in ship fouling or ballast water. First recorded on the Pacific Coast in 1943, and in Puget Sound since the mid-1990s.
Arthropoda: Crustacea: Isopoda	
Caecidotea racovitzai (Williams, 1970)	Native to the northwestern Atlantic and possibly introduced in ballast water or with aquarium or ornamentasl pond plants. Primarily occurs in fresh water, but has been collected in brackish water including the Snohomish River Estuary in 1997 (Toft *et al.* 2002).
Limnoria tripunctata (Menzies, 1951)	Origin unknown. Introduced in hull fouling. First recorded on the Pacific Coast in California in the 1870s and in Puget Sound in 1962.
Arthropoda: Crustacea: Amphipoda	
Ampithoe valida (Smith, 1873)	Native to the northwestern Atlantic, and introduced by ballast water, oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1941, and in Puget Sound in 1966.
Caprella mutica (Schurin, 1935)	Native to the Sea of Japan and introduced by ballast water or oyster aquaculture. First recorded on the Pacific Coast in 1973-77, and in Puget Sound in 1998. Reported in some literature as *Caprella acanthogaster*.
Eochelidium sp.	Probably native to Japan or Korea, and introduced in ballast water. First recorded on the Pacific Coast around 1993, and in Puget Sound in 1997.
Grandidierella japonica (Stephensen, 1938)	Native to Japan, and introduced by ballast water, oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1966, and in Puget Sound in 1977.
Jassa marmorata (Holmes, 1903)	Native to the northwestern Atlantic and introduced in ballast water or hull fouling. First recorded on the Pacific Coast in 1938, and in Puget Sound around 1995.
Melita nitida (Smith, 1873)	Native to the northwestern Atlantic, and introduced by ballast water, oyster aquaculture, solid ballast or hull fouling. First recorded on the Pacific Coast in 1938.
Monocorophium acherusicum (Costa, 1857)	Native to the northern Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1905, and in Puget Sound in 1974-75. Reported in the literature as *Corophium acherusicum* until recently.
Monocorophium insidiosum (Crawford, 1937)	Native to the northern Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1915 and in Puget Sound in 1949. Reported in the literature as *Corophium insidiosum* until recently.
Parapleustes derzhavini (Gurjanova, 1938)	Native to the western Pacific and introduced in hull fouling. First recorded on the Pacific Coast in 1904, and in Puget Sound in 1998.
Kamptozoa	
Barentsia benedeni (Foettinger, 1887)	Native to Europe, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1929, and in Puget Sound in 1998.
Bryozoa	
Bowerbankia gracilis (Leidy, 1855)	Probably native to the western Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast by 1923, and in Puget Sound by 1953.
Bugula sp. A	First recorded on the Pacific Coast in Puget Sound in 1993.
Bugula sp. B	First recorded on the Pacific Coast in Puget Sound in 1998.
Bugula stolonifera (Ryland, 1960)	Native to the northwestern Atlantic and introduced in hull fouling. First recorded on the Pacific Coast by 1978, and in Puget Sound in 1998.
Cryptosula pallasiana (Moll, 1803)	Native to the northern Atlantic, and introduced with oyster aquaculture or in hull fouling. First recorded on the Pacific Coast in 1943-44 and, in Puget Sound in 1998.
Schizoporella unicornis (Johnston, 1847)	Native to the northwestern Pacific, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in Puget Sound in 1927.
Urochordata: Tunicata	
Botrylloides violaceus (Oka, 1927)	Native to Japan, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1973, and in Puget Sound in 1977.
Botryllus schlosseri (Pallas,	Native to the northeastern Atlantic, and introduced by oyster aquaculture or hull

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

5 Risk Assessment and Potential Impacts

5.1 Background

Resource managers at Cherry Point have developed this section to detail how resources listed in Section 4 are at risk, and/or have been, or may be potentially impacted. This section is based upon a decade's worth of research, study, literature searches, personal communication with technical specialists, inter-and intra-agency discussion, and Workgroup discussion. In all cases, an attempt was made to locate the most updated, best available science. Where necessary, recommendations for further research are made in this resource protection and management plan.

5.2 Need for Conservation of Ecosystems at Cherry Point

Habitats, and associated plant and wildlife species, will be identified for the purposes of conservation management areas. An emphasis will be placed upon forage fish habitat, eelgrass beds, freshwater wetlands, birds (migratory and resident), Dungeness crab, endangered and threatened species (including salmonid migratory corridors), and groundfish rearing areas. For the Cherry Point Resource Area, conservation habitats will begin 150 feet inland from the top of the bluff or 200 feet landward of the Ordinary High Water Mark (OHWM) where no bluff exists, and extend through the riparian zone seaward to -70 feet Mean Low Low Water (MLLW)[13]or one-half mile beyond extreme low-tide whichever line is further waterward. These boundaries may shift landward with rising sea levels due to climate change. These habitats are affected by natural and human-influenced processes, which extend beyond the management area and therefore should be considered at an ecosystem scale. Further discussion of why this conservation is necessary follows.

5.2.1 Riparian

Riparian habitats are described in section 4.2.2. Shoreline armoring and fill, overwater structures and land clearing associated with industrial, residential, and recreational land use and activities have already impacted, and have the potential to continue impacting, riparian areas along the Cherry Point. Such impacts include disturbance and loss of habitat functions. Additional concerns include the removal of native vegetation, degradation of water quality, and altering recruitment of large woody material and sediment by either accelerating or limiting input. Climate change may also affect riparian areas.

Disturbance and loss of riparian habitat functions could lead to a net loss of resource values and function within Cherry Point Resource Area. The level of habitat disturbance and alteration

[13] MLLW: mean lower low water equals zero feet in elevation.

should be monitored. For example, tracking removal of native vegetation and any degradation of water quality are ways to monitor disturbance and loss of habitat function.

Species affected by impacts to the riparian habitat include peregrine falcon, bald eagle, great blue heron, and coho salmon.

5.2.2 Nearshore

Nearshore habitat is described under Marine Divisions in Section four. Activities and physical changes that inhibit coastal processes within the nearshore could lead directly to degradation of habitat structure and functions. Species considered to be indicative and reliant upon the nearshore environment may be particularly sensitive to such changes. Potential human-caused changes may include, but are not limited to, oil spills, shoreline modifications, changes in water quality caused by discharges from stormwater, sewage, and industrial sources; derelict fishing gear, and creosote-treated wood. Climate change may cause an increase in winter precipitation, severity of storms, increased sea water temperature, and sea level rise. Characteristic species of concern for the nearshore environment include eelgrass, Pacific herring, surf smelt, Puget Sound Chinook, Dungeness crab, marbled murrelet, and Orca.

Commercial fishing has been active in Cherry Point and derelict fishing gear is likely present in the management area. Derelict fishing gear is detrimental to the habitat structure and biological processes. Lost nets and crab and shrimp pots can continue capturing target species as well as other fish, shellfish, marine mammals and birds.

Species that use various divisions of nearshore habitat are free swimming or planktonic and include Pacific herring in the pre-spawning holding areas, Orca, and other marine mammals, salmon, cod, Pollock, Pacific hake, and various invertebrate species. The deeper, benthic zone is used by species such as crab, groundfish and numerous invertebrates.

Potential threats to the upper intertidal or subtidal divisions of the nearshore habitat include climate change, water quality, ship traffic with associated effects (spills, noise, wake, discharge), and any significant decreases in the water quality of the Fraser River may impact the pelagic habitat of the Cherry Point Resource Area. Additional research would establish relative values of the impact and risk.

Potential threats to the benthic zone may arise from commercial fishing, which has been active in the Cherry Point Resource Area, resulting in derelict fishing gear. Derelict fishing gear is marine debris, and can have the potential to be detrimental to habitat structure and biological processes.

5.3 Impacts to Indicator Fish and Wildlife Species of Cherry Point

5.3.1 Cherry Point Pacific Herring

Since the 1970s, the size of the Cherry Point stock has shrunk from approximately 15,000 tons to a low of about 800 tons in the 2000 spawning season, to an estimated 2,100 tons for 2007, followed by a decrease to 1,352 tons in 2008.

For the 2003-04 period, 50% of Puget Sound herring stocks are classified as healthy or moderately healthy. This is the lowest percentage of stocks meeting these criteria since development of the stock status summary in 1994; following 71% and 83% of stocks considered healthy or moderately healthy in 2000 and 2002, respectively. One stock, N.W. San Juan Island, was also added to the critical list in 2004.In the 1970s, the Cherry Point stock comprised more than half of the herring biomass in Puget Sound (Stick 2005).

The location of herring spawn deposition in lower intertidal and upper subtidal habitats and the geographically specific nature of herring spawning behavior make herring spawning grounds vulnerable to shoreline development. As a result, it is likely that one of the greatest threats to herring within the boundaries of the management area is from damage to eelgrass spawning and rearing habitat. Documented herring spawning grounds are protected from habitat loss by the Washington Administrative Code Hydraulic Code Rules (WDFW, 2007).

Industrial activities along the Cherry Point shoreline, including petroleum offloading and processing and aluminum smelting, represent possible sources of environmental contaminants. However, larval abnormalities in Cherry Point herring larva have not been linked to conditions at the shoreline, and in fact, were reproduced independently by zygotes in a controlled laboratory setting (see Hershberger et al 2005).

5.3.1.1 The role of persistent organic pollutants

Studies have been published (West et al, 2001) that address the concentrations of PCBs and other persistent organic pollutants (POPs) within Cherry Point Pacific Herring (CPPH) and Puget Sound Pacific Herring (PSPH) stocks O'Neal and West et al. (2001) documented that Pacific herring from central and southern Puget Sound basins had higher levels of PCB body burdens when compared to herring stocks from northern Puget Sound and the Strait of Georgia. The results determined that mean total PCB body burden for CPPH stock was 54.89 micrograms per kilograms (µg/kg). Semiahmoo herring that spawns in the same region as the CPPH had total PCBs measured at a mean of 51.24 µg/kg. These levels were compared to the more southerly stocks, which showed higher concentrations of total PCBs. The PSPH stock at Port Orchard had mean total PCBs at 189.40 µg/kg and at Squaxin Pass, showed the mean total PCBs were measured at 195.90 µg/kg. As demonstrated by the high standard deviation, the southerly stocks have a wide range of individual measurements. More southerly stocks do have higher concentrations of PCBs.

In a later study, West et al. (2008) made additional collections of Age 2-3 fish from Squaxin Pass, Quartermaster, Port Orchard, Cherry Point and two other Strait of Georgia stocks. PCBs and other POPs were measured for each stock and normalized to grams of lipid content (ng PCBs/g lipid). The levels were compared to the 10th percentile residue effect threshold for the

protection of juvenile salmonids, which was suggested by Meador et al (2002) to be set at 2400ng PCBs/g lipid (2002).

Port Orchard exceeded this benchmark, Cherry Point had concentrations at about ½ the threshold, and Squaxin Pass was intermediate. The results show that PSPH and CPPH have PCB concentrations that are near or above the suggested threshold concentration for juvenile salmonids of 2.4 mg//g lipid (Meador *et al.* 2002). Uncertainty exists in extrapolating between species of such different phylogeny, and comparable data are not available for other Pacific herring stocks. Studies on PCB effects to Pacific herring stocks outside of Puget Sound and Cherry Point would be informative.

PCBs are known to have a plethora of effects on development and immune function that are typically not included in fish toxicity tests. Development of toxicity tests for Pacific herring has been underway (Dinnel *et al.* 2008) and exploration of the effects of PCBs and other persistent organic pollutants could be informative. PCBs are known to affect degrade the immune systems of fish species (Zelikoff *et al*. 2000, Duffy *et al*. 2002). A high priority should be placed on the effects of these contaminants on immune function consideration the high incidence of disease in Pacific herring of this region.

DDT and hexachlorobenzene residues are also found in the Pacific herring stocks and the pattern of bioaccumulation was specific to CPPH and the PSPH. These data provide information that the two groups of Pacific herring utilize different segments of the landscape (West et al 2008).

5.3.1.2 The role of disease

Disease has been identified as a potential cause of the syndrome parasite *Icthyophonus hoferi* (Hershberger *et al.* 2002, Landis *et al.* 2004, 2005, Landis 2008). The incidence of the parasite *Icthyophonus hoferi* increases with the age of Pacific herring of the Puget Sound region. Fifty eight percent (58%) of Age 6 fish collected were infected. Viral hemorrhagic septicemia virus (VHSV) and other pathogens can also be found in the Pacific herring in the Puget Sound region.

Marty *et al.* (2003) have linked VHSV to the reduction of recruitment of Pacific herring in Prince William Sound. As in Puget Sound, the prevalence of *I. hoferi* increases with the age of the fish, but no relationship between *I. hoferi* and the decline in Pacific herring in Prince William Sound was found.

Disease is a stressor widespread in the region. Routine monitoring of the prevalence of disease within the various PSPHS and CPPHS in concert with the routine counting of the fish would be a useful tool in assessing the state of Pacific herring. As Hershberger has done, disease incidence should be determined for each age class and for each stock.

Potential interactions between the three proposed causes are examined next.

5.3.1.3 The role of interactions

As the change in ocean conditions occurred, diseases with broad host ranges, such as *I. hoferi* may have been introduced to the region. PCBs and other persistent organic pollutants with the

ability to alter immune function may have made the fish more susceptible to infection. The combination could then lead to a persistent and widespread decline in the Pacific herring. No doubt other scenarios could be developed from this or similar datasets. Part of the issue is that the recognition of such an event could not have been done until recently.

5.3.1.4 Current regulatory protection

In response to a 1999 petition that addressed 18 species in Puget Sound, including Pacific Herring, the Department of Commerce, NOAA Fisheries, National Marine Fisheries Service, reviewed formed a Biological Review Team (BRT). While federal protection was not provided, the BRT stated (Stout, et al 2001).:

> ". . .most members expressed concern that they could not entirely rule out the possibility that this Georgia Basin DPS at present is likely to become in danger of extinction, especially because some stocks within the Georgia Basin, such as Cherry Point and Discovery Bay, have declined to such an extent that they may meet the IUCN criteria to be considered "vulnerable" which is "(of special concern), not necessarily endangered or threatened severely, but at possible risk of falling into one of these categories in the near future"

While the petitions to list the Cherry Point Stock as a federally listed species under the Endangered Species Act (ESA) were not successful, continuing declines in the Cherry Point stock have listed it as "critical" in by the Washington State Department of Fish and Wildlife. The Washington State Department of Fish and Wildlife also continues to list the Cherry Point stock a candidate species.

5.3.1.5 Management Considerations

The current age structure of Cherry Point herring is made up of relatively young fish. The estimated age composition in recent years has been dominated by 2 and 3 year old fish, compared to a much higher proportion of older fish in the 1970's. While the ratio of 2 and 3 year olds increased, an increase in the natural predators of herring, including Pacific hake, spiny dogfish, and harbor seals, was also noted in recent decades (Stout et al. 2001; Mitchell, 2006). The increase in predation rates combined with a higher rate of natural mortality (e.g., parasites) in the older age classes could be factors in the age class structure (WDFW, unpublished data, 2008).

Because of their genetic uniqueness, and potential repository for irreplaceable variation, Cherry Point Pacific herring should be protected through careful management.

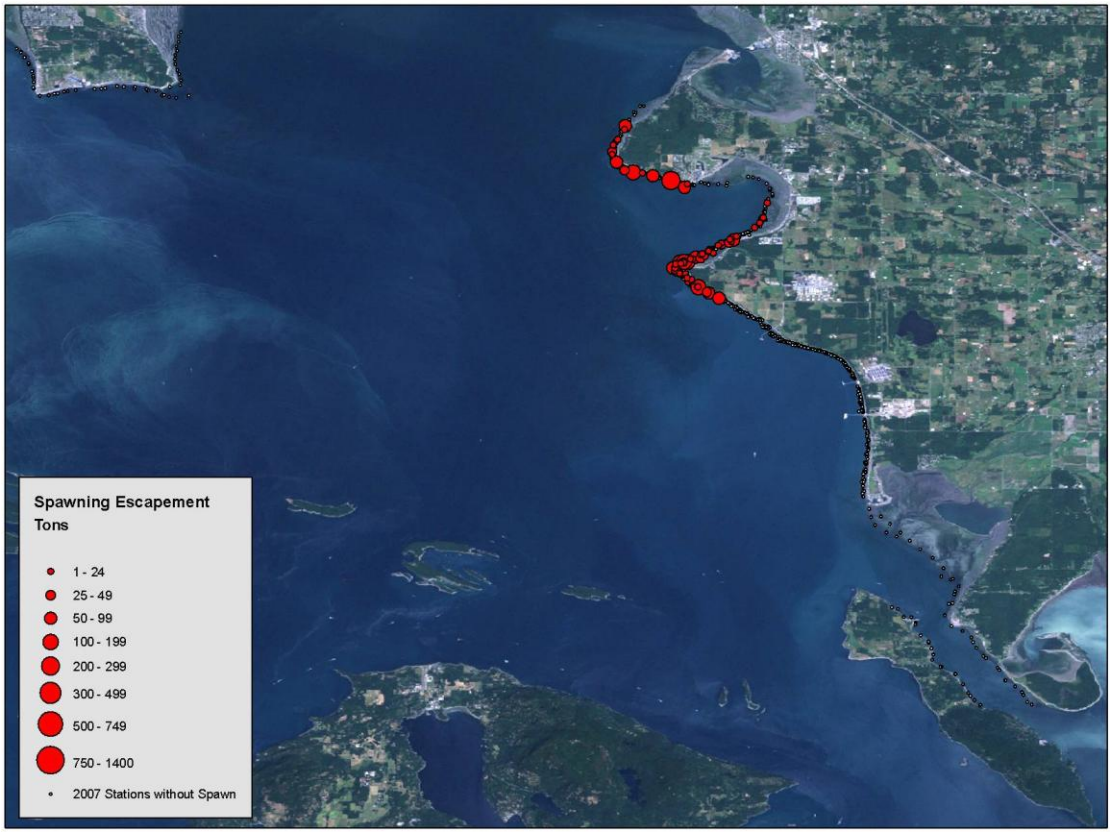

Figure 15 and 16. Spawning escapement for Cherry Point Herring: 1973 – 1980 compared to 2007 (WDFW unpublished)

5.3.2 Surf Smelt and Sand Lance

Surf smelt rarely reach greater than five years of age, with most spawning populations comprised of one and two-year old fish. The species dependence on relatively undisturbed beaches makes them extremely vulnerable to shoreline modifications that alter substrate composition, thereby destroying spawning habitat. The sand lance is also vulnerable, as it spawns in the upper intertidal zone of sand gravel beaches throughout the increasingly populated Puget Sound basin.

Rice (2006) examined the effects of four physical parameters compared to a control on surf smelt spawning success. It was found that the altered beach had significantly higher daily light maximum light intensity, higher daily maximum and minimum substrate temperature, significantly higher maximum daily air temperature, and a significantly lower relative humidity. The altered beach also contained approximately half the live surf smelt embryos as the natural beach. Admittedly, the small number of sites limits this validity of the results, but prompts the needs for future studies into the relationship between beach modification and surf smelt survival. Cherry Point currently has a lower percentage of shoreline modification compared to many other areas (see section 5.6) and the impacts of any development on surf smelt or sand lance habitat should be considered carefully.

The Washington Administrative Code Hydraulic Code Rules now include consideration of surf smelt habitat and sand lance in the permitting of in-water construction activities. Identified surf smelt spawning sites have been given “no net loss” protection (WDFW 2007, Whatcom County MRC 2007).

5.3.3 *Order Anseriformes* - Sea ducks and cavity nesting ducks

Surf Scoter (*Melanitta perspicillata*)
North American populations of scoters have declined by about 60% over the past 30 – 50 years, including 57% declines for all three scoter species combined in a Puget Sound since the late 1970s (Hodges et al. 1996, Dickson and Gilchrist 2002, Nysewander et al. 2005). Reasons for these declines are not clear, but a number of factors in marine habitats may be involved, including but not limited to: declines in the herring population, heavy metal contamination, and oil spills. As discussed in Section 4.4.5.2.1, scoters both rely on herring spawn as a food source, but research shows that herring spawn may be critical for surf scoters to help build up fat reserves prior to migration. For this reason, Anderson et al. (unpublished manuscript, 2008) suggest that management of Pacific herring include protections for spawning areas that preserve feeding opportunities for these diverse predators.

Harlequin Duck (*Histrionicus histrionicus*)
Lewis and Kraege (1999) discuss the sensitivity of the Harlequin Duck to disturbance and pollution. Low benthic macroinvertebrate abundance may limit the productivity of harlequin ducks (Bengtson annd Ulfstrand 1971). Human disturbance discourages nesting at traditional sites and thereby decreases productivity. A high tendency for individuals to breed at the same location year after year may result in a separation of populations with little chance to replenish stable or declining populations. Populations are highly sensitive to additional mortality from such causes as hunting, oil pollution, or food contamination. Lewis and Kraege (1999) recommend protecting rocky shoreline areas that are used during winter and limiting

disturbances at traditional coastal molting sites. According to both surveys (PSAMP and MESA), which surveyed winter and summer, birds were at Cherry Point during both seasons.

Cavity nesting ducks

Lewis and Kraege (2000) discuss the high percentage of aquatic insects, invertebrates, shellfish, crustaceans and small fish in the diet of cavity nesting ducks. All are located in the nearshore environment of Cherry Point, making these species excellent indicators for the overall health of the environment. Many cavity nesting ducks, the wood duck in particular, use Pileated Woodpecker cavities, as well.

When considering management recommendations, the use of herbicides that affect emergent vegetation, and activities that may contribute contaminants which would bioaccumulate should be considered. The use of herbicides or pesticides near wetlands may affect cavity-nesting ducks by lowering the numbers of invertebrates, and by adversely affecting aquatic and emergent vegetation. All of these ducks are known to accumulate toxins in their tissues, especially in areas where toxins are elevated, such as downstream from mines, pulp and paper mills (Lewis and Kraege, 2000).

5.3.4 *Order Charadriiformes* – Alcids, auks, murres, guillemots

Common Murres (Also called the Common Guillemot, *Uria aalge*)

The numbers of Common Murres in Washington fluctuate annually, in response to food supply and climatic events. Common Murres are the most frequent avian victims of oil spills along the Washington coast. Other threats to the population include pollution, over-fishing of prey, gill net entanglement, and predators (WDFW 2005). The population experienced a crash as a result of the 1983 El Niño event, dropping from 30,000 to fewer than 3,000 birds. While some populations have recovered, others have yet to rebound, and the population is about one-third the former level (BirdWeb, 2008).

