DRAFT ENVIRONMENTAL IMPACT STATEMENT

STABILIZATION OF IN-WATER FACILITIES

FOX ISLAND LABORATORY

FOX ISLAND, WASHINGTON

December, 2003

Fox Island Laboratory

Naval Surface Warfare Center
Carderock Division
Detachment Bremerton
630 – 3rd Avenue
Fox Island, Washington 98333

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February 2, 2004

ABSTRACT

The Naval Surface Warfare Center, Carderock Division is proposing to stabilize in-water facilities at Fox Island Laboratory on Carr Inlet in southern Puget Sound. In-water elements of the facility, consisting of several barges, a pier, and associated mooring components, have sustained substantial weather-related damage, and portions of the facility have reached a point of questionable structural integrity. Stabilization of in-water facilities is intended to prevent further damage and to improve the safety of personnel working at the laboratory. The Preferred Alternative, one of four alternatives evaluated, is installation of a 240-foot pontoon barge and replacement of the existing mooring system. The Preferred Alternative is not expected to result in any significant short or long-term impacts on physical, biological, socio-economic resources, or on beach processes and erosive action occurring to the northwest of FIL. No significant cumulative impacts are anticipated, nor are any natural or cultural resources likely to be irreversibly or irretrievably committed as a result of implementation of the Preferred Alternative. The results of analyses of threatened and endangered species indicates that the Preferred Alternative would have "no effect" on humpback whale and leatherback sea turtle, and "may affect" but is "not likely to adversely affect" chinook salmon, marbled murrelet, Steller sea lion, bull trout, and bald eagle. The Navy has determined that the project would have no adverse effect on designated Essential Fish Habitat (EFH).

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SUMMARY

Name of Action: Stabilization of In-Water Facilities at Fox Island Laboratory

Type of Action: Administrative

Description of Action:

The Naval Surface Warfare Center, Carderock Division, is proposing to stabilize in-water facilities at Fox Island Laboratory (FIL) on Carr Inlet in Southern Puget Sound, Fox Island Washington. The facility was established in the 1950s as the Carr Inlet Acoustic Range (CIAR), serving both diesel and nuclear submarines. In 1992, the submarine testing portion of the work associated with CIAR was moved to the Southeast Alaska Acoustic Measurement Facility (SEAFAC). CIAR was then renamed FIL and continues research and developmental testing of small underwater equipment and vehicles for the Navy.

FIL is located on a Navy-owned, 1.3 acre (0.5 hectare) site on the southwest shoreline of Fox Island. The address of FIL is: 630 – 3rd Avenue, Fox Island, Washington 98333.

As part of Carderock Division, Fox Island Laboratory's current mission is:

> "To provide a unique, shallow water (<400 feet(122 m)), protected ocean environment facility which operates and maintains operational barges, shore facilities, personnel and resources required to support research, development, testing and evaluation … for the Navy Deep Submergence Program and other research efforts (commercial, academic, and private research laboratories)."

At the present time, the laboratory consists of a pier, several barges, mooring components, and associated upland support structures and facilities. In recent years, in-water elements of the facility have sustained substantial storm damage and portions of the facility have become questionable regarding their structural integrity. Specifically, problems include: a) Mooring system components for barges and other floating equipment are aging and subject to failure; b) Two fender barges have sustained storm damage; c) The two fender barges are aging and there is potential for loss by capsizing; d) Aging and damaged facilities combine to present a risk to staff and visitors working at the laboratory; e) Movement of equipment between barges and/or pier is difficult and presents safety concerns for staff and visitors; and f) Because of deteriorated facilities, the potential for further storm damage is high.

Fox Island Laboratory must provide stable in-water facilities in order to meet its mission requirements. The purpose of the Proposed Action is to prevent additional damage to existing facilities, and to improve the safety of personnel working at the laboratory. Replacement of the existing configuration of pier and barges with a more stable platform and replacement of the existing mooring components are intended to correct structural deficiencies and provide safe working conditions. A more stable working platform and secure mooring systems would result in more efficient movement of staff and transfer of equipment between the pier and barges. Proposed improvements would ensure a safe working environment for researchers using the laboratory.

Description of Alternatives Considered in Detail

1) 240-Foot Pontoon (Preferred Alternative). This alternative would involve installation of a 240-foot (73 m) by 60 foot (18m) pontoon barge at a location approximately 110 feet (34 m) further offshore than existing facilities. The two small fender barges now in use under the current configuration would be removed for decommissioning. A new 100-foot (30 m) by 60 foot (18m) pontoon section and new steel girder bridge would be installed connecting the existing pier with the new 240-foot (73 m) pontoon. Existing mooring components would be removed and new mooring systems, consisting of spud piles, dragged in anchors, and clump weights, would be installed.