Common Murres are highly sensitive to human presence, whether humans are on foot, in a boat, or in a low-flying plane. When disturbed, the birds may knock eggs and chicks out of the nest sites in their haste to fly clear of the disturbance. The unguarded chicks and eggs become easy prey for gulls and other avian predators (WDFW 2005; BirdWeb, 2008). Common Murres can be used as an indicator of the overall water quality and presence/absence of marine debris, for the foraging areas at Cherry Point.

Pigeon Guillemot (*Cepphus columba*)

Pigeon Guillemots are highly vulnerable to oil spills and other pollution, changing water temperatures, introduced mammals on nesting islands, and gill-nets. Numbers fluctuate in Washington from year to year. Significant increases were seen on the colony at Protection Island from 1976-1984, but that colony has declined dramatically from 3,000 pairs in 1993 to only 1,967 pairs in 1995. A conservative estimate puts the total number of birds in Washington during the breeding season at about 4,000 birds, although some estimates are closer to 6,000 (BirdWeb, 2008).

Since they are not tightly clustered on a few breeding colonies, Pigeon Guillemots are less vulnerable than many alcid species to localized disturbances. In the absence of reliable population estimates however, the conservation status of this species is difficult to ascertain (BirdWeb, 2008).

Pigeon Guillemots do not appear to be abundant at Cherry Point, despite the presence of rocky cliffs for nesting. The population numbers are not well known. Foraging and any future breeding presence can be used as an indicator of the overall water quality, habitat quality, and presence/absence of marine debris for Cherry Point.

Marbled Murrelet (*Brachyramphus marmoratus*)

Marbled murrelets are threatened by habitat loss and fragmentation, accidental by-catch of gill net fisheries, lack of standardized survey protocols and subject to environmental contamination from oil spills and pollution (WDFW 2005). This bird is representative of the Cherry Point ecosystem, in that it makes use of the adjacent upland resources (forests), adjacent offshore marine resources, and the nearshore resources as well. Furthermore, the documented presence of this threatened species in nearby forests and in the nearshore and offshore areas requires management goals to account for its presence and long-term habitat requirements. Marbled murrelets do not appear to be abundant at Cherry Point; foraging, breeding, or presence/absence observations should all be documented.

Rhinoceros Auklets (*Cerorhinca monocerata*)

While the Rhinoceros Auklet is the second most abundant breeding seabird (excluding gulls) in Washington, making up 23.6% of the breeding seabird population, the numbers vary considerably from year to year, as this species is very sensitive to disturbance during the nesting period. Adults will readily desert their nests if disturbed during the incubation or brooding periods. In addition, burrows are often near the surface and collapse easily if trod upon. Rhinoceros Auklets are also vulnerable to gill-nets, oil spills, predators, and climatic events such as El Niño. There are some indications that the population is increasing on the West Coast, but there is no evidence of significant new colonies being formed in Washington (BirdWeb, 2008). The sensitivity of this species, and its preference for forage fish, including herring, anchovy, sandlance and smelt, can be used to monitor overall a number of habitat conditions, including presence of adequate food supply.

5.3.5 *Order Gaviiformes* - Loons

A comparison of the PSAMP survey data to the 1978-79 MESA survey shows a large decline (64% decrease, $p < 0.001$). (Nysewander, D.R. et al. 2005). Adjacent habitat to the Cherry Point Resource Area provide quality wintering habitat for the Common Loon, and high winter counts have been documented along the Strait of Georgia, in Drayton Harbor, Lummi Bay, Hale Passage, Bellingham Bay and Padilla Bay (MESA; Wahl et al. 1981). However, the 1992 – 99 PSAMP surveys document fewer than 5 birds per square kilometer along the Cherry Point (Nysewander, D.R. et al. 2005), perhaps due to the lack of inlets and the presence of deeper waters.

Shoreline development, fluctuating water levels in lakes, and human disturbance are seen as factors most likely to impact successful nesting (Richardson, S. et al, 2000). Common Loons often nest on floating logs or small islands in a secluded lake, and need clean clear water for foraging. As lakeside shoreline development increases, these features may not be as accessible.

5.3.6 *Order Pelecaniformes* – Cormorants

Cormorants

When considering management actions, it should be noted that all cormorants are sensitive to human disturbance to colonies. Cormorants as a group have been killed and harassed by people who believe that the birds damage the commercial fishing industry (Pelagic Cormorants, however, feed on fish that aren't fished by commercial fisheries). Population fluctuations may also be tied to the California current, which is associated with upwelling, deep ocean water, rich in nutrients. Changes in upwellings that occur in El Niño and La Niña years affect food availability for this species. El Niño events reduce the number of breeding pairs as well as the reproductive success of breeders.

Such disturbances, plus commercial fishing and pollution, oil spills, gill-net entanglement, and toxic contamination of prey also affect the cormorant populations (BirdWeb 2008). The sensitivity of comorants to human disturbance, and its reliance on fish populations for food, can be used to help monitor overall the health of ocean currents, certain fish species, and habitat at Cherry Point.

5.3.7 *Order Podicipediformes* – Grebes

Grebes, including western, used to be killed for their feathers. This practice was ended, and the birds have since recovered to the point where they are breeding in areas not occupied historically. Fluctuating water levels, oil spills, gill nets, and poisons such as rotenone (used to kill carp) are factors that negatively affect the population. When approached by humans, the parents will leave the nest, leaving eggs vulnerable to predation and the elements. Thus, areas frequently disturbed by humans may have low productivity. Grebes are considered a Candidate species by the Washington Department of Fish and Wildlife (BirdWeb, 2008; Nysewander, D.R. et al., 2005).

Currently, the greatest threat to grebes is human development. In addition to shoreline armoring decreasing forage fish spawning areas, loss of eelgrass beds due to increasing nutrient loads, overwater structures leading to increased shading, and increased scour of forage fish habitat areas would significantly reduce available food supplies. Western grebes have recovered from a decline in at the turn of the 20th Century, when their numbers suffered because of human's desire for feathers as a commodity. They are now entering areas in Washington to breed where historically they were not documented. This bird is an indicator of forage fish resources, invertebrates, and both freshwater and estuarine habitats. For these reasons, its numbers should be watched closely as an indicator of the resources it relies upon for survival.

Past (PSAMP, 1999; MESA 1979) and recent research (Bower, et al, 2005) which may show this species is declining in large numbers should be supported by the management actions in this plan.

5.3.8 *Order Ciconiiformes* – Wading birds

The Washington Department of Fish and Wildlife has placed great blue herons on the State Monitor List out of concern for its potential to become a species of concern as defined by WAC 232-12-297. Great blue herons can be vulnerable because of their tendency to aggregate during the breeding season. The availability of suitable great blue heron breeding habitat is declining as human population increases in Washington State. In addition, great blue herons may abandon breeding colonies or experience reduced reproductive success when disturbed by humans. WDFW considers great blue herons a "priority species" and has developed management recommendations to conserve great blue herons in the state (Quinn and Milner, 1999). While loss of nesting habitat may be an issue, adjacent to Cherry Point, the birds dependence on nearshore areas for food make them vulnerable to anthropogenic changes from shoreline armoring, increased nutrient loads, and shading.

During the 1992 – 99 PSAMP marine bird surveys, great blue herons were the most common and widespread wading bird seen during summer surveys, often observed in shallow bays and estuaries. Although the most commonly observed wading bird, trends during this time period seemed to indicate a decrease in density, and the authors suggested further study.

Summer surveys were compared for two time periods: 1992-94 and 1995 – 1999. In the Cherry Point area, between 1992 and 1994, blue herons were observed in the northern and central portions at low to moderate densities (2 – 10 animals/km^2) and in the southern portion in higher densities (20 – 132 animals/ km^2). From 1995 through 1999, densities decreased in the southern portion to low (2 – 10 animals/km^2). Winter densities are reduced even further (0 – 2 animals / km^2 in Cherry Point) as females and young move to freshwater and males remain in marine areas (Nysewander, D.R. et al. 2005).

Continued monitoring and support for the rookeries along and within the Cherry Point Resource Area are necessary for this species.

5.3.9 *Order Falconiiformes* – Birds of prey

Bald Eagle (*Haliaeetus leucocephalus*)

Delisted in 2008 from the federal Endangered Species list, the bald eagle will remain protected under the federal Bald and Golden Eagle Protection Act, and federal Migratory Bird Treaty Act and the State Bald Eagle Protection Act RCW 77.12.655. This State law requires the establishment and enforcement of rules for buffer zones around bald eagle nest and roost sites. The majority of bald eagle nests are found on private land not dedicated to conservation (Bohannon, J. WDFW, pers. comm. 2008). Perching habitat along the shoreline has been severely reduced in Birch Bay as a result of residential development. The impact on the bald eagle territories from private development should be followed closely, since the nest locations

are on private land, which is not protected or under a conservation easement. The reliance of this bird on forested areas near waterbodies containing adequate amounts of fish, birds and mollusks for food can be used as an indicator for the overall ecosystem health at Cherry Point.

Peregrine falcon (*Falco peregrines*)

Peregrine Falcons were severely endangered (and actually extirpated from eastern North America) in the mid-20th Century, mostly due to the pesticide DDT, which softens eggshells and results in widespread nest failure. With the ban of DDT in the United States, the falcons have begun to recover, but WDFW still considers environmental contaminants a specific problem with this bird. Another specific problem is disturbance by humans (WDFW 2005).

Peregrine falcons were removed from the federal threatened and endangered species list in 1999, but are still considered sensitive in Washington. In Washington, Peregrine Falcons reached a low of four pairs in 1980. In 2000, 56 pairs were counted, doubling the number counted just seven years prior. Peregrine Falcons can now be found in most parts of the state where there are cliffs or structures for nesting and sufficient prey. The population is still small and is highly vulnerable to disturbance and environmental contaminants, but productivity levels are high and the population continues to increase (Bohannon, J. WDFW, pers. comm. 2008). The sensitivity of this species to environmental contaminants, and human disturbance, can be used as an indicator for both water and habitat quality at Cherry Point.

Osprey (*Pandion haliaetus*)

The primary threat to the Osprey has been organchlorine biocide use, such as DDT, which results in the thinning of eggshells. The ban of DDT in 1972 continues to support a strong recovery in much of North America. Artificial nest platforms have significantly increased nesting in many areas. The Breeding Bird Survey has reported a significant increase in the Osprey population in Washington. Other threats may include gunshots, steel traps, impacts with or electrocution by high-tension wires, and being caught or drowned in fishing nets (NatureServe, 2008; BirdWeb, 2008). The sensitivity of this species to environmental contaminants, human development, marine debris, quality of fish as a food source, and human disturbance, can be used as an indicator for a the overall health of the Cherry Point ecosystem.

5.3.10 *Order Piciformes* - Woodpeckers

Habitat loss and lack of data on population dynamics are the two areas identified by Washington Department of Fish and Wildlife in the *Comprehensive Wildlife Strategy* (September 19, 2005) as specific problems that need to be addressed. Pileated Woodpeckers are currently candidates for endangered species listing by the Washington Department of Fish and Wildlife and are included on the Gap Analysis list of species-at-risk. (WDFW, 2005, BirdWeb, 2008). The requirements of this species for upland mature forested types, including the need for healthy populations of wood-boring insects, and insects that nest in trees, can be used as in indicator of the quality of the surrounding upland forested area at Cherry Point.

5.4 Water Quality

5.4.1 Regulatory Authority

Washington State Department of Ecology develops and approves National Pollutant Discharge Elimination System (NPDES) permits for point sources of pollution. Ecology also manages the issuance of industrial and municipal stormwater permits. Nonpoint source pollution is managed through a variety of state and local programs, Ecology has developed a non-point pollution plan that focuses on local land use activities. Finally, Ecology issues water quality consistency certifications under Section 401 of the Clean Water Act, which help ensure compliance with the law's Antidegradation Policy (Ecology website, 2008).

The U.S. Corps of Engineers oversees any in-water construction in navigable waters, and has been delegated authority under the Clean Water Act for the issuance of Section 404 permits (EPA, 2008).

5.4.2 Characterizing Water Quality

5.4.2.1 Nonpoint pollution management at Cherry Point Resource Area

Nonpoint source pollution, unlike permitted discharges from industrial and municipal sewage treatment plant outfalls, comes from many different sources as a result of rainfall and/or snowmelt moving over and through the ground. Runoff collects nutrients and toxics from upland surfaces and discharges them directly into streams and marine receiving waters without any treatment. Nonpoint sources of pollution include yards, roads, construction sites, marinas, forest lands and agricultural lands. Most of these are not monitored in the Cherry Point Resource Area.

Nonpoint source pollution, if untreated, can contribute to water pollution. In many areas of Puget Sound it affects the flow, chemistry, mixing, temperature of receiving waters, and results in localized decreases in salinity and dissolved oxygen levels. It can also increase biological activity resulting from nutrient inputs and result in shellfish bed closures and other health issues.

The following are potential sources of nonpoint pollution to fresh and marine waters in the Cherry Point Resource Area:

- Excess fertilizers, herbicides, and insecticides from residential areas;
- Oil, grease, metals, and toxic chemicals from roads and impervious surfaces;
- Soil from erosion on construction sites and eroding bluffs due to drainage problems on residential properties;
- Bacteria and nutrients from pet wastes, and faulty septic systems.

Limited information currently exists pertaining to nonpoint pollution in the Resource Area and further study is needed.

The Cherry Point Resource Area receives considerable dilution from freshwater inputs, as noted earlier in this document. The freshwater inputs increase dilution along the reach, decreasing the

possibility of high nutrient load from industrial and municipal outfalls. Considerable dilution is believed to occur in the Cherry Point area and Georgia Strait due to the contributions of fresh water from the Fraser River (Wigfield, K. personal communication, 2008).

Whatcom County (2006) describes the nearshore and marine waters as receiving inputs from natural sources of major nutrients, such as nitrogen and phosphorus, on a level several magnitudes greater than anthropogenic contributions to Puget Sound. The impact is offset by the continuous circulation and mixing between the nearshore and marine environments.

Nutrient loading is traced to river discharge and land uses within the watershed. Upland sources include agricultural operations, wastewater treatment plants, and residential runoff. The Nooksack River contributed the third highest annual nitrogen load and the fourth highest annual phosphorus load of all the major U.S. rivers entering Puget Sound from 1980 to 1993 (Whatcom County 2006).

Nutrient input, whether natural or anthropogenic, can be detrimental at high levels. As the results from the Marine Water Quality Study showed (Newton et al 2002), nearshore areas along Whatcom County shorelines are susceptible to eutrophication from high levels of nutrients including Portage and Drayton Harbors (shellfish protection districts), and Bellingham Bay, an enclosed bay that receives large amounts of fresh water and nutrients from the Nooksack River. These sheltered bays are especially susceptible to elevated pathogen levels from upstream anthropogenic sources.

5.4.2.2 Groundwater Contamination at Cherry Point Resource Area

Ecology and others have expressed a concern that contaminated groundwater is discharging directly to the herring spawning zone in some locations along the Cherry Point Resource Area (Wigfield, 2008, personal communication). Additional testing is needed to determine if this is the case and to identify potential sources if contamination is detected.

“Legacy” sources of contamination resulting from historic (unregulated) industrial waste disposal may still exist on adjacent uplands, such as the TreOil Industries Limited site (4242 Aldergrove Rd.). Contaminants may have leached into the groundwater which later discharges into the nearby marine receiving water. The abandoned TreOil site was historically used to process TreOil, a by-product of the kraft pulp and paper industry. An inspection by Ecology in 2000 revealed the presence of an unsecured laboratory in a modular-type home, a number of above-ground storage tanks and drums with unknown material, many of which were leaking, and other unsecured industrial waste. Some of the drums contained a rosin-type substance which was sampled by the inspectors. A sand-blasting area was located on the property, and the presence of grit was noted.

Ecology has identified the site as potentially hazardous to human health and /or the environment. Ecology also notes there is some potential for this site to be contributing to herring mortality through groundwater transport to the nearshore areas of management area (Marshall, R. personal communication). The TreOil site is ranked 2 on Ecology’s list of Hazardous Sites awaiting cleanup as of February 20 2008 (Ecology Hazardous Sites List, 2008).

Figure 17. Close up picture of rosin pile at TreOil property, taken by Ecology Inspector in 2000

5.4.2.3 Point Source Pollution Management at Cherry Point Resource Area

As part of the requirements for obtaining industrial wastewater or stormwater permits, the three Cherry Point industries have allowed or conducted tests of the surrounding water column and sediments. While initial testing indicated the presence of certain potentially historical contaminants, current work by state agencies as addressed in recent NPDES permits indicates improvement (Ecology, 2007). In general, compared to other locations in Puget Sound and the Strait of Georgia, chemical concentration in receiving waters and sediment at Cherry Point is relatively low.

Sediment studies within in the Resource Area have mostly consisted of monitoring conducted under the three industrial NPDES discharge permits. Although this monitoring has documented contamination associated with the three industries, Ecology cannot tie any sediment violations of Sediment Quality Standards to existing industrial discharges. Contaminated sediment in the area of Alcoa-Intalco Works's pier has been traced to historical spills or releases from the aluminum smelter.

Sediment studies were performed at the BP facility in 2006, at ConocoPhillips in 2004, and at Alcoa in 2000. Although contaminants were detected at all three facilities, levels were not at concentrations sufficient to cause listing on the Washington Department of Ecology 303(d) list of "impaired waters" or the imposition of a "sediment impact zone" (SIZ). The contaminants were detected in a localized area around the discharge locations under the industrial outfalls with concentrations of Polyaromatic Hydrocarbons (PAH) below the current sediment quality standards (SQS), as set by the Department of Ecology. Contaminants were also detected in sediment at the pilings containing creosote, linked to the wood treatment materials for those pilings (Wigfield, 2008, personal communication).

5.4.3 Future information needs

Further information is needed regarding the environmental fate of the natural and anthropogenic discharges entering the Cherry Point Resource Area. Studies should build a better understanding of bioaccumulation in both flora and fauna species of interest at Cherry Point. These studies should pay particular attention to the intertidal and upper subtidal zones. Should adverse impacts be identified, management agencies should consider the need for additional controls to reduce or eliminate these impacts to the habitat and species identified for conservation in the Resource Area.

The following elements of water quality in the Cherry Point Resource Area should be monitored closely:

- Localized ambient water temperature changes and associated sources
- Exceedances of the State Sediment Management Standards and sources
- Exceedances of the State Water Quality Standards and sources
- The potential cumulative effect from the natural discharges, anthropogenic discharges, and water current/temperature modeling along the Resource Area. This evaluation will become more important as sea temperatures rise with climate change and increases become measurable in the Cherry Point Resource Area.
- Relationship between nearshore species, survival and water quality

Modeling of the area needs to be revisited. Water quality within the Cherry Point Resource Area is influenced by a variety of natural and anthropogenic sources including the Fraser and Nooksack rivers, outflow from Birch and Lummi Bays, industrial discharges, domestic discharges (sewage and septic), marinas, recreational and commercial vessel discharges, and stormwater runoff along the Cherry Point shoreline. A number of studies, particularly since 1954, have documented some of these influences and the natural or ambient water quality of the Resource Area. In 2001, at the request of the Cherry Point Technical Workgroup, ARCO, TOSCO, and Intalco contracted with ENSR/AECOM Consulting and Engineering to model the cumulative effects of the three effluent plumes from their plants to the Cherry Point Resource Area. The model consisted of a three-dimensional hydrodynamic circulation and effluent transport study. While the final model results concluded that accumulation of effluent from the three industries does not occur and water quality standards are not exceeded, there were several limitations to this model (Wigfield, 2008, personal communication).

The model did not include consideration of the following:

- Discharge from the outfall belonging to Birch Bay Water and Sewer District,
- Discharge from the Lummi reservation wastewater outfalls,
- Discharge from the stormwater runoff from Unick Road,
- Potential stormwater impacts from the proposed cargo terminal just south of the BP pier, and
- The impacts of other varied sources of non-point source pollution such as groundwater seepage from hazardous waste cleanup sites.
- Influence of pollutants and freshwater from the Fraser River

- Evaluation of the potential for pollutants to accumulate in the nearshore during certain wind or storm conditions (Wigfield, 2008, personal communication).

While the three current industrial outfalls are in compliance with applicable permits, a more thorough analysis of cumulative water quality impacts should be conducted, preferably through the collection of in-water samples to verify the conclusions of the 2001 modeling effort (Wigfield, 2008, personal communication).

5.5 Disturbance from recreational activities

Disturbance to the beach by recreational shellfish digging is altering the ecosystem in several areas of the Cherry Point Resource Area (Kyte, 2007). Area scientists believe the direct and indirect impacts from this activity are significant to herring and other shellfish reproduction. Habitat alteration results in impacts to benthic habitat, intertidal biota, and particularly impacts to herring spawning substrate.

The impact is caused by a relatively small number of recreational shellfish harvesters who do not refill holes as required by WDFW regulations. This results in permanent alteration to Cherry Point beach and intertidal habitat. The impact is primarily in boulder and cobble substrates where the mounded material dug from the hole is not typically restored by tidal and wave action. Public and private property have been impacted, including Point Whitehorn to south of the Gulf Road.

Recreational activities other than shellfish harvest may impact habitat and wildlife in the area. Questions have been raised regarding disturbance of birds and marine mammals by dogs and human activities. Beach fires reduce habitat and threaten riparian areas. Trampling of sensitive vegetation can result in impacts to sea grasses and algaes. As public access increases, these issues could be amplified. At this time there is a lack of education regarding the sensitive nature of many of the systems and resources along Cherry Point.

5.6 Shoreline modification at Cherry Point

Despite the presence of three large industrial piers, the Cherry Point Resource Area has much less shoreline modification than many other comparable areas in Georgia Strait. Only 9% of the shoreline has been significantly modified (Whatcom County, 2006). This is far less than the Georgia Strait region where 32.6% of the shoreline has been modified (Berry et al. 2001).

Shoreline modifications occur in several locations within the Resource Area, potentially influencing ecological characteristics of the shoreline at Cherry Point. The primary forms of armoring are bulkheads in the area of Point Whitehorn on Birch Bay, In addition there is a significant rip-rap along Gulf Road. Finally there are two large rock revetments and fills at the Conoco and Intalco piers. Evidence of adverse impacts from Birch Bay bulkheads has been the focus of Whatcom County managers for several years where they are requiring modifications of these bulkheads.