2) 360-Foot Pontoon. This alternative would involve installation of a 360-foot (110 m) by 60 foot (18 m) pontoon barge, parallel to shore, at the approximate location of the existing M241 Barge. The two small fender barges would be removed. The pier would be connected with a new pontoon barge by a new steel girder bridge. Replacement of existing mooring components would be as described above for the 240-Foot Pontoon Alternative.

3) Fixed Pier. The existing pier would be extended to a length of approximately 325 feet (99 m), roughly double its present length. It would connect with a new fixed pier app 240 feet (73 m) by 55 feet (17 m). The fixed pier would be supported by steel and/or concrete piles. The two small fender barges now in use under the current configuration would be removed.

4) No Action. In compliance with NEPA guidelines, a No Action Alternative is also evaluated. Under this alternative, no stabilization measures would be undertaken.

The first three alternatives are collectively referred to as "action alternatives" throughout the EIS.

Monitoring and Maintenance

The following monitoring and maintenance activities are included in the three action alternatives:

- A survey of the shoreline in the vicinity of FIL was conducted in late spring 2002. Subsequent surveys of the shoreline will be conducted as appropriate to document changes to the beach over time, particularly following any changes to the pier and barge configuration at FIL.
- Similarly, samples of beach material were collected in spring 2002 for grain size analysis. Subsequent samples will be collected for analysis to document changes to the beach over time, particularly following changes to the pier and barge configuration at FIL.
- Exposed wood debris on Navy property would be removed during construction. Subsequently, any additional wood debris accumulating would be removed periodically as it collects on the beach.

Alternatives Considered But Eliminated From Detailed Consideration

Over the course of project planning and scoping, several alternatives were considered but eliminated from detailed evaluation. Criteria used for evaluation included: a) the site must meet the Purpose and Need for the Proposed Action; b) the site must be consistent with the mission of

FIL; and c) the site must provide adequate infrastructure from shore including access. Alternatives not meeting the evaluation criteria included:

- Replace Mooring Systems
- Dabob Test Range Facility
- Southeast Alaska Acoustic Measurement Facility
- McNeil Island

Statement Regarding Scientific Controversy

Property owners to the northwest of FIL have expressed concern that in-water facilities at FIL have altered beach dynamics in a manner that has resulted in substantial beach erosion. Specifically, it is asserted that the barges intercept incident wave energy, acting as a de facto breakwater reducing energy input to the shoreline. Further, this has resulted in the development of a salient (sandspit) beneath the FIL access pier and a reduction in transport of beach sediment to the shoreline to the northwest. Because of the concerns of adjacent residents, the Navy elected to prepare an EIS for the Proposed Action. Through the EIS process, the Navy conducted analyses to determine the nature and extent of any contribution that FIL has on to the beach erosion occurring to the northwest. The analysis, "Fox Island Laboratory Beach Change Study", was performed by Pacific International Engineering. This information was further used to determine any potential impacts resulting from the proposed action. Results of analyses conducted as part of this EIS are summarized below and can be obtained from Fox Island Laboratory.

- Much of the southwest shoreline of Fox Island has experienced beach erosion and bluff retreat, historically, between 0.2 to 0.5 feet (6 to 15 cm) per year.
- Since 1970, much of the bluff retreat northwest of FIL has been obstructed by the placement of numerous bulkheads and revetments.
- In-water facilities at FIL have modified the shoreline, creating a salient (point consisting of accumulated beach material) that extends about 100 feet (30 m) seaward under the access pier.
- In-water structures at FIL do not cause significant blockage of sediment transport from the southeast to the northwest. These structures may capture from 7 to 15 percent of the net sediment transport, a rate "...not significant to the overall transport processes." (Shepsis, 2002).
- The length of shoreline buffered from the effects of wind and wave by in-water facilities is about 950 feet (285 m) northwest of the FIL access pier.
- Modeling indicates that the effects of action alternatives on shoreline processes, including beach erosion of adjacent properties, are not significant and that the differences in impacts between action alternatives are small (Shepsis, 2002).
- While short-term changes in the size of salient may occur, over the long-term the salient is not expected to grow under any of the action alternatives.

Environmental Impacts

- Physical Resources (includes earth resources, water resources, air quality, and noise). Construction impacts would be similar for all action alternatives and are not expected to be significant. Construction is expected to last between one and three months and would create slight increases in noise, air emissions, resuspension of sediments typical of marine construction projects.

Modeling has shown that none of the action alternatives will result in any significant change in shoreline processes that currently exist in the vicinity of FIL, nor will action alternatives significantly alter the conditions (i.e. naturally-occurring bluff retreat, bulkheads, revetments) that result in beach erosion to the northwest of FIL.

Biological Resources (includes vegetation, fish, shellfish and benthos, marine mammals, marine and shorebirds, threatened and endangered species, and essential fish habitat).