Armoring and modifications have the potential to disrupt sediment supply and transport. Shoreline armoring alters beach and subtidal substrates when sediment distribution patterns are changed or cut off. Often substrates become coarser, affecting the natural or successful growth of kelp, macroalgae and eelgrass. Natural nearshore drift processes are essential to the support and conservation of the resources identified in Section 4, particularly nearshore vegetation and the species that rely upon these ecosystem components, such as juvenile salmon and herring.

Shoreline armoring, and/or filling intertidal areas impact wave energy by diverting it in different directions. This wave energy is needed to keep the natural hydrology intact, keep drift cells and sediment moving, and prevent the erosion of beaches. Hard shoreline armoring structures can also result in scouring, if this energy is re-directed to a different location along a shoreline (Jacobson 1980, Whatcom County 2006). Further research is needed to determine the type and magnitude of effect of shoreline armoring in the Cherry Point Resource Area.

5.7 Overwater structures at Cherry Point

Overwater structures within the Cherry Point Resource Area are in the form of industrial wharves and piers, heavily used facilities that are used to transport large of amounts of material. All heavy industrial facilities at Cherry Point possess wharves and piers for commerce of their materials. Depending of the design, level of use, and management, such structures may have a significant impact on ecosystems. Potential environmental impacts tend to be highly correlated with the level of light intensity below the structures, and research (DNR 2007) has shown that the spatial extent of the area influenced by an overwater structure is the sum of both the footprint of the activity and the areal extent of the alterations that are the result of the activity/structure (area of alteration).

Industrial wharves and piers can impact water quality, create diversions in the local hydrology, disrupt sediment flow along drift cells, shade aquatic vegetation, and diminish the euphotic zone in the area of the facility. There is also potential for impacts form noise, prop wash, ballast water and waste discharges, fuel spills, hydraulic fluid spills, material spills, and other activities associated with these facilities that may directly and indirectly impact aquatic flora and fauna. (Nightengale and Simenstad 2001). At this time, little information is available regarding the affects of the existing piers or their operations.

5.7.1 Increase in impervious surface

Researchers examining declines in the growth of eelgrass suggest a link to increased human development (Short et al 1996, Lee et al 2003). While there appears to be no direct link to increased nitrogen loads, the data suggest an indirect link as a result of increased competition from algae, eelgrass epiphytes and nutrient tolerant vegetation (Short et al 1996, Lee et al 2003). Impacts associated with increased freshwater inputs may also be a factor in the decline of eelgrass. As impervious surface increases, estuarine environments receive greater amounts of

freshwater decreasing salinity levels and increasing habitat for species more tolerant of freshwater (Short et al 1996). Decreases in the depth of the euphotic zone from increases in suspended sediments and phytoplankton populations may also be a factor in eelgrass declines.

5.7.2 Shading

One potential impact from overwater structures is the alteration of light in the surrounding area. During day, light under the pier may be limited due to shading. This is a function of the width of the dock and its orientation. At night, security and operational lights on the dock or moored vessels may brighten the otherwise naturally dark waters. Alteration of light conditions in the nearshore has been shown to alter fish migratory behavior and distribution, and affect the ability of predatory fish to see their prey.

Shading affects habitat. Grette and Associates (2007) reports that in Bellingham Bay, Whatcom County, intertidal and subtidal shading decreased the availability of light under and surrounding overwater structures located in the Port of Bellingham. It is further discussed how shading is a primary concern because it reduces the amount of light available for photosynthesis by aquatic vegetation, which can have implications for habitat structure, complexity, and for the surrounding food web (Grette and Associates, 2007). The U.S. Corps Wetlands Regulatory Assistance Program reported that within seagrass habitats, increasing plant biomass and density (i.e. complexity) have been shown to be correlated with higher density and biomass of many fisheries species (Blackmon, D. 2006).

Studies in the Puget Sound region have suggested that under-pier light limitations could result in the following behavioral changes: 1) migration delays due to disorientation; 2) loss of schooling in refugia due to fish school dispersal under light-limited conditions, and 3) increased size-selective predation risk due to changes in migratory routes to deeper waters to avoid light changes (Nightengale and Simenstad, 2001). This behavioral relationship makes sense in light of the point that teleost fishes, a classification that includes all fish, depend upon sight for feeding, prey capture, and schooling. The underwater light environment determines the ability of fishes to see and capture their prey. There are also species-specific differences to consider with respect to how fish react to light. Species that occupy and defend stream territories, such as coho, tend to be quiescent at night while species that disperse to estuaries, such as chinook, pink and chum typically school, show nocturnal activity, and demonstrate an aversion to light (Nightengale and Simenstad, 2001).

Nighttime attraction to artificial lighting has been studied extensively at the Bangor Submarine Base Explosives Handling Wharf (EHW) in Hood Canal (Prinslow et al. 1979). The security lights at this facility are low-pressure sodium vapor lights and incandescent spotlamps, producing 1 to 19 lux[14] at the water surface. No significant difference in catch of chum was detected during period of lights on or lights off. However, at high levels of lighting, chum appeared to congregate, delaying migration (Prinslow et al 1979). These aggregations were observed in both 1977 and 1979, with different light levels (24 to 61 lux in 1977, 1 to 19 lux in

[14] The **lux** (symbol: **lx**) is the SI unit of illuminance and luminous emittance. It is used in photometry as a measure of the *apparent* intensity of light hitting or passing through a surface.

1979). When considering these results it is important to note that the security lighting at the EHW is focused directly on the water.

Congregation of salmon predators has also been observed in freshwater environments. Nightengale and Simenstad (1999, 2001) report that increased artificial lighting levels at night on the dams of the Columbia, Snake and the Sacramento Rivers attracts juvenile chum and may delay outmigration while increasing predation. In a 2004 study on the Cedar River, Tabor et. al observed that increased light intensity caused out-migrating sockeye salmon fry to slow or stop, making them more vulnerable to capture by predators.

One of ongoing questions is how to quantify the amount of shading in order to appropriately assess if an adverse impact is occurring, and if so, how to mitigate for it. Nightengale and Simenstad (2001) addressed this question. In a laboratory setting, studies have shown that the threshold for the lowest levels of maximum prey capture for juvenile chum and pink salmon occurs between 10^{-1} and 1 foot-candles which is partially equivalent to 0.5 (PAR) Photosynthetically Active Radiation. This represents the lowest end of light levels characterizing dawn or dusk which ranges from 10^{-1} to 100 ft-candles. Measurements of light levels under ferry terminals have identified under-dock areas that drop below the threshold even in the high light conditions of summer. When light intensity falls below this threshold, the fish must "dark adapt" to rod vision. During this time they are in a state of blindness with visual adaptation taking between 35 to 50 minutes. This "dark adapt" process is likely what is reflected in fish pause or directional change behavior. To summarize, if an area on a pier is measured at dropping below 0.5 PAR, fish must adapt their eyesight, which can take 35 – 50 minutes, during which they are vulnerable to predation.

Nightengale and Simenstad concluded that during daylight hours, at very minimum, under-dock light levels must be maintained at levels above 0.5 PAR to avoid this behavioral interference. They point out that this lower threshold of light level only addresses migration delays and behavioral alterations associated with required visual adaptation to light intensity variations and transitions from cone to rod vision. Cone vision is often the only form of vision for larval marine fishes. Fish visual development takes place on varying levels. Within juvenile cone vision development stages, there are also varying levels of sensitivity to the full spectrum of ultraviolet wavelengths. As visual development proceeds, juvenile marine fishes are known to behave and feed in response to specific ultraviolet wavelengths, as compared to forms of artificial light, such as fluorescent lights. Note that artificial lighting does not contain both UV-A and UV-B spectra. Evidence reveals that juvenile fish, such as salmonids, feeding in shallow nearshore waters utilize natural ultraviolet wavelengths for prey capture. Therefore, Nightengale and Simenstad (2001) conclude that by allowing the transmission of increasing levels of natural light, and thus ultraviolet light spectra, to the under-dock environment this will reduce structural interference with fish ability to capture under-dock prey.

Current lighting characteristics and patterns have not been assessed at the piers within the Cherry Point Resource Area. Initial assessments should include an evaluation of current operations and lighting characteristics. Based on these assessments the need for studies of lighting impacts on fish and nearshore habitat should be evaluated.

5.7.3 Changes in epibenthic assembles

Haas et. al. (2002) found a statistically significant difference in the epibenthic assemblages that exist around large overwater structures when examining ferry terminals in Puget Sound. These differences were demonstrated in both density and composition of the epibenthos at three ferry terminal structures, both over time (stratified-monthly sampling) and at several tidal elevations and habitat types (stratified-monthly sampling, eelgrass sampling, and cross-terminal sampling). While differences exist, the exact feature or features of the overwater structures which cause these differences was not determined in the study. Haas et. al. concluded that decreases or changes in epibenthos density, diversity, and assemblage composition are probably caused by the following four interacting factors:

(1) direct disturbance and/or removal by regular vessel disturbance;
(2) reduced benthic vegetation or compromised benthic vegetation function due to shading and physical disturbance;
(3) physical habitat alterations (e.g., altered grain-size distribution from propeller wash or piling effects), and
(4) biological habitat alterations (e.g., increased shell hash from sea star foraging and reduced eelgrass density due to benthic macrofauna disturbance)

However, while recognizing that nearshore vegetated habitats are highly productive and play an important role in ecosystem food chain support, the U.S. Corps calls for further studies to gain a clear understanding of the overall importance of eelgrass and kelp habitats for food web productivity in the Pacific Northwest (Blackmon, D. 2006). More information is needed regarding epibenthic conditions around the Cherry Point piers before conditions can be evaluated.

5.8 Potential impacts of excessive intermittent sound on forage fish

Noise has been identified as a potential stressor on Pacific Herring (EVS 1999; Schwartz and Greer 1984); most commercial fish react to loud noise, and these reactions are most pronounced in migratory schooling fish which rely upon hearing to detect environmental cues, such as approaching predators. Physical impacts can occur associated with construction project noise, such as pile driving, and have been documented (Laughlin 2005). Vessel noise is also intermittent, but the impacts are not well studied. Whether it is “loud” to various species of concern at Cherry Point is not understood. What is known is that despite vessel traffic and the associated noise, Cherry Point herring stock have continued to spawn on the Cherry Point shoreline and near the three existing marine industrial facilities.

5.8.1 Defining Noise at Cherry Point

There are three primary types of underwater noise:

- Physical – wind-driven, rainfall, breaking waves
- Biological – animal sounds
- Man-made – ship machinery, propellers, water disturbance.

Ambient noise conditions in the marine environment are dependent on source, propagation, and absorption conditions. Underwater noise in the natural environment is strongly affected by currents; bottom topography; water density variation due to salinity, turbidity, and temperature; the presence of manmade structures; noise from other sources; and surface conditions (wind and wave). Noise levels increase in shallow, hard bottom habitats. In the Cherry Point Resource Area, seafloor topography may create an unusual hydroacoustic situation. Alden Bank borders the western portion of the vessel-approach path. Sound produced by traveling vessels may reflect off Alden Bank and continue to resonate between the shore and the bank over the southern portion of the herring spawning area (EVS 1999).

It is unclear how vessels frequenting herring spawning grounds affect the fish. It is also unclear if the noise affects either herring spawning success or individual health. A preliminary study conducted during pier maintenance at the ConocoPhillips Ferndale Refinery is the only available study of underwater noise in the Cherry Point Resource Area. This study, conducted in 2007, measured ambient noise levels ranging from 139 to 159 decibels (dB). The ambient noise consisted of sounds generated by above-water construction (a crane on a barge), normal operations at the marine terminal, and natural sources. These levels are comparable to those cited by Washington State Department of Transportation of 115 to 135 dB measured in the Hood Canal replacement project, and 136 decibels dB in Eagle Harbor on Bainbridge Island

Schwartz and Greer (1984) tried to address research questions by playing recorded natural and anthropogenic sounds on captive Pacific herring. Avoidance responses were elicited by sounds of large vessels approaching at constant speed, by smaller vessels but only when on accelerated approach, and by 11 different triads of the electronically synthesized sounds. Alarm response and less frequently, a startle response, were both elicited by those electronic sounds with an essentially instantaneous rise time in amplitude. Herring did not respond visibly to any of the taped sounds of natural origin or to sonar or echo sounders.

Sufficient uncertainty exists from published studies and local conditions that one cannot make a definite statement that ship noise does or does not have any effect. Additional study is necessary to judge the effects of future increases in vessel traffic. Research is necessary to ascertain whether underwater sounds like those found at Cherry Point can affect herring or other species of concern at any life stage.

5.9 Vessel traffic and spill risk management at Cherry Point

Since the industrialization of the Cherry Point Resource Area, significant efforts have been made by industry, government and the public to reduce the risk of oil spills and the impacts of commercial and recreational vessel traffic within this area. Projected increases and other changes in marine vessel traffic in the area may increase the risk of accidents. Increased vessel traffic increases the risk of impacts from crude oil and petroleum product spills, fugitive dust, and incidental discharges.

This resource protection and management plan uses the term ***vessel traffic*** to include all forms of commercial and recreational navigation including, but not limited to: cargo ships, tank vessels, barges, tugs, fishing vessels, research vessels, military and governmental vessels. It also includes recreational boats although there is little data regarding their activity level in the Cherry Point area.

Vessel traffic within the Cherry Point region is predicted to increase within the next 10 – 20 years. Much of this predicted increase in traffic has been attributed to operations at a new terminal proposed for construction south of the BP pier. Major expansions at the Port of Vancouver will likely increase vessel traffic density in the approaches to and from Cherry Point. The area is also frequently used by commercial and recreational crab-fishing vessels, commercial trawlers and by seasonal whale-watching tours.

Large vessels load and unload raw materials and products at the three current facilities located in the Cherry Point area. These facilities have shown a steady increase in productivity, expansion, and commercial growth (market driven), which theoretically could result in an increase in regional and international vessel traffic transporting raw material and finished products. There is no study to support this conclusion. It should also be noted that not all ship transits present equal risk of spill. Estimates of the volume of various vessel types calling on this region are provided later in this plan along with recommendations for the types of data to be reviewed and archived by the resource area managers.

For some time, a vessel traffic risk assessment has been proposed for Cherry Point, similar to the one developed for the Washington State Ferries. This work is supported by the Washington Maritime Association, and the Washington State Office of Marine Safety (Harrald, 2006).

5.9.1 Regulatory Oversight

A number of regulatory agencies and committees in the state of Washington oversee vessel traffic and promote oil spill prevention. On the federal level, the Environmental Protection Agency is the lead federal response agency for oil spills occurring in inland waters, and the U.S. Coast Guard is the lead response agency for spills in coastal waters and deepwater ports.

The Washington State Department of Ecology 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. Ecology also tracks vessel entries and transits in Washington State waters.

Committees, councils, organizations and temporary panels that have regulatory oversight for vessel traffic include:

- Puget Sound Harbor Safety Committee, a forum for federal, state, and maritime community members to discuss vessel traffic management.
- Washington State Oil Spill Advisory Council, created in 2006, to maintain Washington's vigilance in the prevention of oil spills while fostering a long-term partnership and consensus between communities, government, and industry.
- North Puget Sound Long-Term Oil Spill Risk Management Panel, whose recommendations were provided in a report to the Coast Guard and Ecology in July, 2000 (Ecology 2000).
- Washington State Maritime Cooperative – a non-profit corporation that provides oil spill contingency plan coverage and emergency response systems to vessels in Washington waters
- International Maritime Organization, the United Nations' specialized agency responsible for improving maritime safety and preventing pollution from ships.

All tank vessels are required under RCW 88.46.040 to prepare and submit an oil spill prevention plan, and certain types of vessels must also submit a contingency plan per RCW 88.46.060. However, approval of a contingency plan by Ecology does not constitute an express assurance regarding the adequacy of the plan nor constitute a defense to liability imposed under that chapter of the RCW or other state laws (see RCW 88.46.040 (7) and RCW 88.46.060(10).

5.9.2 Vessel Traffic at Cherry Point and in Puget Sound

Vessel traffic in Washington State is tracked by Washington State Department of Ecology's Spill Program. According to Ecology, tanker traffic heading to Canada has increased significantly between 2006 and 2007 (See table 6). Ecology's vessel inspector Captain Laura Stratton has stated that 99% of these tankers take the Strait of Juan de Fuca, passing by Cherry Point. The alternative is the shallower, narrower, and much more dangerous Queens Island Sound route.

Data from Ecology's Vessel Entries and Transits (VEAT) System for Washington reports tank ships entering Puget Sound have been increasing, while barge transits have been decreasing. In general, total traffic counts have been relatively cyclical for tankers and barge traffic – neither significantly increasing nor decreasing over the four years examined[15]. More specific vessel docking data was collected by DNR as part of their lease agreement with BP.

[15] It should be emphasized that these numbers represent a fraction of the overall vessel traffic entering, transiting within and leaving Washington state waters. Please see the VEAT reports for more information at: http://www.ecy.wa.gov/biblio/spills.html

Table 6 Data from Ecology VEAT reports showing vessel traffic patterns in Puget Sound

Type of Tank Vessel[16]	**Total**				
Year	2007	2006	2005	2004	2003
Tank ships bound for Puget Sound	614	627	575	609	588
Tank ships bound for Canadian ports via Strait of Juan de Fuca	231	94	50	66	55
Tank Barge transits in Puget Sound	2472	3125	3913	3186	3007

Currently, the majority of raw materials used by the facilities are delivered by vessel. While future trends are difficult to predict, increases in productivity, expansion and organic commercial growth (market driven) reflect a steady increase in regional and international vessel traffic associated with raw material and finished product shipments. However, not all ship transits are of equal risk; risk is based upon size, type of vessel, cargo, weather, route, and other factors.

5.9.2.1 Risk of spills

The risk of a spill in the vicinity of Cherry Point is best measured by the amount of traffic traveling through the Strait of Juan de Fuca. As vessel traffic increases, the risk of a spill increases (Stratton 2008).

It is not possible to gauge if a spill would affect Cherry Point resources, but the risk is present, and it is increasing at the current rate of vessel traffic. Spills have occurred at the BP and Conoco-Philips Cherry Point facilities on several occasions. There is a wide range in confidence as to the accuracy of the volume of oil that has been spilled in the area, especially in earlier accounts. Accurate reporting of spills is important in determining impacts to habitat and biota. Washington State Department of Ecology has prioritized efforts on stopping the source of the spill, containing the spill, recovering the spilled product, and protecting environmental and human health. It was standard practice to accelerate cleanup and disposal of the waste generated, not analysis of cleanup volume, to achieve the most immediate, effective response. Only recently has Ecology begun to track and calculate the volume of spilled oil recovered.

The following list was provided by Ecology Spill Response Program (personal communication, 2009) during March 2009. The list is for reported spills where over 25 gallons of oil impacted water. This standard initiates a Natural Resource Damage Assessment (NRDA) and the amount of oil recovered within the first 24 hours of a spill event will be determined.

[16] A "tank vessel" is defined as any ship that is constructed or adapted to carry, or that carries, oil in bulk as cargo or cargo residue [RCW 88.46.010(20)].

- December 12, 1997 – FNT-340 barge @ ARCO dock

Spill of JP-5 jet fuel occurred while pumping, the lines backed up and product came out of the vents. After the leak was discovered, the USCG ordered offloading of the fuel. A drop valve was left open, product overflowed onto the deck and into the water. NRDA settled on 30 gallons to water.

- June 27, 1999 – ARCO Texas @ TOSCO Ferndale

Spill occurred during offloading, when strong currents and winds pulled the vessel away from the pier and pulling the loading arm off of the dock. No containment was used and there was no documented recovery volume. The spill to water was 1,050 gallons of crude oil, and NRDA estimated and settled on 300 gallons to water.

- June 13, 2001 – T/V Overseas Boston, ATC @ TOSCO Ferndale

The loading arm broke and released under pressure on the ship's loading arm. A significant quantity of the spill went to the dock and the ship deck. It was determined that 2,436 gallons of ANS crude oil was spilled to water and 2,016 gallons were recovered. The vessel was quickly boomed, which prevented the oil from spreading.

- August 28, 2001 – ITB Baltimore @ BP Cherry Point

Slop oil from the tanker leaked through a hole into a separated ballast tank. This ballast tank was being discharged while the tanker was being unloaded, resulting in a spill of oily wastewater. 150 gallons of gasoline went to water during the discharge. The total volume of wastewater discharged cannot be confirmed by Ecology.

- January 18, 2005 – Tank barge Noho Hele @ Conoco Phillips Ferndale

A tug hit the barge while positioning it at the docks, and a bolt from the fender system on the tug punctured a hole into the side of the barge. Diesel spill of 416 gallons to water, and NRDA determined that 91 gallons were recovered.

- February 14, 2005 – Tank barge PB-20 @ Conoco Phillips Ferndale

A fracture in the hull allowed heavy black oil IFO 380 to spill into the water. 109 gallons went to water, 91 recovered.

- June 9, 2008 – Tug Tiger @ Conoco Phillips Ferndale

Diesel spilled from the starboard day tank while the Tug was maneuvering from the lay berth to the end of the dock, possibly caused by a slight list. 120 gallons went to water, 0 recovery was documented (though it was likely that >50 gallons was recovered). NRDA settled on 0 gallons recovered.

During two of these spills, there were herring larvae present at Cherry Point Resource Area. A variety of ongoing efforts are being undertaken to better understand vessel traffic and spill risk along Cherry Point, including: major vessel traffic risk assessments required as part of new terminal developments, US Coast Guard review of designated anchorages, Department of Ecology oil spill contingency plan rules revisions and new oil transfer regulations, and ongoing Geographic Response Plan and Northwest Area Contingency Plan updates. In addition, further

study of dry cargo vessels may be needed, as they have been shown by the International Maritime Organization and Coast Guard to have the highest accidents rates among commercial vessels worldwide. Shipping companies mitigate these risks through thorough vetting processes.

5.9.2.2 Industry Role

The three industrial facilities located along Cherry Point have expanded considerably since their original construction resulting in increased vessel traffic. BP is the largest refinery in Washington State. It was originally built by Arco in 1972 to process approximately 4 million gallons of crude oil daily. Currently, its processing capacity is 9 million gallons of crude oil per day. The Conoco-Phillips refinery was originally built by General Petroleum in 1954 with a capacity of 1.5 million gallons per day; it as increased to nearly 4 million gallons a day. Most crude oil arrives by tanker, with a smaller amount coming from Canada by pipeline. Refined product is shipped out by pipeline, barge and rail.

Alcoa-Intalco Works is an aluminum smelter. Built in 1966, the capacity of the smelter in 1993 was 256,000 tons of alumina processed per year. This has increased to 307,000 tons yearly or 841 tons per day. Alumina is brought to the smelter by bulk carrier to the marine terminal.