- Analyses of threatened and endangered species indicates that action alternatives are expected to have "no effect" on humpback whale, leatherback sea turtle, marbled murrelet, and Steller sea lion and "may affect" but are "not likely to adversely affect" chinook salmon, bull trout, and bald eagle.
- Analyses have shown that none of the action alternatives would result in a "take" of marine mammals.
- The Navy has concluded that action alternatives would have "no adverse affect" on designated Essential Fish Habitat.

Socioeconomic Resources (includes land and shoreline use, transportation, demographics and employment, aesthetics, cultural resources, recreation, environmental justice, and public safety and environmental health hazards to children).

- Construction impacts will be similar for all action alternatives and are not expected to be significant. Construction is expected to last between one and three months and will result in slight increases in waterborne and vehicular traffic, lighting, and general activities typical of marine construction projects.
- The FIL site has little or no potential for containing intact subsurface archaeological resources and none of the structures on site meets the criteria for the National Register of Historic Places. Construction of any of the action alternatives is unlikely to have any effect on historical resources.
- The Navy has concluded that the Proposed Action is consistent with enforceable policies of the Washington Coastal Zone Management Program and will complete a Coastal Consistency Determination in accordance with the Coastal Zone Management Act after consideration of comments on the DEIS.
- Aesthetic impacts range from minor to moderate based on analyses of bulk, scale and lighting characteristics of the action alternatives. None of these changes are considered to be significant. The lightening concerns raised during scoping would be addressed during the design phase.

- None of the action alternatives would result in impacts on minority or low-income populations nor would they result in public safety and environmental hazards to children.
- None of the action alternatives would result in impacts on recreational facilities.

Mitigation Measures

No mitigation measures are required.

ACRONYMS

APE – Area of Potential Effects

BA – Biological Assessment

CAA – Clean Air Act

CIAR – Carr Inlet Acoustic Range

CZMA – Coastal Zone Management Act

DoD – Department of Defense

EFANW – Engineering Field Activity Northwest, Naval Facilities Engineering Command

EFH – Essential Fish Habitat

ESA – Endangered Species Act

FIL - Fox Island Laboratory, Fox Island, Washington

GLO – General Land Office

HPA – Hydraulic Project Approval, Washington Department of Fish and Wildlife

MLLW – Mean Lower Low Water

MMPA – Marine Mammal Protection Act

MOA – Marine Operating Area

MSA – Magnuson-Stevens Fishery Conservation and Management Act

NAAQS – National Ambient Air Quality Standards

NEPA – National Environmental Policy Act

NOAA – National Oceanic and Atmospheric Administration, U.S. Department of Commerce

NRHP – National Register of Historic Places

NSWCCD – Naval Surface Warfare Center, Carderock Division

NUWC – Naval Undersea Warfare Center (e.g. Keyport)

NWI – National Wetland Inventory

OAHP – Office of Archaeology and Historic Preservation, State of Washington

PAH – Polycyclic aromatic hydrocarbon

PALS – Planning and Land Services, Pierce County

PCB – Polychlorinated biphenyl

RDT&E – Research, Development, Testing and Evaluation

ROV – Remote Operated Vehicle

SEAFAC – Southeast Alaska Acoustic Measurement Facility

SIP – State Implementation Plan for Air Quality

SMA – Washington State Shoreline Management Act

SUBASE – Submarine Base (i.e. Bangor)

USACE – U.S. Army Corps of Engineers

USEPA – United States Environmental Protection Agency

USFWS – United States Fish and Wildlife Service, Department of the Interior

UUV – Unmanned Underwater Vehicle

WDFW – Washington State Department of Fish and Wildlife

WDNR – Washington State Department of Natural Resources

WDOC – Washington State Department of Corrections

WDOH – Washington State Department of Health

Chapter 1.0 Purpose and Need

1.1 Introduction

The Naval Surface Warfare Center, Carderock Division is proposing to stabilize in-water facilities at Fox Island Laboratory on Carr Inlet in southern Puget Sound (See Figures 1, 2, and 3). In-water portions of the facility, consisting of several barges, a pier, and associated mooring components, have sustained substantial weather-related damage, and portions of the facility have come to the point of questionable structural integrity. Stabilization of in-water facilities is intended to prevent further damage and improve the safety of personnel working at the laboratory. Stabilization would involve replacement of the existing barge configuration with a more stable platform and replacement of existing mooring components.

1.2 Background

1.2.1 Carderock Division

The Naval Surface Warfare Center's Carderock Division (NSWCCD) is the U.S. Navy's state of the art research, engineering, modeling and test center for ships and ship systems. It provides research, development, test and evaluation, fleet support, and in-service engineering for surface and undersea vehicle hull, mechanical and electrical systems, and propulsors; provides logistics research and development; and provides support to the Maritime Administration and maritime industry.