The construction of a new major bulk cargo facility in the Cherry Point Resource Area would significantly increase vessel traffic. Current plans for the proposed facility (currently in the permitting phase) would result in approximately 140 additional round-trip deep draft barge berths per year. . Six ocean-going ship and barge berths are also planned for this facility. However, vessel traffic within the Cherry Point Resource Area is likely to continue to increase whether the proposed facility is built or not.

Recent investments by the tank vessel and barge industry in double hull and dual propulsion tankers are positive steps towards reducing the risk of a spill. As Alaskan oil continues to decline (Energy Information Administration, 2009) the number of tankers calling from distant ports increases the exposure of Washington waters to less capable ships.

5.10 Ballast water management

Washington is among the states that have chosen to regulate aspects of ballast water management. Other states include Maryland, California, Oregon, and Michigan. On an international level, efforts, which are voluntary, are guided by the International Maritime Organization. Congress is examining current EPA authorities to regulate ballast water in coastal areas. One of the primary incentives to better control of ballast water is to stem the introduction or re-introduction of non-native species to other countries or areas. Future efforts to control non-indigenous species introduced to the Cherry Point area will be directed by Ecology, WDFW, the U.S.Coast Guard, and EPA.

5.10.1 Ballast water issues

The rising levels of maritime shipping is increasing the risk of invasion by non-native species in Puget Sound and the Strait of Georgia. Un-exchanged ballast water discharges from commercial ships, such as those calling at the Cherry Point terminals, are a primary vector for introducing non-indigenous species. With improvements in travel technology, the rate of introductions of nonnative species has increased dramatically.

Non-native aquatic plant and animal species can displace, disturb, consume, and compete with native species (CRS 2007). Non-native organisms may also be attached to the hulls of commercial vessels. This is an identified problem at Cherry Point (Markiewicz, A. et al, 2005). Other introductions result from recreational boaters, commercial aquaculture, indirect Canadian maritime sources, and some natural sources.

A 2007 Congressional Research Service report was developed as Congress was considering whether or not to reauthorize the *Nonindigenous Aquatic Nuisance Prevention and Control Act* (NANPCA), including amending it to add specific provisions that would modify how ballast water is managed.

The CRS report found that globally, an estimated 10,000 marine species each day may be transported across the oceans in the ballast water of cargo ships. The economic, social, recreational, and ecological losses/costs attributable to aquatic invasive species are difficult to quantify. While some costs have been estimated, such as the $5 billion in damages to water pipes, boat hulls, and other hard surfaces by zebra mussels in the Great Lakes. Other costs, such as the loss of native species and environment restoration to pre-invasion quality, are unknown (CRS 2007).

Ships can manage ballast water through exchange or treatment. Exchange means that before reaching port, the lower-salinity coastal water from the last port is released and replaced with higher-salinity ocean water. This reduces the number of non-native species by flushing them out to sea, and it is assumed they are less likely to survive in the higher salinity environment. However, there is no guarantee all organisms are flushed out (CRS 2007).

Another approach is to treat the water. Ballast water treatment is currently highly researched, and a number of methodologies are being proposed. One treatment involves ultraviolet light, another is filtration and separation, others propose using heat, or electric current, and finally there are chemical treatments, such as biocides. A combination of these treatments is also possible (CRS 2007).

5.10.2 Invasive Species at Cherry Point

The risks of invasive species have been analyzed for the region including the Cherry Point Resource Area. Funded by U.S. EPA as part of a program to calculate the risk of an invasive species, the study located the invasive species European Green Crab (*Carcinus maenas*), and *Sargassum*, a non-native kelp. At the time of the research, green crab were being captured along

Vancouver Island – in relatively close proximity to Cherry Point (Landis et al. 2005; Colnar, A.M. and W.G. Landis. 2007).

Conversely, *Saragssum* is clearly an important habitat in Cherry Point, enhancing the underwater vegetated communities, although possibly posing a risk to native algae (Landis et al. 2005; Colnar, A.M. and W.G. Landis. 2007).

5.10.2.1 History of federal attempts to regulate ballast water management

In 1996, the National Invasive Species Act (NISA) created a national ballast management program modeled after the Great Lakes program. All ships entering U.S. waters after operating in the offshore, beyond the U.S. Exclusive Economic Zone, were directed to undertake high seas (i.e., mid-ocean) ballast exchange or alternative measures pre-approved by the Coast Guard as being equally or more effective.

Reporting was low during the first two years, as reporting was voluntary. The U.S. Coast Guard proposed mandatory reporting, with penalties for those failing to submit Ballast Water Management reports. The Coast Guard has implemented a similar program in the Great Lakes and other waterbodies, and it has proven very effective.

The CRS report states that other aspects of the NISA have been criticized as inadequate and faulted for several alleged shortcomings, including agency weakness or delay in implementing some of its provisions. Since then, NISA has exempted most coastal wide vessel traffic from ballast water exchange guidelines. Vessels traveling short distances between U.S. ports (e.g., from San Francisco Bay, which is highly invaded, to Puget Sound, which is less so) are exempt from controls. Some parties are critical of the provisions of 16 U.S.C. §4711(k)(2)(A) giving the vessel owner a blanket exemption to ignore any mandatory regulations if the master determines that the vessel might not be able to safely conduct a ballast water exchange on the open ocean. Finally, NISA has been criticized for its apparent failure to actually prevent additional introductions of damaging organisms into the Great Lakes, despite this being the one area where the requirements for managing ballast water have been the most stringent for the longest time (CRS 2007).

While the Coast Guard is responsible for managing the Ballast Water Management Program, and ensuring that vessels abide by it, the U.S. EPA is responsible for ensuring that the discharged water complies with the Clean Water Act.

On September 18, 2006, the federal district court ruled that EPA's regulations exempting ballast water discharges from the Clean Water Act was contrary to congressional intent and ordered EPA to promulgate new regulations within two years. This ruling essentially directs EPA to ensure that shipping companies comply with the Clean Water Act by restricting the discharge of invasive species in ballast water. The government has appealed the district court's ruling, and the parties are waiting for a ruling from the appeals court. However, in June 2007, EPA also initiated steps seeking public comment on regulating ballast water discharges from ships, an information-gathering prelude to a potential rulemaking in response to the district court's order. (CRS 2007).

5.11 Air quality, global warming, and climate change considerations at Cherry Point

5.11.1 Airshed Characterization

Cherry Point is located in the Georgia Basin/Puget Sound airshed. The Georgia Basin/Puget Sound (Basin) airshed is made up of two smaller and intertwined airsheds. The Georgia Basin airshed ranges from the lower Fraser Valley, and includes Whatcom County and the coast of the Strait of Juan de Fuca. The Puget Sound airshed encompasses counties located south of Whatcom County. Cherry Point air quality is influenced by air movement within this area.

The Environmental Protection Agency has described the Georgia Basin/Puget Sound airshed (Figure 18) in order to gain a better understanding of the current status of and trends in air quality, particularly given the rapid development in the area. Further detail can be found in *Characterization of the Georgia Basin/Puget Sound Airshed* (2004).

Figure 18. Georgia Basin/Puget Sound Airshed

5.11.1.1 Common Air Contaminants

The group of air pollutants referred to as common air contaminants (CAC) in Canada and as "criteria" pollutants in the Unites States include sulfur dioxide (SO_2), nitrogen (NO_2, ozone (O_3), carbon monoxide (CO), fine particulate matter ($PM_{2.5}$) and lead (Pb). The effects of these pollutants have been well-documented by the Northwest Clean Air Agency (2008) and include:

- **Health effects** These can be chronic (arising from long-term exposure), or acute,. For example, ozone is a very powerful oxidant which is an eye irritant and can also cause breathing difficulties, especially to older people or sick people or children.
- **Visibility impairment** Small particles are very efficient at scattering light and therefore reduce visibility.
- **Materials damage** Air pollutants may chemically alter the structure of a material. For example a sandstone sculpture will turn into gypsum after it has been exposed to sulfur dioxide, and gypsum is something that is much more brittle than sandstone. Ozone damages materials and causes fading to pigments.
- **Agricultural damage** Ozone is responsible for damage to the leaves of plants, it reduces crop yield and stunts tree growth. Acid rain not only affects bodies of water but also trees and crops.
- **Climate change** Global warming has been shown to be due to certain anthropogenic pollutants, also known as greenhouse gases, such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone (O_3), ammonia (NH_3) and others. Particulate matter also might cause global cooling due to increased PM emissions.

Other pollutants include ammonia (NH_3), which is considered toxic and is involved with the formation of $PM_{2.5}$. Indeed, most $PM_{2.5}$ is secondary in nature[17], with sulfate $PM_{2.5}$ and nitrate $PM_{2.5}$ originating from SO_2 and NO_2 respectively. Particulate matter may include heavy metals such as mercury and arsenic. Volatile organic compounds (VOC) are a group of gases that react with other airborne pollutants to form O_3, $PM_{2.5}$ and other secondary compounds. VOC also include the airborne persistent organic pollutants (POP) that are of particular concern because of their ability to bioaccumulate in living organisms.

Within the Georgia Basin/Puget Sound air basin, just like in many other areas of the USA and Canada, the main air pollutants of interest are ozone and $PM_{2.5}$, mostly because both pollutants are secondary in nature, thus making their control difficult. Ozone is detrimental to human health and causes damage to vegetation and physical structures. $PM_{2.5}$ is linked to respiratory and other health problems and also impairs visibility. Therefore, ozone and $PM_{2.5}$ constitute the main air quality pollutants in the Basin.

[17] Secondary pollutants are those which are not emitted directly into the atmosphere from identifiable sources but rather are created in the atmosphere from other pollutants. O_3 is such a pollutant, which is created in the atmosphere by VOC, oxides of nitrogen, and sunlight. Primary pollutants, on the other hand, are those which are emitted directly in the atmosphere from identifiable sources. CO from combustion sources is such a primary pollutant.

5.11.1.1.1 Point Source Emissions of Common Air Contaminants

In the *Characterization of the Georgia Basin/Puget Sound Airshed* (2004), EPA examined emissions from point sources. These are stationary emitters of pollution, such as refineries or power generating facilities, compared to an emitter that is not stationary (mobile sources, such as cars, or marine and locomotive engines) or a natural (biogenic) source. The EPA compared Puget Sound to the Georgia Basin and noticed that while some of the contaminants were similar, the contributors were slightly different.

In Georgia Basin, the most recent emissions inventory for 2000 (Department of Ecology in EPA, 2004) for the entire airshed shows the beginning of a change in important sources of contaminants. Marine vessels account for 22 per cent of the NOx emissions, with light-duty vehicles responsible for 23 per cent. Marine vessels are the largest single source of SO_2 in the airshed emitting 33 per cent of the SO_2 emissions. Agriculture is the dominant source of PM_{10} (21 per cent), with space heating responsible for 20 per cent of the $PM_{2.5}$. The 2000 inventory also shows how the use of a single surrogate (population) to compare emission levels can be misleading. Whatcom County has just 7% of the entire population in Georgia Basin, but also has several major industries, contributing 29 % of the-smog-forming emissions. Contrast this to the Greater Vancouver Regional District, with 83 % of the population, emitting 56% of smog-forming emissions, and the Fraser Valley Regional District, with 10 % of the population, producing just 15 % of the emissions (EPA 2004).

5.11.1.2 Local Air Quality

Between the years 1900 and 1970, the emissions of various pollutants increased significantly. In 1970, the Clean Air Act Amendments (CAAA) were signed into law, providing a departure from previous federal strategy on combating air pollution. Two types of pollutants were to be regulated according to these new laws:

- The criteria pollutants[18] which were to be regulated to achieve the attainment of the National Ambient Air Quality Standards (NAAQS), including primary standards for the protection of public health, and secondary standards for the protection of public welfare.
- The hazardous air pollutants[19] which were defined as those "to which no ambient air standard is applicable and that ... cause, or contribute to … an increase in mortality or an increase in serious irreversible or incapacitating reversible illness."

The local clean air authority that monitors Whatcom, Skagit and Island counties is the Northwest Clean Air Agency (NWCAA). The NWCAA is one of seven regional air quality control agencies located throughout Washington State. It was established in 1967 after passage of the Washington State Clean Air Act (RCW 70.94). The agency is responsible for enforcing federal, state and local air pollution regulations in Island, Skagit and Whatcom counties. Also, the NWCAA monitors ambient air and emissions. Ambient air monitoring helps air quality

[18] The current list of the six criteria pollutants are: ozone, sulfur dioxide, nitrigen dioxide, carbon monoxide, particulate matter and lead.
[19] The list of 188 HAP, about half of which are either known or suspected carcinogens, includes benzene, mercury, asbestos, and others.

authorities gather data about pollutants in the air, monitor for trends, judge progress, and determine if emergency measures are needed to alleviate air pollution episodes.

The NWCAA produces annual emission inventories from large stationary industrial facilities within its jurisdiction, including those located within the Cherry Point site. The data shown in the table below do not include emissions from mobile sources, biogenic sources, or area sources. The NWCAA reports that for the 2004 and 2005 years, for all of Whatcom County, the primary stationary sources of particulate matter (PM_{10}), sulfur dioxide (SO_2), nitrogen dioxide (NOx), volatile organic compounds (VOC), and carbon monoxide (CO) were the industrial facilities located at Cherry Point: Alcoa Primary Metals (Intalco), BP West Coast Products, and ConocoPhillips (NWCAA, 2006).

These facilities at Cherry Point contributed an average of 92% of all monitored industrial air pollutants from stationary sources in Whatcom County in 2005 and 2006 . Results of monitoring showed that four of the five monitored pollutants decreased between 2004 and 2006 (NWCAA, 2004, 2005, 2006).

Table 7. Emissions inventory, in tons per year, from large industrial facilities leasing state-owned aquatic land at Cherry Point compared to Whatcom County total, for the years 2004, 2005, and 2006. From the Tri-County Emissions Monitoring Reports, Northwest Washington Clean Air Agency.

Cherry Point Facilities and County Total Emissions	**Particulate Matter (PM_{10})**	**Sulfur Dioxide (SO_2)**	**Nitrogen Dioxide (NOx)**	**Volatile Organic Compounds**	**Carbon Monoxide (CO)**
2004 County Total, including facilities	480	4242	3836	1181	16442
2004 Cherry Point Facilities (% of county total)	402 (84%)	4186 (99%)	3447 (90%)	1070 (91%)	16328 (99%)
2005 County Total, including facilities	450	3676	3793	1359	12586
2005 Cherry Point Facilities (% of county total)	363 (81%)	3627 (99%)	3420 (90%)	1228 (90%)	12462 (99%)
2006 County Total, including facilities	431	3499	3622	1412	12616
2006 Cherry Point Facilities (% of count total)	347 (81%)	3478 (99%)	3241 (89%)	1296 (92%)	12500 (99%)
Cherry Point Facilities Change 2004-2006	(-133)	(-764)	(-595)	+115	(-3942)
County Change 2004-2006	(-49)	(-743)	(-214)	+231	(-3826)

The county is currently in attainment (meeting requirements) under EPA standards set forward by the Clean Air Act and administered by the Northwest Clean Air Authority for this region (NWCAA, 2008).

5.11.1.3 Relationship of Air Pollution Management to Cherry Point Resource Area

While considerable work has gone into understanding and regulating air pollution in the region and specifically at the Cherry Point industrial facilities, little is actually known about the relationship of this pollution to the health of the aquatic ecosystem and the organisms that rely on it. Water quality studies in this area should attempt to quantify air deposition in their evaluation of sources.

5.11.2 Climate Change Considerations

Climate variability must be considered when discussing how the climate changes. At Cherry Point, global warming will occur within the context of existing inter-annual and inter-decadal climate variability. There are two recognized natural sets of climate variability that impact the climate of the Pacific Northwest: the Eastern Pacific Decadal Oscillation (PDO) and the El Nino/Southern Oscillation (ENSO). The PDO is the main source of inter-decadal climate variability. The PDO is characterized by two phases: a warm phase and cool phase. During the 20th century, each PDO phase lasted 20 – 30 years. The last warming trend began in the mid-1970s and persisted until at least 1998. Regional climate changes in the 1990s suggest that the PDO may be shifting back to a cool phase in recent years. ENSO is the main source of inter-annual climate variability. ENSO events are more commonly referred to as El Nino (the warm phase of ENSO) and La Nino (the cool phase of ENSO) events. Each ENSO phase typically lasts 6 to 218 months and can have dramatic climatic effects. During El Nino a gyre is formed outside of the Straits of Juan de Fuca that dramatically changes currents and can aid in the dispersal of invasive species (Yeh and Kirtman 2004). At present it is unclear how global warming will affect these two large scale patterns of climate variability; furthermore, even considering the PDO and the ENSO, about 70% of the climate variability is unexplained (CIG 2008).

The question becomes how much will the natural climate variability be altered by human activities – specifically, the alteration of the earth's energy balance resulting from the accumulation of greenhouse gases in the atmosphere (CIG, 2005). That tipping of the balance is what many call "***climate change***."

5.11.3 Greenhouse Gases and Global Warming – role of emissions and contaminants at or adjacent to Cherry Point

As mentioned earlier, atmospheric concentrations of greenhouse gases are the primary contributor to climate change. The gases trap the sun's radiation as it passes through the atmosphere, altering natural climate variability through a mechanism known as "global warming," an average increase in the temperature of the atmosphere, which contributes to changes in global climate patterns.

5.11.3.1 Global Warming and Greenhouse Gases

Global warming can occur from a number of causes, both natural and anthropogenic. The increased emissions of greenhouse gases, so called because of their ability to absorb infrared radiation emitted by the earth, associated with human activities are the most commonly recognized link to global warming. However, other activities include changes in solar radiation, volcanic activity, and changes in the ocean's circulation (EPA 2008).

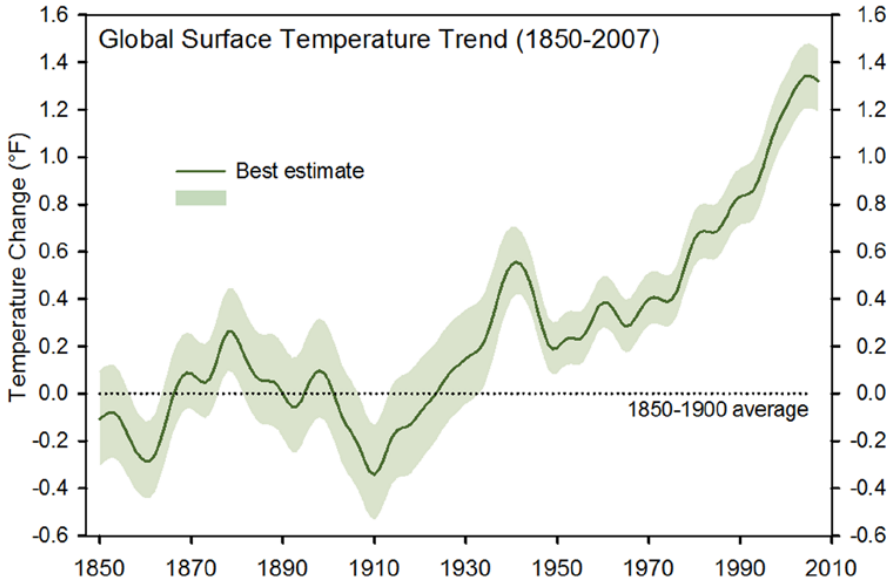

Figure 19. Average global surface temperature based upon instrumental measurements (Adapted from Brohan et al. 2006 © Crown copyright 2006, data supplied by the Met Office). Temperature rise during the twentieth century is much larger than the uncertainty range.

While it is increasingly clear that atmospheric warming is occurring (Figure 19), there are a variety of estimates for the amount of atmospheric warming and the resulting change in sea level and climate conditions. The estimates of change are even more variable at small sites such as the Cherry Point. A general trend in warming is being measured and tracked; according to the Office of the State Climatologist, temperatures at Bellingham, Sedro Woolley and Everett monitoring stations have increased by 1.14 - 1.15F° between 1915 and 2006 (OWSC 2008). The question remains as to how significant that warming trend is, over this period of time, and how will it change in the future.

5.11.4 Potential Impacts

Human and naturally induced climate change have the potential to significantly alter the physical and biological characteristics of Cherry Point. Impacts include: ocean acidification, sea level rise, increased storm severity, increased water temperature, photo enhanced toxicity, which may result in changes to species abundance and distribution. It is unclear how climate change will interact with natural alterations of the Cherry Point Resource Area related to El Nino/La Nina cycles, or the Eastern Pacific Decadal Oscillation. Climate change could impact most of the management actions in this plan.

5.11.4.1 Sea Level Rise

Sea level rise could lead to flooding of low-lying property, loss of coastal wetlands, erosion of bluffs and beaches, saltwater contamination of drinking water, and decreased longevity of low-lying roads, causeways, and bridges. In addition, sea level rise could increase the vulnerability of coastal areas to storms and associated flooding. At Seattle, Washington, sea level already is rising by 8 inches per century, and it is likely to rise another 19 inches by 2100 (EPA 1997).

A reduction in the availability of tidal marsh/tidal flat habitats could occur, as sea level rise combined with increased river flow increases the salinity of the nearshore area while decreasing the availability of tidal marsh areas. Cherry Point has several scattered salt marsh habitats that could be affected by changes in salinity and rising water levels. The EPA states that commercial shellfish communities (e.g., oysters and clams) and duck and geese populations that utilize these flats for habitat and feeding also may decline accordingly. The commercial and recreational shellfish activities in the Cherry Point Resource Area may also be affected by these changes.

Washington's coastal region consists primarily of cliffs and a few low-lying tidal flats. Possible responses to sea level rise include building walls to hold back the sea, allowing the sea to advance and adapting to it, and raising the land (e.g., by replenishing beach sand and/or elevating houses and infrastructure). Each of these responses will be costly, either in out-of-pocket costs or in lost land and structures. The cumulative cost of sand replenishment to protect Washington's coastline from a 20-inch sea level rise by 2100 is estimated at $143 million to $2.3 billion (EPA 1997).

5.11.4.2 Increases in ocean heat content

Studies have measured an increase in ocean warming that is separate from the natural internal variability of the temperature cycles in the Atlantic, Indian and Pacific oceans (Levitus et al, 2005 in Pew 2008). This gradual warming has been occurring for five decades, according to scientists from the U.S. National Oceanographic and Atmospheric Administration (Levitus et al. 2005). The only way to force enough energy into the system to warm all the world's oceans so quickly and simultaneously is through external means (Hansen, Nazarenko et al. 2005). Modeling (see Figure 20) has supported this conclusion. Also evident on the graphs is that the highest increases in temperature (observed, recorded) are occurring in or adjacent to the shallowest areas, as would be expected. This may have implications for nearshore resources that are temperature sensitive, such as spawn.

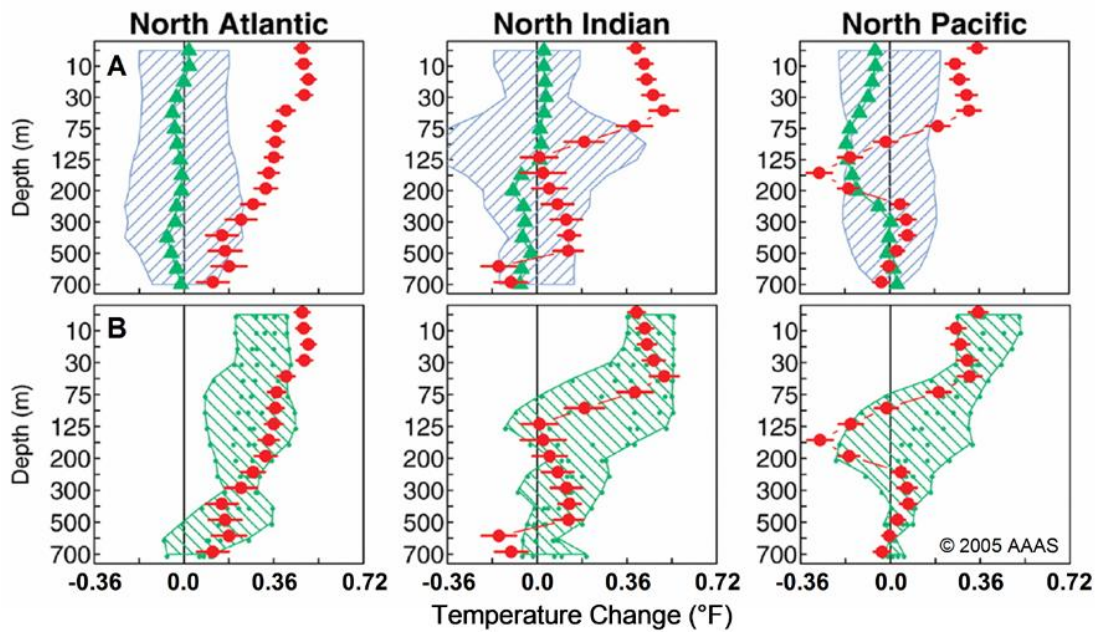

Figure 20. Observed and simulated heat penetration into three ocean basins (Adapted from Barnett et al. 2005; Reprinted with permission from AAAS). (A) The ***blue hatched region*** represents the 90% confidence limits of modeled ***natural*** internal variability resulting from heat exchange among different ocean basins. Note how the actual, observed temperature change (the red dots) does not fit the model. The green triangles represent a warming trend forced by observed solar and volcanic variability. It also does not fit what would be expected from natural, internal variability. (B) Change the model so that it represents ***human-induced*** warming resulting from greenhouse gases and sulfate aerosols (***green hatched region***) and the red dots, or observed temperatures, show substantial fingerprint matching with the observed heat penetration.

5.11.4.3 Increases in air temperature

Warming by small incremental amounts such as a few degrees can have a wide variety of impacts. According to the EPA and Ecology, warmer temperatures can affect our snowpacks, time of peak snow melt, glaciers, lower stream flows, exacerbate the decline of salmonids, and increase sea level rise (Ecology 2007), as previously discussed.

5.11.4.4 Changes in fish and wildlife

The EPA stated in a 1997 report that the primary natural features of Washington that are vulnerable to climate change are its extensive rivers, streams, and coastal estuaries, noting that these three environments are critical for a wide diversity of wildlife, endangered species, and commercial and sport fisheries. Should climate change alter the flows of freshwater streams, whether seasonally or otherwise, it could reduce the amount of suitable salmon spawning habitat. In recent years, populations of salmon and steelhead have been reduced to less than 10% of historical levels. The EPA states that these past losses cannot be attributed to climate change, but that pink and chum salmon – both of which are documented at Cherry Point - could lose all of their habitat with climate change. Other cold water species such as brook trout, brown trout, and mountain whitefish could lose most of their habitat. Climate varies naturally over both short and long time-scales, but natural climate variability can be distinguished from human-caused climate change.

5.11.5 Regional and International Initiatives to address emissions and global warming

5.11.5.1 Western States Climate Initiative

The Western States Climate Initiative (WCI) was launched in 2007 to identify, evaluate, and implement collective and cooperate ways that will reduce greenhouse gases in the region, focusing on a market-based cap-and-trade system. It is a collaboration involving seven U.S. governors and four Canadian Premiers. The goal of this program is to assist with a regional effort to reduce the pollution that causes global warming to 15% below 2005 levels by the year 2020 (WCI 2008).

Greenhouse gases that are targeted under the WCI are: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Also covered under the WCI are emissions from electricity generation, industrial and commercial facilities, and a number of other emissions, including certain types of residential and transportation. Regulated entities will use a consistent reporting methodology, and any economic impact on consumer or regulated entities will be mitigated for (WCI 2008).

A cap-and-trade program sets a limit or "cap" on greenhouse gas emissions from a sector or multiple sectors. Tradeable emissions "allowances", or permits, are then distributed in the same amount that equals the total amount of emissions permitted by the cap. Each Partner in the WCI will be given an "emission allowance budget" that is consistent within the jurisdiction-specific emissions goal for the year 2020. The Partner has discretion on how to use the budget; a Partner could "give" allowances to other emitters within the jurisdiction, "auction" for a profit to willing buyers, or do a combination (WCI 2008).

The cornerstone of the cap-and-trade system is the reporting requirements, which are independently verified. At the end of a compliance period, if facilities and entities do no return to the government the same amount of emissions allowances they were initially provided with, they are penalized a sum of three allowances for every one they are short (WCI 2008).

5.11.5.2 MARPOL and other Initiatives

Air pollution from ships burning diesel, bunker oil and other fuels may be a concern, if an expansion of a pier or an additional pier lead to a significant increase in vessel traffic. As mentioned earlier, a recent inventory of emissions in Georgia Basin airshed shows marine vessels account for 22 per cent of the NOx emissions, and also that marine vessels are the largest single source of SO2 in the airshed emitting 33 per cent of the SO2 emissions (EPA 2004).

The Member States of the International Maritime Organization (IMO) has developed estimates for international shipping and carbon emissions. During October of 2008, the IMO Marine Environment Protection Committee updated a 2000 study on greenhouse gas emissions from ships. Using activity data and international fuel statistics, the conclusion was that 2007 CO2 emissions from international shipping would be 2.7% of all global CO2 emissions, or 843 million tons. This is an increase from 1.8% estimated in 2000. The Commission will wait before developing any further updates pending global developments outlined by the Intergovernmental

Panel on Climate Change (IPCC). Also, in the absence of future regulations on CO2 emissions from ships, such emissions were predicted in the base scenarios to increase by a factor of 2.4 to 3.0 by 2050 (IMO 2008).

On October 9, 2008, the IMO adopted new international standards for marine diesel engines and their fuels. This important new program matches closely the program that the United States Government first advanced at the IMO in February 2007. The IMO program, contained in amendments to Annex VI to the International Convention for the Prevention of Pollution from Ships (also called MARPOL), consists of engine and fuel sulfur standards (EPA 2008).

The program is geographically-based, meaning that ships that operate in designated Emission Control Areas (ECAs) – or "sensitive" areas – will be required to use the most advanced technology-forcing engines, and the sulfur content of the fuel used in those areas cannot exceed 1,000 ppm. In all other areas of the world, including on the high seas, engine emissions will be also be reduced, and the global fuel sulfur cap outside ECAs will drop to 5,000 ppm in 2020 (pending an availability review in 2018) (EPA 2008).

The EPA states that this new international program will provide benefits to national air quality. The IMO and the WCI are two ways that address air quality improvements, targeting those emissions that play a role in global warming.

The IMO's MARPOL amendments is one part of the Marine Vessel and Port Emission Reductions Initiative, supported by Environment Canada, the U.S. EPA, state and local agencies such as Metro Vancouver, Northwest Clean Air Authority (NWCAA), and Ecology. These amendments state that marine vessels are a large, growing source of smog in the Georgia Basin/Puget Sound airshed, and that marine vessel activity is projected to double in some areas, or even triple, in the next ten to twenty years. Reducing air emissions will ensure compliance with federal and local air quality standards, as well as project public health, the environment, and improve visibility.

5.11.6 Summary of Climate Change Considerations

In summary, the alterations due to natural and human induced climate change will affect many of the actions listed in the remainder of the document. An adaptive management approach which considers climate change trends and indicators is recommended when planning research studies and evaluating impacts of new management. Adaptive management requires that the potential for change be measured, the effects monitored and that management actions be modified to meet the need. Further measurement and monitoring can then provide information on the effectiveness of the management activity. In the case of climate change it is unlikely that any one activity at Cherry Point can effectively alter the degree of the global warming trend, but if the impacts are identified early and understood, this will help develop appropriate mitigation and/or adaptive management actions for this resource protection and management plan.

6 Desired Future Conditions

The following list is a summary of the desired future conditions for the Cherry Point Resource Managers Area. This list was formulated by combining potential management objectives and addressing ecological questions.

6.1 Natural resources

The following are desired future outcomes for natural resources and natural resource management:

- Marine and freshwater systems meet State surface water quality standards;
- The Cherry Point Resource Area is not listed on the 303(d) list for impaired waterbodies;
- Groundwater systems meet State water quality standards;
- Naturally functioning environmental processes create and sustain habitats (nearshore drift and high energy intertidal environment);
- Riparian, nearshore and offshore ecosystems supports spawning, breeding, nesting, feeding habitat and movement corridors for local and migratory fish and wildlife;
- No new introductions of invasive species.

The actions addressing these desired future conditions will be implemented consistent with and under the umbrella of the Goals of the Puget Sound Action Agenda[20].

6.2 Business and industry

The following are desired future outcomes for business and industry:

- Successful and sustainable businesses at Cherry Point;
- Successful operation of the Birch Bay Water and Sewer District's wastewater treatment plant;
- Successful commercial fisheries in concert with commercial vessel traffic.

6.3 Recreation and public access

The following are desired future outcomes for recreation and public access:

- Ample opportunities for public access;
- Recreational users are informed and impacts are avoided or minimized;

The actions addressing these desired future conditions will be implemented consistent with and under the umbrella of the Goals of the Puget Sound Action Agenda[21].

[20] See Puget Sound Partnership Action Agenda: Table 1-1: Ecosystem recovery goals, desired outcomes and provisional indicators, page 14 – 16. Goals 4, 5, and 6 (December 1, 2008)
[21] See Puget Sound Partnership Action Agenda: Table 1-1: Ecosystem recovery goals, desired outcomes and provisional indicators, page 14 – 16. Goals 1,2, and 3 (December 1, 2008)

6.4 Culture and history

The following are desired future outcomes for culture and history:

- Significant historical findings are documented.
- Schelangen (language, culture, heritage, traditional practices and places, or way of life) is protected and preserved;
- Natural resources that are part of their tradition and are required to sustain and enhance the quality of life of the Lummi Nation and the Nooksack Tribe are protected and preserved;
- Community and economic development is conducted in a manner that is respectful of, and in harmony with, traditional cultural values and the needs of the Lummi Nation and the Nooksack Tribe.
- A Cultural Resources Protection Protocol is developed and implemented

7 Management Actions

Management actions address the goals and objectives identified in section 6, and identify ways to address potential risks outlined in section 5. The Management Actions recommended in this resource protection and management plan are based upon the recognition of the unique conditions at the Cherry Point Resource, and the identification of ongoing, unanswered questions related to the area.

Management actions have been developed to address the plan's goals and objectives. This section will detail the management actions that should be carried out over the initial 10 years of the resource protection and management plan. The management actions should improve the ecological condition of the management area and will assist in the adaptive management process, which is ongoing.

Since most of the long-term goals and management strategies for Cherry Point depend on understanding the baseline ecological conditions within the area, a major emphasis during the first ten years will be placed on determining these baseline conditions. After resource conditions are determined, specific quantifiable goals for the ecosystem will be developed and incorporated into the plan.

Establishing a baseline will be accomplished through studies that initially identify data gaps, then study topics in depth as necessary to better understand Cherry Point ecosystems. The topics listed below include general guidelines for designing such a baseline study and any subsequent research to specifically identify the components that required further study. A primary function of this plan is to facilitate the coordination and sharing of data generated by research among the interested parties.

Additional management actions will address what DNR currently knows about the ecosystem at Cherry Point, potential impacts, and the uses and activities occurring there. DNR recognizes that uses may change over time. This section identifies actions to protect, restore and prevent future degradation of aquatic resources in the Cherry Point Resource Area.

Each general topic of ecological question is provided a section in this plan. Within each topic area the identified management activities are divided into four primary categories:

- Protection
- Enhancement and Restoration
- Monitoring, Data Collection, and Research
- Outreach and Education

Cooperating parties that are needed for each action to be successful have been identified and outlined below.

7.1 Conservation of Ecosystems at Cherry Point

Protection

- Protect existing native vegetation to maintain wooded buffers within the setbacks landward of the top of the bluffs. Encourage landowners to manage adjacent lands to ensure that woody material is available to the nearshore system through time as the shoreline retreats in response to geomorphic processes and anticipated sea level rise. Cooperators: Whatcom County.
- New salt water intake structures should be located outside of forage fish spawning areas and juvenile salmonid migratory corridors (-30 ft. depth). Cooperators: WDFW
- Cable or pipeline installations should not be allowed unless horizontally drilled beneath the Cherry Point Resource Area. Cooperators: Ecology, WDFW, DNR, Whatcom County
- Regulatory agencies should required best available technology in permits for all new structures to prevent harm to key habitats and species. Cooperators: COE, Ecology, WDFW, DNR, Whatcom County

Restoration & Enhancement

- Inventory and remove derelict fishing gear in the Cherry Point management area. Cooperators: Whatcom Marine Resources Committee, DNR, WDFW.
- Remove derelict gravel conveyor at Gulf Road to eliminate creosote pilings and allow recolonization of marine vegetation in the footprint of the structure. Cooperators: landowner.
- Encourage enhancement of native vegetation along shoreline, particularly along county-designated setback zones landward of the tops of bluffs. Cooperators: Whatcom County.

Monitoring, Data Collection & Research

- Inventory and characterize riparian condition. Monitor condition at regular intervals. Evaluate trends and environmental effects of management. Cooperators: Beachwatchers, Whatcom Marine Resources Committee.
- Conduct detailed seafloor mapping and analyze habitat characteristics within the management area. Cooperators: Research institutions, DNR.
- Identify and catalog habitat protection, enhancement, and restoration opportunities within the management area with special emphasis on native Submerged Aquatic Vegetation. Cooperators: WDFW, Ecology, DNR, affected tribes, Beachwatchers, Whatcom Marine Resources Committee.

Education and Outreach

- Educate homeowners abutting the shoreline regarding the importance of riparian vegetation protection. Cooperators: Whatcom County, Whatcom MRC, Beachwatchers.
- Make information and results readily available to the public, regulatory agencies tribes and education institutions. Cooperators: Plan manager, research partners.

7.2 Impacts to indicator fish and wildlife species of Cherry Point ecosystems

Protection

- Minimize disturbance of riparian vegetation adjacent to freshwater streams and wetlands, and along marine shorelines. Cooperators: Whatcom County.
- Identify necessary and immediate protections for forage fish spawning habitats. Cooperators: WDFW, DNR, affected tribes, Beachwatchers, Whatcom Marine Resources Committee.
- Identify necessary and immediate protections for marine and terrestrial bird habitat. Cooperators: WDFW, DNR, affected tribes, Beachwatchers, Whatcom Marine Resources Committee.
- Identify necessary and immediate protection for submerged vegetation habitat. Cooperators: WDFW, DNR, affected tribes, Beachwatchers, Whatcom Marine Resources Committee.
- Prevent loss of submerged aquatic vegetation from new structures. Cooperators: WDFW, DNR, Ecology, COE, Whatcom County.

Restoration & Enhancement

- Encourage restoration of native plant species most adapted to the local conditions in areas of freshwater or marine shorelines where riparian habitat has been either removed or eliminated as a result of past human activities. Cooperators: Whatcom County, Whatcom Marine Resources Committee.

Monitoring, Data Collection & Research

- Complete the validation of the herring larval survival and growth test in a commercial lab to finalize protocol for use by regulated community. Cooperators: Ecology, WWU
- Repeat and expand on the herring embryo temperature tolerance study. Cooperators: Ecology, WWU
- Conduct surveys to determine abundance, distribution, and population trends of nearshore and riparian bird species. Encourage and provide assistance to ongoing studies including WWU and PSAMP programs. All avian studies should be conducted throughout the year for a complete understanding of the use and trends in the Cherry Point Resource Area. Cooperators: WWU, Audubon
- Continue monitoring of local fish (salmon, flatfishes, forage fish) and shellfish (Dungeness) populations to evaluate trends and effectiveness of management. Cooperators: WDFW, WWU, Whatcom Marine Resources Committee, Beachwatchers
- Identify the location, extent and quality of other forage fish (e.g., surf smelt, sand lance) spawning habitat. Cooperators: DNR,WDFW, Whatcom Marine Resources Committee, Beachwatchers
- Measure the diversity, distribution, and abundance of intertidal species adjacent to and within the Cherry Point Resource Area. Cooperators:WDFW, Whatcom Marine Resources Committee, Beachwatchers
- Continue the mapping of submerged aquatic vegetation within the entire management area at five year intervals to provide a dynamic baseline inventory. Evaluate trends and environmental effects of management. Methodologies should be comparable with previous inventories. Cooperators: DNR, Whatcom Marine Resources Committee, Beachwatchers,
- Continue monitoring of the Cherry Point herring stock population and spawning events to evaluate trends and effectiveness of management. Cooperators:WDFW
- Determine causes for small size, low hatch rate, and the high rate of abnormal development in Cherry Point herring stocks. Cooperators: WDFW, Ecology, WWU

Education and Outreach

- Make information and results readily available to the public, regulatory agencies tribes and education institutions. Cooperators: Plan manager, research partners.

7.3 Water Quality

Protection

- Repeat and expand on the ambient water toxicity study to evaluate cumulative effects of industrial wastewater outfalls. Cooperators: Ecology, WWU.
- Address any known permit or regulatory violations to ensure ongoing compliance with State Water Quality Standards and Sediment Management Standards. Cooperators: Ecology, Dischargers.
- Take action to reduce sources of non-point source pollution. Cooperators: Whatcom County, Ecology
- Implement the Programmatic Solutions identified as recommendations in the Birch Bay Comprehensive Stormwater Plan (2006). Cooperators: Whatcom County .
- Ensure that new shoreline related development does not cause erosion and nonpoint source pollution from upland activities. Cooperators: Whatcom County, Ecology.
- Provide technical assistance and incentives to property owners to retrofit existing tightlines drains. Many are inadequate, resulting in erosion due to leaks and breaks. Cooperators: Whatcom County.
- Encourage homeowners to intercept increased surface water and shallow groundwater resulting from alterations of the natural hydrology of upland portions of bluff properties to maintain and restore natural rates of erosion from Point Whitehorn to Birch Bay State Park, specifically the Holeman, Birch Bay Drive Bluffs, and high berm segments (identified in Johannessen, 2003). Cooperators: Whatcom County.
- Encourage and support proposals for water quality treatment system upgrades to the existing discharges where needed, ensuring that they will minimize impacts to habitats. Cooperators: Ecology.
- Ensure compliance with all state and federal regulations for the discharge of onboard sewage while transiting the Cherry Point Resource Area or while berthed at industry piers. Cooperators: Ecology, Coast Guard.
- Encourage and support proposals for the treatment and re-use of stormwater, re-use of treated wastewater and re-claimed water, and water conservation programs in order to reduce discharges. Assist existing dischargers with alternatives for water re-use, designs, permits, and information on applicable grant funds. Cooperators: Whatcom County, Whatcom PUD, Birch Bay Water and Sewer District, Ecology, Dischargers.
- Prevent water quality degradation and habitat loss from any new stormwater or wastewater outfall. Cooperators: Whatcom County, Whatcom PUD, Birch Bay Water and Sewer District, Ecology, Dischargers.
- Require all new construction to meet requirements of the Birch Bay Plan including low impact development designs where appropriate. Cooperators: Ecology, Whatcom County
- Design and implement strategies to reduce onsite system pollution if needed. Seek funding alternatives to encourage landowner participation. Cooperators: Whatcom County

Monitoring, Data Collection & Research

- Seek out and coordinate funding to address water quality monitoring, data collection and research. Cooperators: Plan manager
- Evaluate residential areas to identify sources of onsite system pollution. Cooperators: Whatcom County
- Prepare summary reports of discharge data to evaluate long term trends. Cooperators: Plan manager, Ecology
- Continue and expand the ambient toxicity assessment using protocols accepted by EPA and WDOE. Consider the use of caged mussel, harbor seal blood chemistry and other biological impact assessments for monitoring of indicators of potential problems. Cooperators: Ecology, WWU
- Assess the cumulative impacts of the wastewater discharges from the industrial and municipal facilities discharging to the waters of the Cherry Point Resource Area to include pharmaceuticals and other endocrine disrupters. Integrate discharge information from the Birch Bay Water and Sewer District and any other dischargers to the Resource Area into the Effluent Plumes Modeling Study model and re-assess conclusions. Emphasis should be on providing a more comprehensive sampling regime along the intertidal and upper sub-tidal zones. Cooperators: Ecology, Wastewater dischargers, Birch Bay Water and Sewer District, Lummi Nation
- Require sediment quality studies as a part of all NPDES permits. Cooperator: Ecology
- Characterize sediment chemistry throughout the Resource Area. Areas outside sediment impact zones should be evaluated with particular attention to the intertidal and upper subtidal zones. Cooperators: Leaseholders, DNR, Ecology
- Characterize sediment, groundwater, and surface water sources and quality within the depositional zone of the surface water runoff at Unick Road. Cooperators: Whatcom County, Ecology
- Locate freshwater seeps and describe groundwater movement patterns from upland areas to nearshore. Describe volume of flows and effects on the marine ecosystem. Cooperators: Whatcom County, Ecology
- Evaluate relationship of the Treoil site on inter-tidal water quality. Cooperators: Ecology
- Monitor toxicity in the nearshore to assess potential impacts of contaminated groundwater discharges. Cooperators: Ecology

Restoration & Enhancement

- Implement the Treoil Site Emergency Interim Actions March (2000) to characterize and stabilize waste and releases at the site. Ecology should investigate the need to raise this site to a higher priority on their Contaminated Sites List for remedial action because of questions for potential contamination of the Resource Area. Cooperator: Ecology
- Clean-up plan groundwater contamination from the Treoil site. Provide on-going groundwater characterization. Cooperators: Ecology, Whatcom County
- Investigate and remediate un-authorized dump sites. Cooperators: Ecology
- Minimize or prevent any new sources of nonpoint pollution to the Cherry Point Resource Area. Special emphasis should be placed on limiting impacts from stormwater runoff. Cooperators: Whatcom County, Ecology

Education and Outreach

- Provide outreach and education to residential property owners on use of eco-friendly fertilizers, herbicides, and pesticides. Cooperators: Ecology, Whatcom County, Beachwatchers
- Make information and results readily available to the public, regulatory agencies tribes and education institutions. Cooperators: Plan manager, research partners.