Specifically, NSWCCD is involved in seven core areas of research and engineering:

- Signatures and silencing
- Hull forms and propulsors
- Machinery systems and components
- Structures and materials
- Vulnerability and survivability
- Environmental quality
- Design and integration technology.

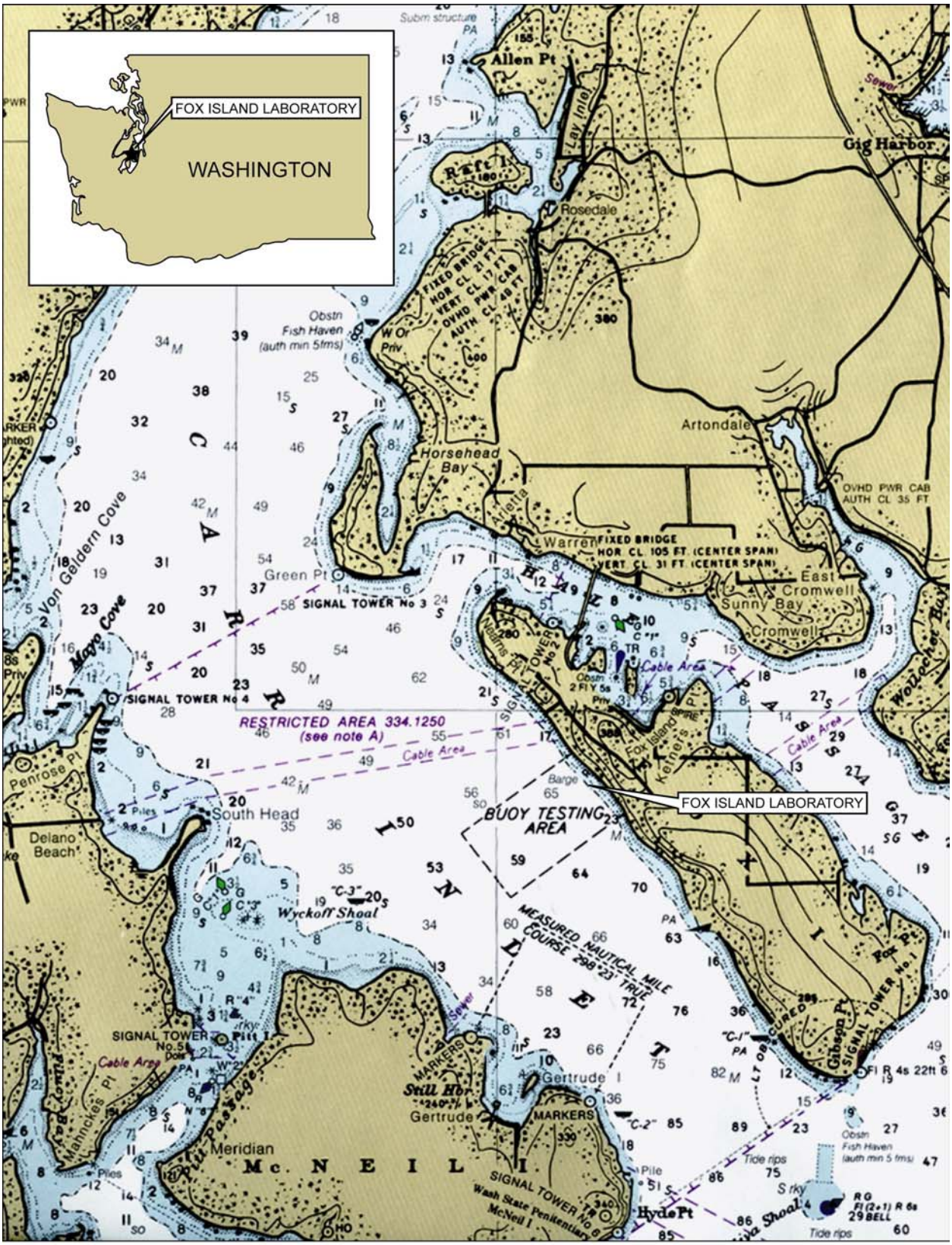


Figure 1. Location map for Fox Island Laboratory.