7.4 Disturbance from Recreational Activities

Protection

- Implement the following restrictions and/or recommendations on the public beaches accessible from the new park planned for Point Whitehorn:
    - No dogs should be allowed on the beach. They cause disturbance and harassment of birds and wildlife. A seal haul-out area is near the new park access.
    - Education should be provided regarding the sensitivity of the Cherry Point ecosystem. Visitor should be advised to "Stay on bare rock and sand" to avoid trampling of sensitive aquatic plants and organisms.
    - No beach fires should be allowed.
    - Visitors should be advised to avoid illegal removal of marine organisms (see WDFW regulations), wood and substrate.
    - A plan should be developed and implemented that will result in the maintenance, and if appropriate, restoration of bluff vegetation.

  Cooperator: Whatcom County (Parks)

- Investigate opportunities to coordinate with security needs of facilities to address public access management objectives. Cooperators: Whatcom County, DNR, Industrial landowners.
- Enforce existing shellfish harvest regulations with emphasis on the ecological impacts of unfilled holes. Cooperator: WDFW
- Public access may be improved and developed in the area of Gulf Road in the future. Whatcom County should coordinate with the owner of the beach to strive for the same kinds and levels of protection provided at the Point Whitehorn park: Cooperators: Whatcom County

Restoration & Enhancement

- Restore areas impacted by recreational shellfish digging activities to natural beach contours. Document the impacts/effects of restoration. Cooperators: Whatcom County Marine Resources Committee, Beachwatchers

Monitoring, Data Collection & Research

- Evaluate recreational harvest impacts on the Cherry Point Resource Area nearshore marine environment and provide management strategies for addressing questions. Cooperators: WDFW and affected Tribes.
- Study clam recruitment at Birch Bay State Park from the Cherry Point Resource Area. Cooperators: WDFW, Universities, affected Tribes, Beachwatchers, Whatcom MRC

Education and Outreach

- Provide signage at appropriate locations specifying regulations and interpretive education information related to impacts of recreational shellfish harvest. Cooperators: Whatcom County, Beachwatchers, Birch Bay State Park, Whatcom County Marine Resources Committee.
- Provide public education regarding the sensitivities of the Cherry Point ecosystem with emphasis on trampling of aquatic vegetation and disturbance of birds and seals (in haul out areas.) Cooperators: Beachwatchers, Whatcom County Marine Resources Committee, Birch Bay State Park, Audubon.

7.5 Shoreline modification along Cherry Point

Protection

- Ensure that new structures or modifications to existing structures do not significantly impact wave energy, nearshore sediment drift, and aquatic and riparian vegetation. Include provisions to minimize such impacts to marine vegetation and species. Ensure that there is no net loss of biological aquatic resource values. Cooperators: COE, DNR, WDFW, Whatcom County
- Whenever possible prohibit construction of new or replacement ”hard” structural shoreline armoring, in favor of soft-shore protection projects. Vegetation management should be an important tool for maintaining slope stability. Cooperators: COE, DNR, WDFW, Whatcom County
- Mooring buoys may be installed as alternative to docks and to avoid impacts to marine vegetation and species. Cooperators: DNR, WDFW, COE, Whatcom County

Restoration & Enhancement

- Restore armored shorelines to shore forms that promote natural processes. Sites include north side of Point Whitehorn and armoring at Gulf Rd. Cooperators: WDFW and Whatcom County
- Evaluate and encourage options for restoring natural transport processes of sediment across impediments at Cherry Point Resource Area, such as the pier aprons at Alcoa-Intalco Works and ConocoPhillips marine facilities, to help reduce impacts from existing structures and associated fill. Cooperators: WDFW, Whatcom County, and industrial pier owners.

Monitoring, Data Collection & Research

- Assess the impact of shore armoring near Point Whitehorn and Gulf Road. Cooperators: Whatcom County, Whatcom County Marine Resources Committee

Education and Outreach

- Provide technical assistance and incentives to shoreline property owners to assist with removal of bulkheads or their replacement with soft bank or other alternatives where appropriate. Cooperators: Whatcom County

7.6 Overwater structures at Cherry Point

Protection

- Ensure that any new overwater structure in the planning area minimizes shading to the maximum extent feasible and results in no net loss of biological aquatic resource values. This should be accomplished through managing location, orientation, design, materials, construction best management practices, operation of structures and activities contributing to shading. Cooperators: DNR, WDFW, COE, affected Tribes, Whatcom County.
- No additional residential docks should be permitted in the management area. Cooperators: Whatcom County, COE, Ecology, DNR, WDFW.
- Mooring buoys shall be installed to avoid impacts to marine vegetation and species. Cooperators: Whatcom County, ACOE, DNR, WDFW.

Restoration & Enhancement

- Encourage voluntary retrofitting improvements on older facilities with shading impacts. Cooperators: DNR, WDFW, affected Tribes, owners of over-water structures.

Monitoring, Data Collection & Research

- Conduct studies to identify if there are any potential impacts and to what extent salmon, herring, sand lance, and surf smelt behavior and distribution changes over time due to the artificial light from the commercial piers at Cherry Point. Define if there is any real harm posed by artificial light to these fishes. The studies should also investigate the potential changes in species abundance and dominance resulting from increased prey access under artificial lighting, and address ways to reduce or eliminate any identified impacts. Cooperators: U.S. Coast Guard, Washington Dept. of Labor and Industries, DNR, WDFW, ACOE, affected Tribes and Cherry Point industries.

7.7 Potential impacts of excessive intermittent sound on forage fish

Monitoring, Data Collection & Research

- Assess affects of sound from commercial vessel traffic and dock operations on the spawning behavior of herring. Cooperators: WDFW, U.S. Coast Guard, Cherry Point industry pier operators, tug operators
- All future development of overwater structures should be designed to avoid and minimize noise based on latest research and monitoring findings and knowledge of the CPRA ecosystem characteristics and uses. Cooperators: ACOE, DNR, WDFW, affected Tribes.

7.8 Vessel traffic and spill risk management at Cherry Point

A primary goal of these management strategies is to provide a forum for discussion of vessel traffic and spill-related topics and a data repository in support of adaptive management at the Cherry Point Resource Area.

Protection

- Review and comment on proposed Coast Guard vessel traffic risk mitigation efforts. Consider vessel traffic studies conducted for BP and Gateway Pacific Terminal and other available vessel traffic information in environmental review and determinations related to the permitting of dock operations. Data from these and future studies may also be used to develop vessel traffic risk mitigation strategies for the Resource Area, as appropriate. Cooperators: Plan Manager, WDFW, Ecology, DNR, Whatcom County, Cherry Point industries, pilot associations (Puget Sound Pilots) and affected tribes and public interest groups.
- Review and comment on Federal and State rules proposed to mitigate impacts to natural resources from any future changes or increases in risk from vessel traffic along the Cherry Point Resource Area, to include vessel anchorage options, such as:
    a. establishing new or revising existing anchorages;
    b. evaluating the use of permanent mooring buoys for tug-tows to protect sensitive habitat and species and to minimize conflicts with sport, commercial and tribal fishing; and
    c. review and comment on proposed berthing and mooring plan for new or expanded pier facilities.

    Cooperators: Plan Manager, WDFW, Ecology, DNR, Whatcom County, Cherry Point industries, pilot associations (Puget Sound Pilots), affected tribes and public interest groups.
- Reduce vessel interference with fishing activities to reduce fishing loss and associated incidences of derelict fishing gear. Evaluate options for reducing impacts from anchoring and barge in tow on habitat and loss of fishing gear. Consider viability of open water mooring systems. Cooperators: Industries, pilot associations (Puget Sound Pilots), commercial and tribal fishermen.
- Provide input to the natural resource managers (trustees) regarding future additional Geographic Response Plan updates focusing on protecting heavily used herring spawning areas. Cooperators: Ecology, DNR, WDFW
- Review and comment on Ecology's five-year review of Oil Spill Contingency Plans and stay apprised of changes that occur to plans in the interim. Cooperators: Plan manager, WDFW, DNR, affected Tribes, ship, tug and barge companies, Puget Sound Pilots.
- Review implementation of industry's fishing vessel response plan. Cooperators: Plan manager, Coast Guard, Ecology, Ship, tug and barge companies, Puget Sound Pilots.
- Review and comment on Ecology's five-year review of Oil Handling Facility Operations Manuals and stay apprised of changes that occur in the interim. Cooperators: Plan manager, WDFW, DNR, affected Tribes, ship, tug and barge companies, Puget Sound Pilots.

Monitoring, Data Collection & Research

- Collect and maintain a quarterly tabulation of the following vessel traffic and spill data within the Cherry Point Resource Area.:

    - Seasonal vessel traffic and anchorage use
    - Ecology boom reporting form submissions
    - Quarterly summaries of the Cherry Point PORTS data
    - Spill history and reporting

- Fuel/oil transfer interruptions due to weather conditions
- Near miss/incident data for vessels
- Recreational boating data, as available
- Changes to vessel traffic bound to and from the Cherry Point Resource Area relative to existing and proposed regional commercial, recreational and port operations. e.g., DeltaPort Phase 3, Roberts Bank T-2 expansion, marina expansions, etc.

Cooperators: Plan manager, Ecology, USCG.

- Prepare regular summary reports of vessel traffic and spill data for agencies, affected tribes and the public. Cooperator: Plan Manager
- Conduct research on the seasonal occurrence of larval organisms present along the Cherry Point Resource Area to help inform dispersant use decision-making by Incident Command in the event of a spill. Cooperators: WDFW, Ecology, affected Tribes.

Education and Outreach

- Observe and review lessons-learned from oil or other hazardous material spill preparedness drills. Cooperators: Plan manager, USCG, WDFW, Ecology, DNR, affected Tribes, ship, tug and barge companies, Puget Sound Pilots.
- Review lessons-learned from spills. Cooperators: Cooperators: Plan manager, Coast Guard, WDFW, Ecology, DNR, affected Tribes, ship, tug and barge companies, Puget Sound Pilots.
- Study opportunities to coordinate spill response with volunteers/community groups. Work with Ecology to develop a voluntary community-based response capability. Cooperators: Coast Guard, Ecology and public interest groups.

7.9 Ballast water management

Protection

- Review and comment on ballast water treatment/management methods to reduce the possibility of introducing invasive species from tankers and other cargo vessels. No testing of unproven treatment methods will be permitted that have the potential to negatively impact native habitat and species. Cooperators: WDFW, Ecology, DNR, USCG, EPA, leaseholders, the Invasive Species Council, U.W. Sea Grant, and others as appropriate.
- Develop strategies for dealing with ballast water from ships that call at Cherry Point terminals consistent with Chapter 77.120 RCW, WDFW ballast water management, the interim ballast water management laws, and upcoming recommendations of the Ballast Water Working Group. Cooperators: WDFW, Ecology, DNR, leaseholders.
- Develop and implement a management plan, including monitoring and adaptive management plans, to reduce the risks of non-native species to the valued ecological resources at Cherry Point. Strategies should include controlling the introduction of non-native plant and animal species and their management and eradication to protect native plant and animal communities. Cooperators: WDFW, Ecology, DNR, USCG, EPA, leaseholders, the Invasive Species Council, U.W. Sea Grant, and others as appropriate.
- Prohibit testing of unproven treatment methods that have the potential to negatively impact native habitat and species in the Cherry Point Resource Area. Cooperators: WDFW, Ecology, DNR, USCG, EPA, and others as appropriate

- Ensure that protocols and monitoring efforts are expanded to address increased threats of non-natives from increased vessel traffic. Cooperators: WDFW, Ecology, DNR, USCG, EPA, leaseholders, the Invasive Species Council, U.W. Sea Grant, and others as appropriate

Monitoring, Data Collection & Research

- Develop monitoring protocols to track likely vectors (sources for introduction) of non-native organisms and support methods of treatment that reduce risks and avoid impacts to the Cherry Point Resource Area. Where non-native species have become established, characterize the occurrence and dynamics of non-native species at Cherry Point and study measures to safely eradicate the invaders and/or mitigate impacts. Cooperators: WDFW, DNR, and others including U.W. Sea Grant, USGS, WSU Beachwatchers, Whatcom Noxious Weed Board, Whatcom County Marine Resources Committee (MRC), NOAA.
- Institute a study to characterize the occurrence and dynamics of non-native species at Cherry Point and sources of non-native species that can immigrate to the region. The study would also evaluate the probability of the introduction of invasive species by vector. Cooperators: WDFW, DNR, and others including U.W. Sea Grant, USGS, WSU Beachwatchers, Whatcom Noxious Weed Board, Whatcom MRC, NOAA.

Education and Outreach

- Support education efforts targeting recreational boaters to reduce the introduction of non-indigenous species. Cooperators: WDFW, State Parks, NOAA, Sea Grant, Whatcom MRC, Dept of Licensing. Others: Northwest Marine Trade Association (NWTA)

7.10 Air quality, global warming, and climate change considerations

Protection

- Develop plans to mitigate the effects of climate change upon the valued ecological resources described in this plan using likely scenarios of climate change developed through careful monitoring, data collection and vulnerability assessment, working in coordination with the Climate Impact Group of the University of Washington. Cooperators: WDFW, DNR, Climate Impact Group (CIG), Whatcom County.
- Coordinate the efforts to measure-mitigate climate change among the other management questions in the document. Since climate change is an all encompassing aspect of the Cherry Point Resource Area, coordination should take place to ensure that a mitigation plan for one area does not impact another area of management. An example would be protection against sea level rise by altering a shoreline; or providing protection against an increase in invasive species, which would be able to colonize the region because of the increase in water temperature. Cooperators: WDFW, DNR, Whatcom County.
- When reviewing project proposals, consider information collected on Georgia Strait climate and microclimate, as collected by resources such as the Office of the Washington State Climatologist (OWSC), the office of the State Climatologist. This will serve as a credible and expert source of climate and weather information for state and local decision makers and agencies working on drought, flooding, climate change, and other related issues. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.

Monitoring, Data Collection & Research

- The impact on Cherry Point Resource Area for atmospheric deposition is unknown and currently not being researched. Support ongoing efforts to monitor deposition from air pollution and evaluation of its impacts in the vicinity of Cherry Point. Cooperators: EPA, Ecology, Northwest Clean Air Agency, participating industries.
- Track and report on facilities' efforts to reduce air pollution, the regional and global investigations and look at new technology to address potential impacts. Cooperators: DNR, EPA, Ecology, Northwest Clean Air Agency, participating industries.
- Investigate the potential impacts of vessel emissions, population affects, new facilities and global transport of pollutants. Cooperators: DNR, EPA, Ecology, Northwest Clean Air Agency, participating industries.
- Support the cap-and-trade program within the Cherry Point Resource Area. Cooperators: Ecology, Northwest Clean Air Agency, participating industries.
- Support efforts to establish a consensus on sea level rise estimates state-wide and coast-wide, through the National Academy of Sciences. Cooperators: Ecology, WDFW, West Coast Governor's Agreement on Ocean Health.
- Modify existing plan to incorporate climate change-related issues or impacts, such as new information on ocean acidification and changes in sea surface temperatures, water column stratification, and regional hydrology. Cooperators: Ecology, WDFW, EPA, University of Washington's Climate Impacts Group (CIG).
- Collect and summarize data on natural climate change (El Nino, PDO) and human induced climate change (field research, models) that may affect the Cherry Point Resource Area. This effort should include change in ocean currents, migration of species, and temperature regimen at the Cherry Point Resource Area. A contingency plan should cover what ecological resources are likely to be affected by climate change and which can be preserved given reasonable model outputs. Cooperators: WDFW, DNR, leaseholders, research institutions.
- Monitor temperature and currents entering the Cherry Point Resource Area, and map changes in species location, density of sea grasses, location of shellfish and other variables that may indicate long-term changes due to climate alterations. Cooperators: WDFW, DNR, leaseholders, research institutions.
- Track changes in species composition and the sensitivity of the community to shading effects. Climate change can affect water chemistry, such as increasing temperature or acidity, which in turn, can alter various species compositions. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Track changes in sedimentation and filling due to changes in currents or storm frequencies. Current and storm frequency and energy can be altered compared to historical conditions. Rates and direction of sediment transport may be altered as a result. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Changes in currents may change scheduling of transport vessels. Alterations in abundances of target species may alter the timing and number of fishing (commercial and sport) within the region. Provide information about change in the pattern of vessel movements throughout the region. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Examine the pathways and threat of additional invasions and changes in the patterns of *Sargassum*. The change in physical parameters (currents, pH, oxygen, temperature) and the

change in the composition in local community structure will alter the likelihood of invasion by organisms being transported by ballast water, currents or other vectors. Alterations in climate will also change the patterns of occurrence of invasive species already established in the region. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.

- Re-examine dilution models if currents change due to climate induced factors. There are uncertainties regarding how a changing climate might affect water quality in the Cherry Point Resource Area. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Examine the affect of increased photo-toxicity and temperature on PAHs and other key chemicals as the climate changes, these effects should be re-examined. Fate and toxicity of contaminants may change with rising ocean temperatures. It is already known that exposure to sunlight can lead to enhanced toxicity effects from PAHs. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Examine the need to adjust dilution ratios for temperature mixing zones in facility discharge permits as ocean temperatures rise. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Examine the effect of changes in ocean acidity on the pH of the receiving water and the toxicity of the wastewater streams Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Examine changes in run-off frequency, volume and the fate of contaminants. The physical characteristics of the receiving water can change due to alterations in temperature, pH and other factors that alter the fate of the contaminants and the sensitivity of organisms. Patterns of stormwater quantity and timing are also susceptible to change as the climate is altered. WET testing should also take into account changes in receiving water temperature and changes in species composition of the appropriate receiving waters. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Examine the likelihood that changes in precipitation patterns will affect transport of surface and subsurface nonpoint source pollutants to the Cherry Point Resource Area. Climate change can bring about an alteration of agricultural practices within the watersheds. Transport of contaminants can also be altered as groundwater flows vary because of changes in discharge rates due to a lack of rainfall. Changes in storms are likely to change the transport of legacy sources of contaminants in the Cherry Point region. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Track changes in the timing and location of herring or other species that use the Cherry Point area as a spawning ground. These may be altered by changes in currents, temperature or other clues used by the Cherry Point Pacific herring to set spawning time and location. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Examine the impact of climate change on recreational uses. If the amount of harvestable species is altered by a change in climate it is likely that the amount and type of recreational activities in the region may change. Different species may be harvested or the harvest may become more intense. If the weather becomes milder the region may see an increase in recreational use along the shoreline. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Examine the impact of climate change on development. The type of development in the region will be affected in part by climate change. In residential areas the types of lawns and the amount of surface water introduced to the region will be heavily impacted by climatic conditions. Water shortages for residential use can also change inputs to the Cherry Point

region. The monitoring plan should measure the type and extend of residential and other development within the area of Whatcom County deemed critical for managing the Cherry Point region. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.

- Examine the relationship between climate change and air quality. Alteration of long range transport of contaminants may be altered by climate change. A drying landscape may allow contaminants to become airborne, transporting atmospheric pollutants over long distances until the materials settle or are removed by precipitation. Changes in soil water content, pH and temperature can alter the persistence or transformation of contaminants in water or the solid. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.
- Track the type and extent of habitat within the management area using models to predict likely outcomes. Habitat patterns will shift due to change in sea and air temperature, the type of disturbance regime and the colonization of the region by species adapted to warmer temperatures. There may be a tendency for some types of habitats to move in a North-South direction depending upon temperature and other habitat variables. It may prove necessary to create new habitats able to support species that can exist in a transformed region. Cooperators: OWSC, DNR, Ecology, EPA, research institutions.

Education and Outreach

- Support education efforts providing information to the local community on the effects of global warming at Cherry Point, and what actions can be taken locally to try and help offset the overall impact of global carbon emissions. Cooperators: Ecology, DNR, NWCAA, and WDFW.
- Support education efforts to provide information to the local community describing the cap-and-trade program, and how it is designed to work. Cooperators: Ecology, DNR, NWCAA, and leaseholders.

7.11 Addressing Cultural Resources

- All existing and proposed restoration and development activities must comply with all applicable mandated by federal, state, and tribal cultural protection laws, and prior to any construction commencing along the Cherry Point shoreline. Cooperators: Lummi Indian Nation, the Nooksack Tribe, DNR, WDFW, Whatcom County, COE
- All existing and proposed restoration and development activities must comply will all applicable federal laws including, but not limited to: Archeological Resource Preservation Act; National Historic Preservation Act; Clean Water Act; River and Harbors Act; Resource Conservation and Recovery Act; Safe Water Drinking Act; Clean Air Act; Endangered Species Act, National Environmental Policy Act; and Coastal Zone Management Act. Cooperators: Lummi Indian Nation, the Nooksack Tribe, DNR, WDFW
- The Lummi Indian Nation, in coordination with the applicant and the State Historic Preservation Office, and the U.S. Army Corps of Engineers, will jointly develop a Cultural Resources Protection Protocol. The protocol would include but is not limited to requirements for appropriate pre-construction surveying, a procedures for addressing inadvertent discoveries during clean-up and construction, and procedures for repatriation or re-interment (Lummi Indian Nation, 2008). Cooperators: Lummi Indian Nation, DNR, WDFW, Whatcom County

8 DNR Lease Management

One of the Department of Natural Resource's key contributions to this plan is lease management for activities within CPRA. DNR will use this plan to guide decisions regarding approve only proposals that are consistent with the objectives and desired future outcomes of this plan. DNR will need to address two primary types leasing of decisions:

(1) renewal of leases for existing facilities and expansion or modifications to existing facilities.
(2) leasing for future facilities and uses, and

DNR cannot alter the terms and conditions of an existing lease, easement, or other use authorization without consent of the tenant or grantee. Existing lease conditions can only be amended with the consent of both the lessee and DNR. Therefore, this management plan does not alter existing contractual rights and obligations. Existing tenants and grantees may continue to conduct their activities in conformance with their current use authorization.