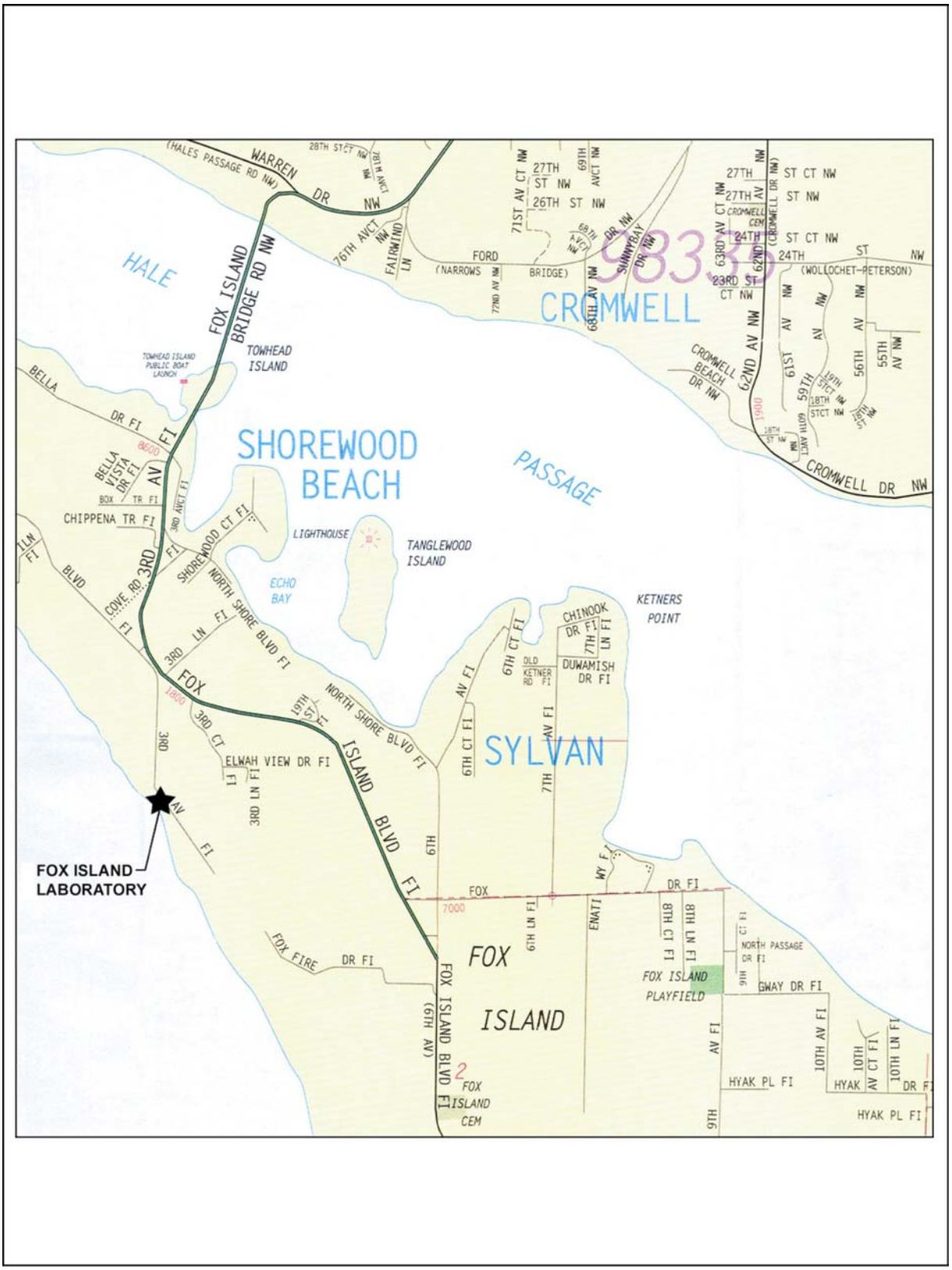


Figure 2. Access to Fox Island Laboratory.

Figure 3. Overview of Fox Island Laboratory and surrounding beach area.

1.2.2 Fox Island Laboratory

The NSWCCD has been conducting acoustic and performance measurements for the U.S. Navy and other customers at the Fox Island/Carr Inlet facility for 50 years. Established in 1953 as the Carr Inlet Acoustic Range (CIAR), the facility was an integral part of the submarine (diesel and nuclear) and surface ship silencing programs. In 1992, CIAR activities were moved to Southeast Alaska Acoustic Measurement Facility (SEAFAC). CIAR was then renamed FIL and continues research and developmental testing of small underwater equipment and vehicles for the Navy.

FIL is located on a Navy-owned, 1.3 acre (0.5 hectare) site on the southwest shoreline of Fox Island. Additional submerged lands within Carr Inlet are utilized through a lease agreement with the Washington State Department of Natural Resources (WDNR). Carr Inlet is located in southern Puget Sound, is about 13 nautical miles (24 km) in length, and ranges from one to two nautical miles (1.8 to 3.7 km) in width over much of its length. It has a maximum depth of approximately 535 feet (163 m) off Gibson Point. The average daily tide range is 9.5 feet (2.9 m).

The inlet provides a protected marine environment with low sea states, and has low ambient noise levels. Commercial vessel activity is infrequent and there are few sources of shoreline noise (e.g., port activity, shipyard activity, generators, cathodic protection systems on large piers). Benefits also include access to relatively deep water (up to 400 feet (122 m) of depth) in Carr Inlet and the ability to reach water depths of 100 feet (30 m) within the reach of shore power and communications connections.

Due to the unique conditions afforded by Carr Inlet and the Fox Island location, FIL's mission has evolved and currently is:

> "To provide a unique, shallow water (<400 feet(122 m)), protected ocean environment facility which operates and maintains research barges, shore facilities, personnel and resources required to support research, development, testing and evaluation ...for the Navy Deep Submergence Program and other sponsors (commercial, academic, and private research laboratories)."

This broad mission statement is further divided into the following objectives:

- To conduct technical and operational evaluations of advanced technology, experimental vehicles, and underwater equipment.
- To serve as a shallow water test-bed for projects that demonstrate proof-of-concept, exercise engineering prototype hardware, and groom pre-production models.
- To perform scientific research in support of special warfare requirements.

Support of research, development, testing and evaluation provided by FIL covers a wide range of customers, including government, education, and privately owned organizations. These diverse operations include:

- Ocean engineering projects
- Performance and acoustic testing
  - Mine-hunting and search sonar
  - Doppler sonar (velocity, current measurements)
- Underwater robotic evaluation
  - Remotely operated vehicles (ROVs)
  - Unmanned Underwater Vehicles (UUVs)
- Training
- Operations and logistics support
  - Fleet Training
  - Special warfare exercises

Fox Island Laboratory is a dedicated facility that is available to Navy clients on an as needed basis, able to conduct fast track test and development programs for sophisticated marine systems. FIL offers a superior research and testing environment for scientists and engineers. Items which are typically deployed from Navy vessels, can be deployed from the test facilities at FIL eliminating the need to use Navy ship time and personnel for testing. Researchers and engineers also benefit from the abundant information available on oceanographic characteristics of Carr Inlet (i.e. detailed bathymetry; salinity, temperature, and density characteristics; detailed tidal data; sound velocities; biological characteristics).

Infrastructure and support capabilities have been developed at FIL to support research and development. These include: portable underwater acoustic data acquisition and processing capability; surface and subsurface navigation and tracking systems hardware / software; secure telephone lines and T-3 (high speed fiber optic) communication lines; and scuba and surface supplied diving systems. Security systems have been developed that provide secure working environments for proprietary or classified systems. In addition, FIL benefits from its proximity to services and facilities at the Puget Sound Naval Shipyard and Naval Submarine Base Bangor (SUBASE Bangor) and port facilities in Tacoma and Seattle.

1.2.3 FIL Research and Development Operations

Since its reorganization in 1992, FIL has conducted and supported a wide range of customers and operations, and continues to do so. These projects include performance and acoustic testing of UUV, ROV and mine hunting hardware, as well as diving and manned-system evaluations.

Depending on customer requirements, the duration of testing typically varies between a few hours and several weeks. Testing is conducted throughout the year. During the recreational boating season, the majority of acoustic testing is limited to the hours of darkness since the underwater noise generated by passing vessels surpasses the quiet ambient noise levels needed for acoustic tests. For the remainder of the year, acoustic testing may be conducted around the clock, when weather conditions and background ambient noise level permit.

Testing is accomplished within a framework of guidelines established to preserve the natural environment of the inlet. These guidelines have been developed over the years through Navy-supported environmental research and by conformance with Federal, State, and local environmental regulations.

The test requirements for these technical and operational evaluations of advanced technology, experimental vehicles, and underwater equipment sometimes requires the deployment of temporary, bottom-mounted acoustic systems and/or bottom-laid or embedded target fields. On occasion, FIL conducts performance, engineering and operational testing of specialized underwater tools and equipment developed by the Navy and private industry. The types of equipment evaluated include such tools as marine cable burial machines and excavators used for coring and sampling of bottom composition, material properties, and physical characteristics.

The sandy loam and mud bottom of Carr Inlet present a general, representative spectra of the types of bottom characteristics encountered in major ocean areas and littoral regions of naval interest. The sheltered environment of the inlet provides a discrete area in which to operationally test specialized underwater systems before actual field operations in an open ocean or littoral environment. These demonstration tests under realistic conditions are essential for the successful deployment of associated equipment on military missions or for employment in commercial applications.

The test and evaluation activities routinely conducted at FIL also often involve the use of various acoustic devices, including side scan sonar, forward looking sonar, homing and docking sonar, acoustic communication links, and Doppler velocity logs. Each of these acoustic systems projects sound into the water, at various source levels and frequencies. The types of operations involved with this equipment includes mine-hunting and identification exercises, launching and docking tests, navigation, and a wide range of other actions which require either underwater detection, tracking, or communication.

The technical and operational evaluations of advanced technology, experimental vehicles, and underwater equipment will continue at historic levels.