DNR will use its leasing and management authorities to achieve the desired future outcomes in the Cherry Point Resource Area. The agency will accomplish this by integrating current knowledge, research findings and recommendations for action into its lease conditions. DNR will also encourage voluntary and cooperative efforts of lessees to address identified issues and objectives of this plan. Finally, DNR will work with lessees through lease conditions to address DNR's long term management objectives such as improving conditions for endangered species and a reduction of wastewater discharges.

DNR is obligated to seek a balance of its social, economic and environmental needs through its management of state owned aquatic lands. While DNR is concerned with the long-term protection of the natural resources, DNR provides the following commitments to current and future lessees in light of the comprehensive approach to management of the Cherry Point Resource Area.

8.1.1 Re-authorization of Existing Leases:

DNR will continue to authorize existing uses at Cherry Point if the tenant or grantee meets criteria specified below at the time of re-application. DNR may require current lessees to provide plans to reduce identified environmental impacts from existing facilities and uses based on research and monitoring findings at the time of re-authorization. DNR will also be seeking programmatic improvements to all authorized uses over time to address endangered species protection.

DNR will consider the following questions when evaluating applications from existing Cherry Point lessees and to determine if they are consistent with this plan:

- Is the lessee in good financial and contractual standing with the Department of Natural Resources?

- Is the lessee in substantial compliance with conditions of federal, state and local laws and permits?

8.1.2 Approval of Leases for Future Facilities and Expansion or Modification of Existing Facilities:

DNR will consider the following questions when evaluating applications for new facilities, or expansion or modification of existing facilities to determine if the proposal is acceptable to DNR and is consistent with this plan:

- Has the applicant carefully reviewed any potential impacts that may be associated with the proposed risk (see Section 5)?
- How does the applicant address these risks and potential impacts?
- Is the proposal consistent with all other federal, state and local laws and permitting requirements?
- After permitting, would the new, expanded, or modified facility or structures still have an additional need to reduce impacts to specific resources identified in this plan?
- Does the proposal address impacts to specific habitats and species identified in this plan?
- Does the proposal conflict with management objectives or desired future conditions identified in this plan?
- Has the applicant agreed to implement voluntary actions related to their operations identified in this plan?

While one goal of this plan is to quantitatively develop an environmental baseline for Cherry Point using existing and future data, enough is known about some resources to make an informed decision about use authorizations. Should Cherry Point herring continue to decline, DNR will discuss with WDFW approval of any future use authorizations within the planning area boundary, in order to determine whether such an approval would hinder recovery of the Cherry Point ecosystem so that historic population levels of herring could not be supported. In addition to reliance on regulatory actions implemented by resource management agencies and conditioning of leases, DNR will seek voluntary cooperation from lessees and the support of other interested parties to enhance the quality of habitat and provide long-term protection to the Reserve.

See Appendix B for a description of the current facilities and associated leases with DNR.

9 Plan Implementation

9.1 Role of the Plan Manager

This plan envisions a plan manager who oversees the day to day actions identified in this plan. This position should be housed and supported by one of the resource agencies to provide the best opportunity for organization, coordination and oversight. The plan manager for the Cherry Point Resource Area will be the Washington Department of Natural Resources.

The plan manager will be the primary responsible person for organizing and facilitating meetings and keeping the process moving forward. All meetings should be recorded and information made available to the participants and the general public. The plan manager will assist with the coordination of funding and support for the work that needs to be done in the Cherry Point Resource Area.

Data management will be an important facet to the overall management and decision making within the Cherry Point resource protection and management plan. Data will come from two primary sources: research and monitoring projects sponsored under the plan, and tracking data generated by other agencies. In addition, information and records related to the plan implementation should be tracked and shared.

It will be one of the plan manager's roles to assemble, summarize and report out this data as appropriate for managers involved with the long-term over-site of the activities at Cherry Point as well as the cooperators working to address long-term needs in the area. This data and information should be available to the public, industries, agencies, tribes, environmental groups, and others.

The plan manager should do the following:

- Establish a system for the storage of data and information generated by research and monitoring actions identified in this plan. This system should be designed to make information and data readily available to the public as well as resource agencies, industry and tribes.

- Establish connections and coordinate with regulatory agencies that routinely develop data needed to address the actions identified in this plan.

- Should track activities called for in the plan and ensure that priority activities are being implemented first.

- Routinely provide reports on monitoring and research, and summaries of reports from other agencies to cooperators who participate in the long-term over-site of this management plan.

- Ensure new and renewed use authorizations are consistent with this plan
- Will implement, amend, and update this plan.

Finally, the plan manager will provide materials and presentations to the public regarding the activities in the Cherry Point Resource Area. DNR will be responsible for maintaining an online library of all plans, reports, and decisions pertinent to Cherry Point and make it available to the public.

9.2 Plan Oversight and Implementation

Agency and tribal resource managers are the primary decision makers working together to provide protection of the resources in the Cherry Point Resource Area. Review and evaluation of sound scientific and management information by resource managers should guide the future development, restoration and protection decisions.

An administrative structure involving the resource managers should be formed as soon as possible. The purpose of this group is to guide the implementation of this plan and coordinate decisions that will affect the long-term health of the resources and ecosystems in the Cherry Point Resource Area. These groups should meet and consider information generated through the adaptive management process described below. The goal of this administrative structure should be to ensure the desired future condition of the Cherry Point Resource Area is met while ensuring a sustainable economy and addressing other social needs of the community.

To enhance coordination and cooperation the resource managers are encouraged to jointly develop an MOA to address issues of mutual interest in the Cherry Point area. The MOA should describe how these entities will coordinate the discharge of their authorities and responsibilities, and will state common objectives and desired outcomes for resource protection as presented in this plan for the CPRA. The resource managers and their entities should seek information and review recommendations for action from this plan and other locally developed plans, the scientific community, local industry, Whatcom County Marine Resources Committee and local interest groups in making decisions. The resource managers may choose to establish advisory committees to enhance review and input on specific research, protection or restoration efforts.

The resource managers should rely on existing regulatory and governmental decision processes as the basis for managing activities of the regulated community including general land use. They should make decisions that support the long-term objectives as stated in this plan and the MOA. To achieve this outcome:

- All major regulatory decisions and significant leasing conditions will be shared and discussed with the resource managers prior to implementation.
- The resource managers should employ an adaptive management approach to implementing the long-term protection of resources in the Cherry Point area and the balancing of local needs.

In addition to coordinating with each other, the resource managers should coordinate decisions and activities related to the maintenance of navigation, water quality and habitat protection with the US Corps of Engineers, US Fish and Wildlife Service, NOAA fisheries and the U.S. Environmental Protection Agency. Decisions and activities related to vessel traffic management, spill prevention and clean-up should be coordinated with US Coast Guard.

9.2.1 Coordination with community groups

Many actions will require the assistance of nongovernmental entities. These largely non-regulatory actions require careful coordination and clear delineation of responsibility and activity. The plan manager should make sure that the efforts of these groups is regularly coordinated with the resource managers and opportunities for discussion and sharing are established. Emphasis should be on prioritization discussions and assisting these groups through support of funding requests.

9.2.2 Updating the Plan

The Plan will be updated every 10 years or sooner as appropriate. DNR or the Plan Manager will prepare annual reports on progress implementing the plan. Based on regular reviews of progress, the resource managers should determine the need for an update to the plan. Resource managers should establish a general basis upon which the decision to update the plan would be taken.

9.2.3 Plan Area Modification

Modification of the planning area should result from consensus of the agency and tribal resource managers under advisement of interested parties and science teams. No change in the plan area should be considered for the first five years of implementation.

9.2.4 Communication with the Public

DNR or the Plan Manager should maintain an online library of all plans, reports, and decisions pertinent to Cherry Point and make it available to the public. Meetings of the resource managers should offer opportunities for interested parties to offer information and provide feedback on plan implementation. The plan manager or DNR should organize workshops on a regular basis to share new information and to enhance coordination of efforts with community groups and the science community.

9.2.5 Funding

Implementation of this plan is anticipated to be a cooperative effort. Funding for the activities will be a key to the successful achievement of the plan's goals. The plan manager will be expected to coordinate funding efforts to ensure that the plan is implemented based on priorities established by the resource managers under advisement by interested parties and science teams.

Funding should be sought from a variety of sources including grants, agencies and other sources. Lessees are required to fund required regulatory mitigation associated with the ongoing operations of their facilities. Lessees and other agencies are also encouraged to consider proactively participating in cooperative efforts to assist in ensuring the funding of the issues identified in Section 5: *Potential Risks and Impacts*, even if a local, state, tribal or federal regulatory agency has not identified the issue as a current priority under their regulatory authority.

Cooperative efforts should be a high priority where resources and information are shared. There should be a clear connection of the work at Cherry Point to the ongoing efforts of the Puget Sound Partnership and other regional science investigations.

9.2.6 Adaptive Management

Adaptive management is a key component to the success of the Cherry Point Plan. Numerous questions need to be addressed in the coming years. This will require the cooperation of agencies, affected tribes, industry, community groups and research institutions. Since all questions cannot be addressed at one time, a scheme of prioritization will be needed that identifies the most important studies and work to be completed first.

Through the adaptive management process, the resource managers should be focusing on the achievement of the desired future outcomes. An evaluation process should be established early in the implementation process that will provide the basis for determination if implementation of actions in this plan is achieving those outcomes in all areas. This may involve a certain degree of balancing to achieve all the outcomes identified in the plan.

This management plan shall be reviewed and updated every ten years (2019, 2029, 2039, etc.) or more frequently if the resource managers deem it more appropriate. Among other things, changes in scientific knowledge concerning the site, conditions habitats and species, and existing encumbrances will be included in the updates. Additionally, data and reports generated from research and monitoring activities will be evaluated in attempts to determine if management actions are meeting the goal and objectives of this plan.

Glossary

Antidegradation Policy: The Clean Water Act's (CWA) antidegradation policy is found in section 303(d) (and further detailed in federal regulations) and its goals are to 1) ensure that no activity will lower water quality to support existing uses, and 2) to maintain and protect high quality waters. States must adopt an antidegradation policy and methods for implementation.

Aquatic Lands: All state-owned tidelands and bedlands. "Aquatic lands" means 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.

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

Ballast water: Ballast water is held in tanks and/or cargo holds of ships to provide stability and maneuverability during a voyage when ships are not carrying cargo, are not carrying heavy enough cargo, or require more stability due to rough seas.[8] Ballast water may be either fresh or saline. Ballast water may also be carried so that a ship rides low enough in the water to pass under bridges and other structures.

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, Beds of navigable waters: Those submerged lands lying waterward of the line of extreme low tide in navigable tidal waters and waterward of the line of navigability in navigable lakes, rivers and streams.

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.

Biological Diversity: The various plant and animal species representative of and native to a site. "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."

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 to 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.

Critical Habitat: Those areas necessary for the survival of threatened, endangered, sensitive 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 (DAHP) and protected under Title 27 RCW.

Dredging: The enlarging or cleaning out a river channel, harbor, etc.

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

Endangered, Threatened and Sensitive Species (ET&S): Plants and animals protected under the federal Endangered Species Act or state designation.

Enhance: To intentionally re-create elements that existed on site before disturbance, or introduce new functions or characteristics to a site.

Epibenthic: Living on the bottom of the ocean.

Extreme low tide: The line as estimated by the federal government below which it might reasonably be expected that the tide would not ebb. Varies by location.

Extreme High Water (EHW) **-** The average height of the highest tidal waters reached during the year over a 19-year period.

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

Hydraulic Project Approval: Permit issued by the Washington State Department of Fish and Wildlife, the purpose of which is to address any damage or loss of fish and shellfish habitat which is considered to result in a direct loss of fish and shellfish production.

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.

Littoral zone: The littoral zone of the coast is 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.

lux: The **lux** (symbol: **lx**) is the SI unit of illuminance and luminous emittance. It is used in photometry as a measure of the *apparent* intensity of light hitting or passing through a surface.

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

Mean Low Water: A tidal datum. The average of all the low water heights observed over the National Tidal Datum Epoch.

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

Monitor: To collect and analyze data for the purpose of answering management questions. 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.

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.

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).

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 feet above the datum plane of mean lower low water (0.0).

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

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).

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-foot rise in a 10-foot 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 ocean, that is exposed to sufficient sunlight for photosynthesis to occur. The depth of the euphotic zone can be greatly affected by seasonal turbidity.

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).

Polycyclic aromatic hydrocarbons (PAH): A group of chemicals that are formed during the incomplete burning of coal, oil, gas, wood, garbage, or other organic substances, such as tobacco and charbroiled meat. There are more than 100 different PAHs. PAHs generally occur as complex mixtures (for example, as part of combustion products such as soot), not as single compounds. PAHs usually occur naturally, but they can be manufactured as individual compound. Can also be found in substances such as crude oil, coal, coal tar pitch, creosote, and roofing tar. They are found throughout the environment in the air, water, and soil. They can occur in the air, either attached to dust particles or as solids in soil or sediment. Health effects vary depending upon compound.

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

Restore: To recover natural site features and processes that existed on site prior to disturbance.

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 that appears in uncontrolled surface ground floor, drains, or sewers.

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

Sediment Impact Zone (Ecology)[22]: A sediment impact zone is an area where the specific sediment quality standards may be exceeded in conjunction with an authorized discharge permit. In authorizing a sediment impact zone, Ecology must find that the discharge is in the public interest and may require that best management practices be employed or that all known, available, and reasonable technology ("AKART") be applied to minimize the adverse impact of the discharge on sediments.

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.

Shoreline - The intersection of a specified plane of water with beach; it migrates with changes of the tide.

State Environmental Policy Act (SEPA): State law that requires administrative action for nonexempt government actions.

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)).

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

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)).

Tidelands: 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

[22] WAC Chapter 173-204 establishes sediment standards. Section 173-204-420 specifies sediment quality criteria for Puget Sound that may not be exceeded, and section 173- 204-120 provides that existing beneficial uses (of the benthic environment) must be protected, and no degradation which would interfere with those uses will be allowed (see definition of Antidegradation Policy). The regulations, while requiring adherence to sediment quality criteria, also recognize that goal may not always be attainable. The result of that regulatory conflict is the authorization of sediment impact zones.

regulations pertaining to navigation and safety equipment on vessels, including, but not limited to, registration as a vessel by an appropriate government agency.

Water-dependent use: A use which cannot logically exist in any location but on the water RCW 79.105.060(24)).

Wetlands: Lands where saturation with water is the dominant factor determining soil development and the types of plant and animal communities living in the soil and on its surface.

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Appendix A - Archaeological, Cultural, and Historical Resources

Native American History

The Puget Sound prehistoric record is divided into three broad chronological periods: the Early Period (15,000–5,000 Before Present), the Middle Period (5,000-1,000 Before Present), and the Late Period (1,000-250 Before Present).

The Early Period is characterized by chipped stone assemblages attributable to fluted projectile point, leaf-shaped projectile point, and cobble tool traditions. Subsistence patterns exhibit reliance upon inland hunting, supplemented with fishing and marine invertebrate procurement in riverine and coastal areas. Settlements were typically located on upland plateaus or river terraces, although coastal occupations may have been flooded because of seismic activity or changes in sea level related to glaciation (Carlson 1990; Kidd 1964; Nelson 1990)

The Middle Period represents a proliferation in tool diversity within regional assemblages. Notched stone projectile points were characterized by a decrease in size, and toolkits were supplemented with groundstone, bone, and antler industries. Subsistence practices showed an increased orientation toward marine and riverine habitats; shellfish, salmon, and sea mammals became more important resources; and shell middens appeared in the archaeological record. Occupation areas expanded to include modern shorelines and islands and the earliest evidence of seasonal village sites dates to this period (Carlson 1990; Kidd 1964; Nelson 1990).

The Late Period is characterized by assemblages containing exotic trade goods imported from indigenous populations in the Columbia Plateau as well as metal arrowheads and trade beads from Euro-American groups. Small side-notched and triangular stone projectile points persisted but were superceded by an emphasis on bone and antler tools. Salmon became a major staple as evidenced by elaborate fish traps; subsistence practices were supplemented by terrestrial hunting and plant procurement. Permanent, village sites described by Euro-American settlers and ethnographers were established and persisted into the historic period (Carlson 1990; Kidd 1964; Nelson 1990).

Central Coast Salish Native Americans occupied the Puget Sound area during the late historic times. In the Cherry Point vicinity, three linguistic subdivisions of the Central Salish are recognized:

Halkomelem speakers lived north of Birch Point and along the lower Fraser River valley. *Nooksack* speakers lived in inland sections of the Nooksack River drainage, and *North Straits'* speakers occupied the coastal areas north of Anacortes as well as the San Juan and other islands in the southern section of the Strait of Georgia.

At that time, subsistence focused on seasonal harvests of marine foods such as salmon, herring and lingcod, which were eaten fresh or dried and stored for winter use. Terrestrial foods that were favored included deer, elk and bear, which were caught with pitfalls, snares, bow and arrow, while women gathered shellfish, sea urchins and barnacles along the coast. The Central Coast Salish also utilized western yarrow, creambush, oceanspray, western red cedar, swordfern, salal, skunk cabbage, and vine maple for pharmaceutical, technological, and ceremonial use (Moerman 1999; Suttles 1990).

The Revised Code of Washington, Chapter 27.44 protects Indian burial sites, cairns, petroglyph (incised in stone) and pictograph (painted) markings, and historic graves on public and private land. The chapter further stipulates that persons knowingly removing, destroying, or defacing these resources will be charged with a Class C felony. RCW Chapter 27.53 protects sites, objects, structures, artifacts, and locations of prehistoric or archaeological interest located in, on, or under the surface of any lands or waters owned or under the control of the state of Washington or its counties, cities, or political subdivisions. Disturbing archaeological resources without an archaeological excavation permit is punishable as a Class C felony.

Lummi Indian Nation

The shoreline within the Cherry Point Resource Area was the primary home of many Lummi villages and Traditional Cultural Properties (TCPs) within the traditional homeland of the Lummi. This area is an important component of the Lummi usual and accustomed grounds and stations used since time immemorial for hunting, fishing and gathering. The development of the Cherry Point shoreline by Euro-Americans since the 1950's has resulted in the elimination of fishing and gathering grounds and stations, village sites, landing sites, and locations where commerce was conducted. This development has also resulted in the filling of previously extensive and productive natural tidelands and has caused the contamination of previously pristine waters and sediments due to the operation of industrial and commercial facilities (Lummi Indian Nation, 2008).

The Lummi Indian Nation resides in an area ceded by the Lummi, Nooksack, and Samish Indians; these groups now comprise the Lummi Indian Nation. The Lummi are thought to have derived their name from *Lkungen*, the name that the North Straits-speaking Songish of Vancouver Island called themselves. The Lummi occupied coastal areas surrounding the mouth of the Nooksack River as well as several islands in Puget Sound. The Nooksack, meaning "mountain men," lived in the Nooksack River drainage. The Samish occupied additional islands in Puget Sound, including one that now bears their name as well as Guemes and Fidalgo islands (Ruby and Brown 1986; Suttles 1990; Swanton 1978).

The Lummi Indian Reservation is located south of Cherry Point. The Lummi Nation has a Department of Natural Resources, under which the Water Resources staff provide technical support for Lummi Indian Reservation Tidelands and Coastal Zone Management.

Nooksack Indian Tribe

Placeholder for info from Nooksack…..

European History

Whatcom was named after a noisy waterfall, called “What-Coom” by the Lummi Indians, which means “noisy, rumbling water”. The first Europeans were Spanish Explorers in the late 1700s, followed by James Vancouver from England. Early land uses included fur trapping and trading, logging, lumber processing, farming, salmon packing, and mining coal. The first non-Indian residents settled including Hudson's Bay Company, which ran from 1825 to 1846. In the early 1850's, a high demand for timber in California led to scarce lumber supplies (Figure 21). Coal was discovered in the early 1800’s, and the lumber trend turned to mining. Bellingham Bay Coal Company became the area’s largest employer. In the mid 1800’s, a large influx of gold seekers entered the area on their way to the Fraser River to seek gold (Kyte, 1999). The County of Whatcom was created by territorial legislature on March 9, 1854 (Whatcom County website, 2007).

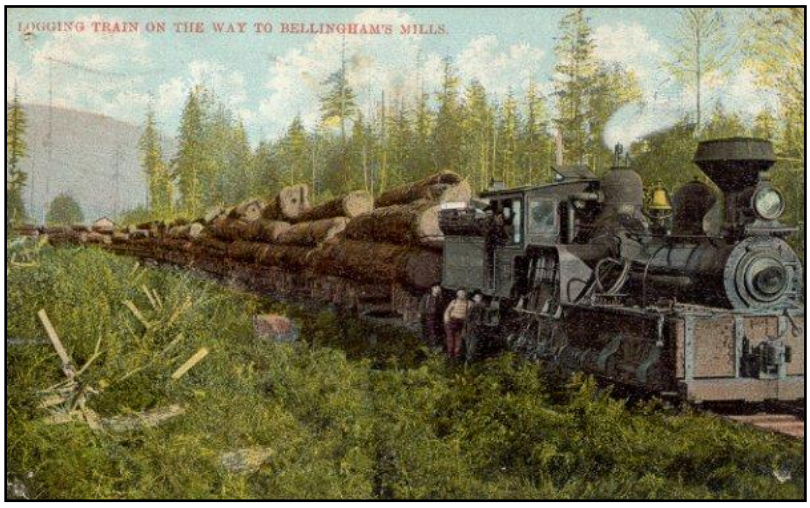

Figure 21- Postcard, mailed 1908 showing logging train heading to Bellingham

Northern Pacific Railroad expanded its infrastructure into Whatcom County in the late 1800’s, bringing further opportunities as Bellingham was linked to Vancouver, B.C., via Ferndale and Blaine, stimulating the lumber and salmon packing industries. The population increased by sixfold during this time, from approximately 3,000 to 18,000 (Kyte, et al. 1999). The national depression stopped the boom, and the railroad left. The population of the bay decreased, but by the turn of the century, Whatcom County was growing again. New lumber and shingle mills, salmon canneries, shipyards and agriculture brought stability to the area. Between 1890 and 1925, logging cleared thousands of acres for farmsteads. Development of commercial and residential areas increased, and major fish processing plants were constructed at Bellingham Bay. Between 1950 and 1990, coal mining had ceased, while sand and gravel mining grew in importance (Kyte, et al 1999).