1.3 Purpose and Need

The National Environmental Policy Act (NEPA) requires that an environmental analysis of potential effects of a proposed federal action be conducted and that this information be made available to decision makers and the public. The NEPA process is designed to help make informed decisions based on an understanding of environmental consequences. A clear definition of the purpose and need of the action alternative is an integral part of this process. It also facilitates comparison of alternatives by evaluating the degree to which a given alternative meets the objectives of the Proposed Action.

At the present time, FIL consists of a pier, several barges, mooring components, and associated upland support structures and facilities. In recent years, in-water elements of the facility have sustained substantial storm damage and portions of the facility have reached a point of

questionable structural integrity. Specifically, the need for the Proposed Action is based on the following identified problems:

- Mooring system components for barges and other floating equipment are aging and subject to failure;
- The two fender barges have sustained storm damage, are aging and there is potential for loss by capsizing;
- Aging and damaged facilities combine to present a risk to staff and visitors working at the laboratory;
- Movement of equipment between barges and pier is difficult and presents safety concerns for staff and visitors; and
- Because of deteriorated facilities, the potential for further storm damage is high.

Fox Island Laboratory must provide stable in-water facilities in order to meet its mission requirements. The purpose of the Proposed Action is to prevent additional damage to existing facilities and to improve the safety of personnel at the laboratory. Replacement of the existing configuration of pier and barges with a more stable platform and replacement of the existing mooring components is intended to correct structural deficiencies and provide safe working conditions. A more stable working platform having secure mooring systems would result in more efficient movement of staff and transfer of equipment between the pier and barges. Proposed improvements would ensure a safe working environment for researchers using the laboratory.

1.4 Environmental Review Process

1.4.1 Notice of Intent

A Notice of Intent to prepare an EIS and to hold a Public Scoping Meeting announcement for the Proposed Action was published in the *Federal Register* (67 FR 14921) on March 28, 2002. This Notice of Intent was issued in accordance with the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council of Environmental Quality. The notice briefly described the Proposed Action and provided the date, time, and location of the scoping meeting. The notice also provided contact information and mailing address for submission of written comments during the scoping period.

1.4.2 Scoping Process

The Scoping Meeting / Open House was held on Wednesday, April 17, 2002 from 6:00 to 9:00 pm at the Nichols Community Center, located at 690 Ninth Avenue, Fox Island, Washington. The purpose of the meeting was to receive oral and written comments on environmental concerns that should be addressed in the EIS. The Scoping Meeting / Open House was advertised in two local newspapers: the *Tacoma News Tribune* on Sunday, April 7, Thursday, April 11, and Monday, April 15; and in the *Peninsula Gateway* on Wednesday, April 10 and Wednesday, April

17. The advertisement briefly described the action alternatives, explained the purpose and need for the scoping meeting, and provided the time and location for the meeting.

A four-page notice describing the Proposed Action, the alternatives under consideration, and advertising the Scoping Meeting / Open House was mailed to local residents; elected officials (federal, state, and local); county, state, federal agencies, and tribes on April 4, 2002. A total of fifty-five local residents and land owners within approximately one-half mile of FIL were included on the mailing list.

The Scoping Meeting / Open House began with an informal question and answer period, where attendees were allowed to view a series of poster boards describing FIL, the Proposed Action, and alternatives. A more formal presentation followed, beginning with an overview of the EIS process, the Proposed Action, and alternatives under consideration. Speakers were then invited to offer formal scoping comments. A total of 25 people attended the Scoping Meeting / Open House. All attendees who signed in were residents of Fox Island. Of the 25 attendees, 12 spoke during the formal comment period. In addition, a representative of Congressman Norm Dicks' office, Erin Babbo, spoke briefly. The Scoping Meeting / Open House was transcribed by a court reporter.

The formal scoping comment period began on April 17, 2002 with the Scoping Meeting / Open House and ended at 5:00 pm on May 17, 2002. A total of 34 comments (written and oral combined) from individuals, agencies, and tribes were received. Several parties provided written and/or oral comments more than once. The following issues were raised during the scoping period:

- Buildup of material at FIL and erosion of the beach to the northwest beginning with installation of the pier in the 1960s. Commenters believe erosion has been more pronounced within the last 10 years. Commenters believe that erosion has resulted in the loss of beach and property damage northwest of FIL (e.g., bulkhead failure, slumping).
- Effects of erosion and sedimentation on the intertidal ecosystem.
- Aesthetic issues associated with installation of the 360-foot (110 m) pontoon.
- Potential noise and lighting impacts.
- Justification for need of facility at Fox Island.
- Sediment quality in the study area.
- Potential shading effects on fish and organisms (e.g. eelgrass).
- Potential impacts to the benthic ecosystem from anchoring / mooring systems.
- Potential impacts to smelt habitat.