Current Uses

Currently, Whatcom County maintains a rural character, with large tracts of agricultural land used for pasture and commodity crops. Residential, commercial and industrial uses continue to

creep into these agricultural areas, as Whatcom County experienced a 100% increase in population in between 1950 and 1990. The population continues to increase, and in 2006 was 184, 300 (Kyte et al, 1999; OFM, 2006).

Between 1954 and 1971, three industries moved into the Cherry Point vicinity. In 1954, Mobil Oil constructed an oil refinery near Cherry Point, now called the Ferndale Refinery. In 1966, Intalco Aluminum built a processing facility north of Mobil. In 1971 Atlantic Richfield Company (ARCO) constructed another oil refinery even further north. Whatcom County designated 6,000 acres as "Heavy Impact Industrial" along Cherry Point to support the requirements of heavy manufacturing uses that require water deep enough to accommodate large vessels (Kyte, et al 1999; Whatcom County, 2006).

Today, valuable natural resources continue to play an important role in the Whatcom County economy and community. Also important are public recreational activities such as boating, fishing, shellfishing, swimming, and beach walking.

At Cherry Point, recreational uses are common use. Beach walking likely occurs extensively along the reserve boundary on privately owned and state-owned aquatic tidelands. Gulf Road provides access to a public beach that is used for recreational clam harvesting. DNR does not have regulatory authority to manage public recreational uses, and offshore areas have traditionally been use for the commercial and recreational harvest of salmon, harring, Dungeness crab, and bottomfish. Methods include trawl, crab pots, and purse seine.

Appendix B - Existing Encumbrances and Applications within the Management Area

The following encumbrances have specific exceptions from the aquatic reserve in the original Commissioner of Public Lands withdrawal order and are therefore treated as leases adjacent to the aquatic reserve.

Birch Bay Water and Sewer District: DNR Aquatic Lease 20-010521 – Lease pertaining to the Birch Bay Water and Sewer District wastewater pipeline and diffuser.

A right of way measuring 2,300 feet in length and 100 feet in width comprising a total area of 5.28 acres of tidelands and bedlands was established in on March 23, 1975 as a lease (Lease 20-010521). This lease had a thirty-year term that expired in 2005. DNR currently actively working with the applicant on the new authorization which will be an easement, # 51-082214.

British Petroleum: DNR Aquatic Lease 20-A09122 – Lease pertaining to BP/ARCO pier and outfalls

The BP Cherry Point Refinery is located at 4519 Grandview Road in Whatcom County, Washington. The refinery is situated on 849 acres of developed land 8 miles south of the U.S./Canada border and 20 miles northwest of Bellingham, Washington. BP owns an additional approximately 2000 acres of undeveloped land around the refinery, including approximately 1000 acres of marine riparian land between the Cherry Point Refinery Dock and Point Whitehorn. The refinery has been in operation since 1971 processing mainly Alaska North Slope (ANS) crude oil with an increasing percentage of oil from other parts of the world as ANS crude supplies decline over time. Refinery throughput averages approximately 200,000 barrels of crude oil per day, from which Cherry Point produces multiple grades of gasoline, jet fuel, low-sulfur and ultra low-sulfur diesel fuel, calcined coke, butane, propane and sulfur. The Cherry Point Refinery operates 24 hours a day, 365 days a year and has approximately 780 full-time BP employees; an additional approximately 1000 contractors also work on-site.

The Cherry Point Refinery Marine Terminal is located approximately 1.5 miles south of the refinery, extending 2,100 feet offshore into the Southeast Strait of Georgia in a “Y” configuration and terminating in two vessel berths - the North & South Dock Wings. The Cherry Point Dock is constructed of concrete on steel pilings and there is a minimum of 65’ of water alongside each dock wing at MLLW. The Cherry Point Dock can accommodate only one tanker or barge at a time on the seaward side of each dock wing (2 vessels max at any time). The maximum vessel length that can be accommodated is 1,100 feet.

Nearly 100% of all crude oil used by the refinery is delivered by tank vessel. Approximately 75 percent of the refined petroleum products are transported through the Olympic Pipeline to marketing terminals in western Washington and Oregon. The remaining products are transported

by tanker, barge, or truck to other West Coast locations. In 2007, approximately 370 vessels transited to/from the Cherry Point Dock.

The refinery has approximately 50 crude oil and refined product storage tanks with a combined working capacity of over 7,500,000 barrels. The Cherry Point Refinery processes industrial wastewater and stormwater through its on-site wastewater treatment plant and discharges an average 3,500,000 gallons of combined treated process wastewater and stormwater per day under NPDES Permit No. WA 002290-0 to the Strait of Georgia through a diffuser located below the North Dock. BP Cherry Point's NPDES permit requires daily effluent quality monitoring, effluent mixing and fish toxicity studies, groundwater studies, sediment quality studies, and the development and implementation of Pollution Prevention Plans.

Dock Operations at the BP Cherry Point Refinery are conducted in accordance with the BP Cherry Point Refinery's USCG- and Washington Department of Ecology-approved Oil Handling Facility Operations Manual, which describes personnel responsibilities, Dock operating procedures, and safe operating envelopes. The BP Cherry Point Refinery has a rigorous Dock inspection and maintenance program designed to protect the marine resources of the Cherry Point Resource Area and ensure the long-term operational integrity of the BP Cherry Point Dock.

The term for the BP lease, # 20-A09122, is April 1, 1999 – March 31, 2029

<u>Ferndale Refinery operated by ConocoPhillips: DNR Lease 20-A11714 – Lease pertaining to ConocoPhillips/Tosco pier and outfalls</u>

The ConocoPhillips (COP) Ferndale Refinery is located in Whatcom County on an 850 acre site, fronting on the Georgia Strait between Cherry Point and Sandy Point, five miles west-southwest of Ferndale, Washington. Originally built in 1954, the refinery has completed several upgrades and expansions since then and, as of January 2008, has a capacity to process approximately 105,000 bbl per day of crude oil. The main source of crude oil is from tankers delivering oil from Alaska's North Slope and Canadian crude via pipeline. The crude oil is processed to produce a range of fuels and products including: gasoline, diesel (low sulfur & ultra low sulfur), liquid petroleum gas, residual fuel oil, marine bunker fuel oil, and sulfur. The refinery currently employs about 280 people with an additional 150 contract employees. The indirect employment associated with the refinery is about 900 people. The refinery operates 24 hours per day and 365 days per year, except during turnaround periods which occur about once every two to three years.

As part of normal operation, the refinery has substantial water-dependent activities associated with the receipt of raw materials, shipping of products, vessel fueling and permitted Clean Water Act (CWA) discharges. In 2007, approximately 530 vessel transfers were conducted at the refinery dock. These vessels primarily consist of crude oil tankers and petroleum product barges. The scheduling of vessel and cargo activities at the marine terminal is coordinated by the refinery and is intended to meet raw material needs for the refinery and product distribution to the market.

All governmental regulations and ConocoPhillips' standards and procedures are strictly enforced throughout docking and loading/unloading operations. The refinery maintains and updates its

Marine Terminal Safety & Operations Manual, which describes personnel responsibilities, operating procedures, and related data concerning the refinery dock and transfer operations, including the pre-booming of oil transfers in accordance with state requirements which came into effect in 2007. In compliance with federal and state regulations, the refinery also maintains and updates plans and programs, such as the Oil Spill Prevention Plan, the Oil Spill Response Plan, the Spill Prevention, Control, and Countermeasure Plan, the Integrated Contingency Plan, and Oil Handling Personnel Training. ConocoPhillips has an ongoing program for periodic inspection, maintenance, repair, and replacement activities required to ensure the longevity and reliability of operations at the dock and associated facilities; these activities may include above-water, on-water, and in-water work and are conducted in accordance with approvals received from federal, state, and local permitting agencies.

The refinery operates an NPDES AKART-permitted wastewater treatment plant. The NPDES outfall discharges into the Strait of Georgia approximately 1200 feet from the shoreline. The outfall line also periodically conveys treated wastewater from Tenaska, a cogeneration facility located adjacent to the refinery. The refinery NPDES permit requires monitoring, effluent mixing and toxicity studies, sediment sampling, and Stormwater Pollution Prevention Plan updates and implementation.

<u>Intalco Aluminum Corporation – DNR Lease 20-A08488 – Lease pertaining to Intalco pier only (outfalls are managed using a separate lease instrument).</u>
Intalco Aluminum Corporation (Intalco), a subsidiary of Alcoa Inc. (Alcoa), the world leader in the production and management of primary aluminum, fabricated aluminum and alumina combined, is located in Whatcom County approximately 100 miles north of Seattle, Washington and 50 miles south of Vancouver British Columbia. Intalco operates an aluminum smelter that occupies approximately 300 acres of a 1,500 acre tract fronting on the Georgia Strait between Cherry Point and Sandy Point near Ferndale Washington. Intalco has been part of the local community for more than 40 years and began operation in 1966 as a primary aluminum smelter, owned by Alumax, Pechiney and Howmet. In 1998, Alcoa acquired Alumax, resulting in Intalco becoming an Alcoa subsidiary.

Intalco produces aluminum metal utilizing the Hall-Heroult reduction process. This process utilizes electrical current to dissolve alumina in a cryolite bath inside large carbon-lined aluminum reduction cells. Once dissolved the molten aluminum separates from the solution and collects at the bottom of the reduction cell where it is removed and transported to natural gas fired furnaces. The molten aluminum is then cast into various sizes and forms to be utilized in casting or extrusion processes to make products such as window frames, wheels and ladders.

Intalco was originally designed and built to accommodate a paste plant, bake furnace, three operating potlines, and a casthouse. Each potline consists of 240 side worked, pre-bake aluminum reduction cells for a total of 720. While the smelter is currently permitted to produce 307,000 tons of aluminum metal per year, rising power costs in early 2001 caused the facility to operate in a curtailed mode since June of 2001. Since that time Intalco has been operating in a curtailed mode and as of March 2008 is operating at approximately 70% of capacity with a workforce of over 600 full time employees. Economic study has shown that every Intalco job in Washington creates an additional three jobs in the community.

Intalco's pier operations consist of permitted Clean Water Act (CWA) discharges and unloading activities as described in the current Aquatic Lands Lease between Intalco and the State of Washington (Department of Natural Resources). This lease currently allows for unloading alumina ore and liquefied petroleum gas. It also allows for the addition of future loading and unloading activities pending regulatory permit approvals.

There are numerous State and Federal regulations that apply to the activities throughout the facility including those activities associated with the loading/unloading operations at the facility's pier. These include, but are not limited to Spill Prevention, Control, and Countermeasure Plans, National Pollutant Discharge Elimination System permits, Title V Air Operating Permits, DNR Aquatic Lands Lease requirements, etc. Intalco takes all of these regulations seriously and is routinely inspected by State and Federal regulatory agencies to ensure compliance.

Gateway Pacific Terminals – DNR Lease 20-013265 – Application for a lease made by Gateway Pacific Terminals for a pier

Pacific International Terminals, Inc. (PIT) owns 1,092-acres of heavy-impact industrial zoned land at Cherry Point in Whatcom County, Washington. PIT is in the process of permitting and developing a deep-sea cargo shipping facility on the property known as Gateway Pacific Terminal (or proposed project). The proposed project includes a ~3000 x 105 foot wharf with three berths averaging approximately 80 feet of draft, a 1,250 foot access trestle connecting the wharf to the shore, and a series of on-shore cargo storage buildings, railroad track for transporting commodities, parking area, equipment storage, and administrative areas. The waterside trestle and wharf would be located on the shoreline at Cherry Point between the BP Cherry Point Refinery pier and the Alcoa-Intalco Works pier. The shoreward facility is on PIT's upland property bounded by Aldergrove Road on the north, the Straits of Georgia on the west, Kickerville Road on the east and Henry Road on the south. The proposed project's site is located 17 miles south of the United State and Canada boarder and 6 miles from Interstate 5 along Highway 548. The property has access to BNSF rail at the site boundary along with industrial water, natural gas, high voltage power and other heavy industry support utilities. The heavy impact industrial zoning, close proximity to deep water without dredging, supporting infrastructure, good geotechnical conditions and large number of acres at the site all lend themselves to a successful development of a marine shipping terminal.

In 1997, PIT received a Shoreline Substantial Development Permit from Whatcom County, Washington, to construct GPT. A consortium including Washington State Department of Ecology (Ecology), Washington Department of Fish and Wildlife (WDFW), and a coalition of environmental groups appealed the permit to the State Shoreline Hearings Board on the basis that potential environmental impacts from the project were not satisfactorily addressed or mitigated. The appeal led to a Settlement Agreement (SA) among all the parties executed in 1999. Subsequently, PIT commenced implementation of the SA conditions. These actions included baseline environmental studies and surveys; revisions and order-of-magnitude designs; financial studies; real estate acquisitions; contractual arrangements and the on going efforts to acquire the additional permits from the US Army Corps of Engineers (USACE) required for the project and Aquatic Lands Lease from the Washington State Department of Natural Resources (DNR). .

Appendix C - Public Withdrawal of the Cherry Point

Withdrawn Public Land Boundary Description

State owned lands within the boundary of the existing Cherry Point Aquatic Reserve were withdrawn from leasing in 2000 by Commissioner of Public Lands Jennifer Belcher. As a result of the process for developing this management plan, DNR has determined that additional lands should be withdrawn to meet the objectives of the Cherry Point Aquatic Reserve and the Cherry Point Resource Protection and Management Plan. Therefore, the deep water boundary of the Aquatic Reserve will be extended waterward to match the deepwater extent of the Cherry Point Management Area as defined in the Whatcom County Shoreline Master Program. This will provide a consistent approach to management between state and local programs in this area. Additional state owned bedlands in the vicinity of Point Whitehorn have also been included in the withdrawn area as shown in the map provided below (Figure 22).

The waterward boundaries of the withdrawn area coincide with the aquatic boundaries of the Cherry Point Resource Area. The Cherry Point Resource Area, for purposes of the planning document, includes the withdrawn areas, private tidelands and beaches, and DNR leased lands, as well as public and private uplands as shown in Figure 1 of this plan (p. 17). DNR will implement the actions and obligations described in this plan as the basis for managing the Cherry Point Aquatic Reserve.

<PLACEHOLDER FOR NEW WITHDRAWAL ORDER>

Cherry Point Aquatic Reserve

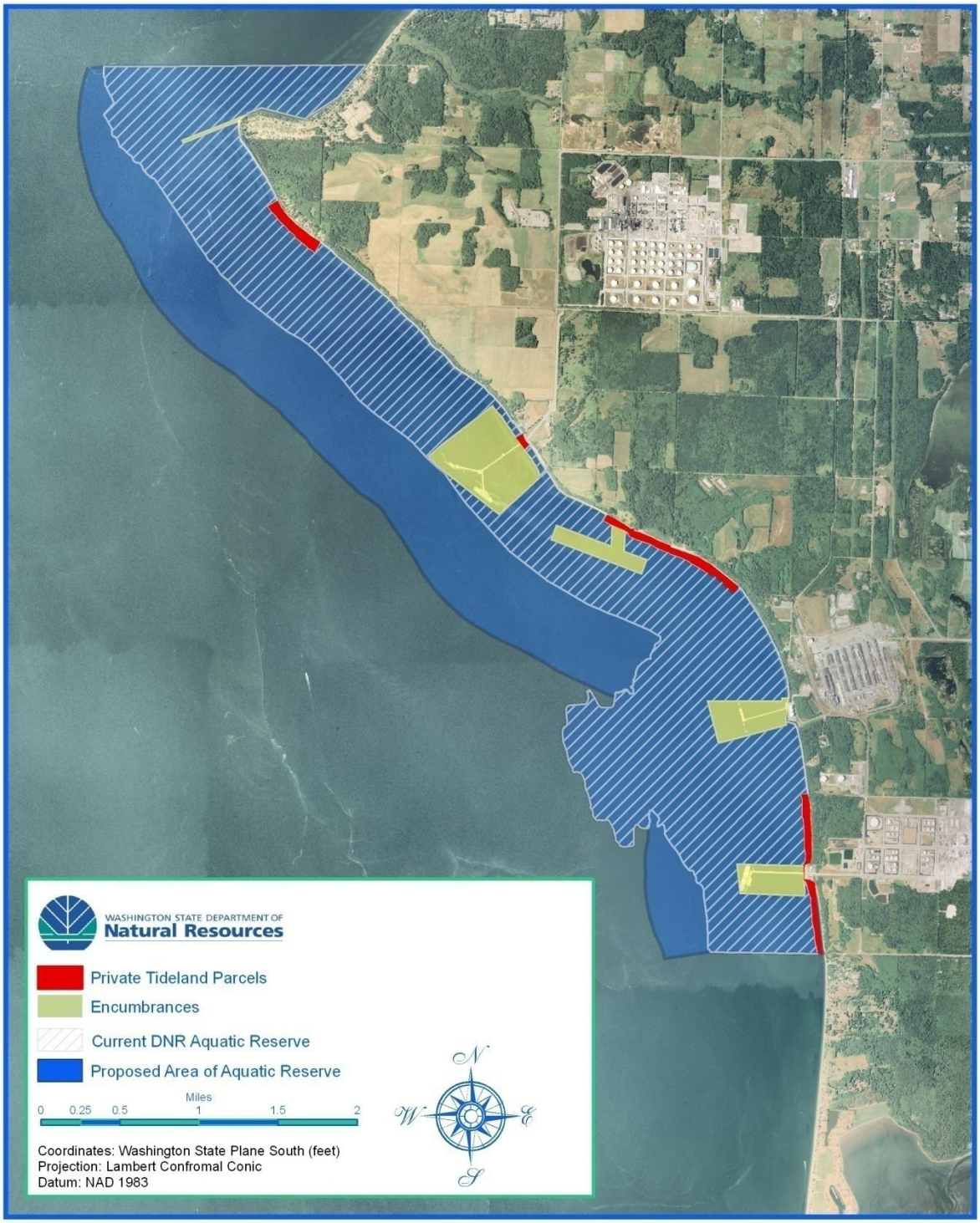

Figure 22 Historical Planning Area

Appendix D – Bird Species Observed at Cherry Point

Ring-necked Pheasant-Resident-Introduced
Ruffed Grouse - Resident*
Brandt's Cormorant - Resident
Double-crested Cormorant - Resident
Pelagic Cormorant - Resident
Great Blue Heron - Resident
Green Heron - Summer
Turkey Vulture - Summer
Osprey - Summer
Bald Eagle - Resident
Northern Harrier - Resident
Sharp-shinned Hawk - Resident
Cooper's Hawk - Resident
Red-tailed Hawk - Resident
Rough-legged Hawk - Winter
American Kestrel - Resident
Merlin - Resident
Peregrine Falcon - Resident
Killdeer - Resident
Spotted Sandpiper - Summer
Wandering Tattler - Winter
Greater Yellowlegs - Winter
Marbled Godwit - Migrant**
Black Turnstone - Winter
Sanderling - Winter
Semipalmated Sandpiper - Migrant
Dunlin - Winter
Bonaparte's Gull – Migrant/Winter
California Gull – Summer
Heerman's Gull - Summer
Mew Gull - Winter
Ring-billed Gull - Winter
Thayer's Gull - Winter
Glaucous-winged Gull - Resident
Black-legged Kittiwake - Migrant
Caspian Tern - Summer
Common Tern - Migrant
Parasitic Jaeger - Migrant
Rock Pigeon - Resident-Introduced
Mourning Dove - Summer
Western Screech-Owl - Resident
Great Horned Owl - Resident
Barred Owl - Resident
Rufus Hummingbird - Summer
Belted Kingfisher - Resident
Red-breasted Sapsucker - Summer
Downy Woodpecker - Resident
Hairy Woodpecker - Resident
Northern Flicker - Resident
Pileated Woodpecker - Resident
Olive-sided Flycatcher - Summer
Western Wood-Pewee - Summer
Willow Flycatcher - Summer
Pacific-slope Flycatcher - Summer
Northern Shrike - Winter
Cassin's Vireo - Summer
Hutton's Vireo - Resident
Warbling Vireo - Summer
Red-eyed Vireo - Summer
Steller's Jay - Resident
American/Northwest Crow - Resident
Common Raven - Resident
Tree Swallow - Summer
Violet-green Swallow - Summer
N. Rough-winged Swallow - Summer
Cliff Swallow - Summer
Barn Swallow - Summer
Black-capped Chickadee - Resident
Chestnut-backed Chickadee - Resident
Bushtit - Resident
Red-breasted Nuthatch - Resident
Brown Creeper - Resident
Bewick's Wren - Resident
Winter Wren - Resident
Golden-crowned Kinglet – Resident

Ruby-crowned Kinglet - Resident
Swainson's Thrush – Summer
Hermit Thrush - Winter
American Robin - Resident
Varied Thrush - Winter
European Starling - Resident-Introduced
Cedar Waxwing - Resident
Orange-crowned Warbler - Resident
Yellow Warbler - Summer
Yellow-rumped Warbler - Resident
Black-throated Gray Warbler - Summer
Townsend's Warbler - Summer
Common Yellowthroat - Summer
Wilson's Warbler - Summer
Western Tanager - Summer
Spotted Towhee - Resident
Savannah Sparrow - Summer

***Migrant = present in Spring and/or Fall*
**Resident = usually present all year*

Fox Sparrow - Winter
Song Sparrow - Resident
White-crowned Sparrow - Resident
Golden-crowned Sparrow - Winter
Dark-eyed Junco - Resident
Black-headed Grosbeak - Summer
Red-winged Blackbird - Resident
Western Meadowlark - Resident
Brewer's Blackbird - Resident
Brown-headed Cowbird - Resident
Bullock's Oriole - Summer
Purple Finch - Resident
House Finch - Resident
Red-Crossbill - Resident
Pine Siskin - Resident
American Goldfinch - Resident
Evening Grosbeak - Resident
House Sparrow - Resident - Introduced

This list includes birds recorded at or immediately adjacent to the boundary of Cherry Point Reserve. Not included on this list are over 30 species of ducks, geese, swans and alcids documented by experts such as Dr. John Bower, Professor, Fairhaven College, Western Washington University.

These 108 species represent 32% of the 344 species of birds that have been recorded in Whatcom County. Inclusion of the marine species brings the percentage of local bird species that utilize the habitat at some point in their annual lifecycle to just over 40%. As noted within the above list, different species use the habitat of the management area at various times throughout the year. Though there are seasonal differences, the habitat supports a variety of avian species throughout the year.

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Plus contributions from Dr. John Bower, Jennifer Bohannon (WDFW), Joe Meche and David Schmalz and Jeanie Johnson.