Additional alternatives were also suggested by individuals during the scoping comment period. These included:

- Relocating in-water facilities to McNeil Island;
- Relocating FIL to some other unspecified location; and

- Closing FIL operations altogether.

A transcript of the Scoping Meeting can be found at the website: //www.dt.navy.mil/div/news/foxislandeis.html (February 11,2003).

1.4.3 Draft Environmental Impact Statement (DEIS)

This Draft Environmental Impact Statement (DEIS) has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council of Environmental Quality and U.S. Navy implementing guidelines for NEPA *Environmental and Natural Resources Program Manual* (OPNAVINST - 5090.1B, CH-2, September 9, 1999). The Draft EIS evaluates four (4) alternatives, including the No Action Alternative. Descriptions of alternatives can be found in Chapter 2. Particular emphasis in the evaluation is placed on pertinent issues identified during the Scoping Process.

Copies of the Draft EIS will be circulated to regulatory agencies, municipalities, tribes, elected officials, and interested individuals. A Notice of Availability for the Draft EIS will be circulated concurrently indicating locations (e.g., public libraries) where the Draft EIS can be reviewed, the duration of the comment period, the address where written comments can be sent, and the time and place of the Public Hearing on the Draft EIS. The Notice of Availability will be published in the *Tacoma News Tribune* and *The Peninsula Gateway*, the *Federal Register*, and on the website: //www.dt.navy.mil/div/news/foxislandeis.html. The Public Hearing will provide an opportunity for interested parties to comment on the content of the Draft EIS.

1.4.4 Final Environmental Impact Statement (FEIS)

Following the close of the comment period, written and oral comments on the DEIS will be reviewed and responses to these comments prepared. A Final EIS will then be prepared, incorporating responses to comments and any additional evaluation that may be warranted. The Final EIS will be circulated in the same manner as the Draft EIS.

1.4.5 Record of Decision

Following issuance of the Final EIS and a 30-day no action period, a Record of Decision (ROD) will be issued by the Navy. The Record of Decision will be published in the Federal Register and will be distributed to all agencies and interested parties.

1.5 Documents Incorporated by Reference

A number of documents provide important information directly related to the impact evaluation provided in this EIS. The applicable content of these documents is discussed within this EIS. These documents, incorporated by reference include:

- *Fox Island Laboratory Beach Change Study* (Shepsis, Vladimir, 2002).

- *Sediment Study, Fox Island Laboratory*, Fox Island, Washington (HWA Geosciences, Inc., 2002)
- *Cultural Resource Reconnaissance of the United States Navy Fox Island Laboratory*, Fox Island, Pierce County, Washington (Walker Gray et al., 2002).
- *Fox Island Laboratory Shoreline Change Evaluation* (Miller et al., 2002).
- *Cultural Resource Reconnaissance of the United States Navy, Naval Acoustic Range,* Fox Island, Pierce County, Washington (Lewarch et al., 1997).
- *Environmental Management Plan*, Fox Island Laboratory (FIL, 2003).

Chapter 2.0 Proposed Action and Alternatives

2.1 Existing Facility

2.1.1 Upland Facilities

The upland portion of the Navy's Fox Island property measures approximately 150 feet (45.7 m) wide by 350 feet (107 m) deep. The property is approximately 1.3 acres (0.5 hectares). The site slopes from an elevation of approximately 100 feet (30 m) Mean Sea Level (MSL) southwest to the shoreline.

The access road is located in the upper portion of the site and provides access to parking areas in the middle and lower portions of the site (See Figure 4). There is a storage structure in the extreme northeast portion of the site near the access road entrance. A laboratory building is located in the lower section of the site near the base of the pier.

2.1.2 Pier and Catwalk

The existing pier extends from the access road at approximately the high water mark, 184 feet (56 m) in a southwest direction to a water depth of approximately 0 feet (0 m) MLLW. See Figures 4 and 5. The pier is approximately 15 feet (4 m) wide. The pier is supported by concrete piles, most spaced 20 feet (6 m) apart. On the southeast side, there are fourteen (14) wood piles used to protect the pier from floating objects that might damage the access pier. At the outer end of the pier, there is a 30-foot (9 m) catwalk that leads to the moored 912 Barge.

2.1.3 Barge Configuration

The catwalk provides access from the pier to the moored 912 Barge (YFN-912). The 912 Barge is 112 feet (34 m) long by 36 feet (11 m) wide (See Figure 5). This barge serves as a support facility and includes a machine shop and work areas for assembling in-water systems, storage of mooring and rigging gear, and conducting maintenance on small boats.

Outboard of the 912 Barge are two 60-foot (18 m) by 30-foot (9 m) fender barges moored end-to-end parallel to 912 Barge. These barges, referred to as "camels," provide a buffer between the 912 Barge and the M241 Barge.

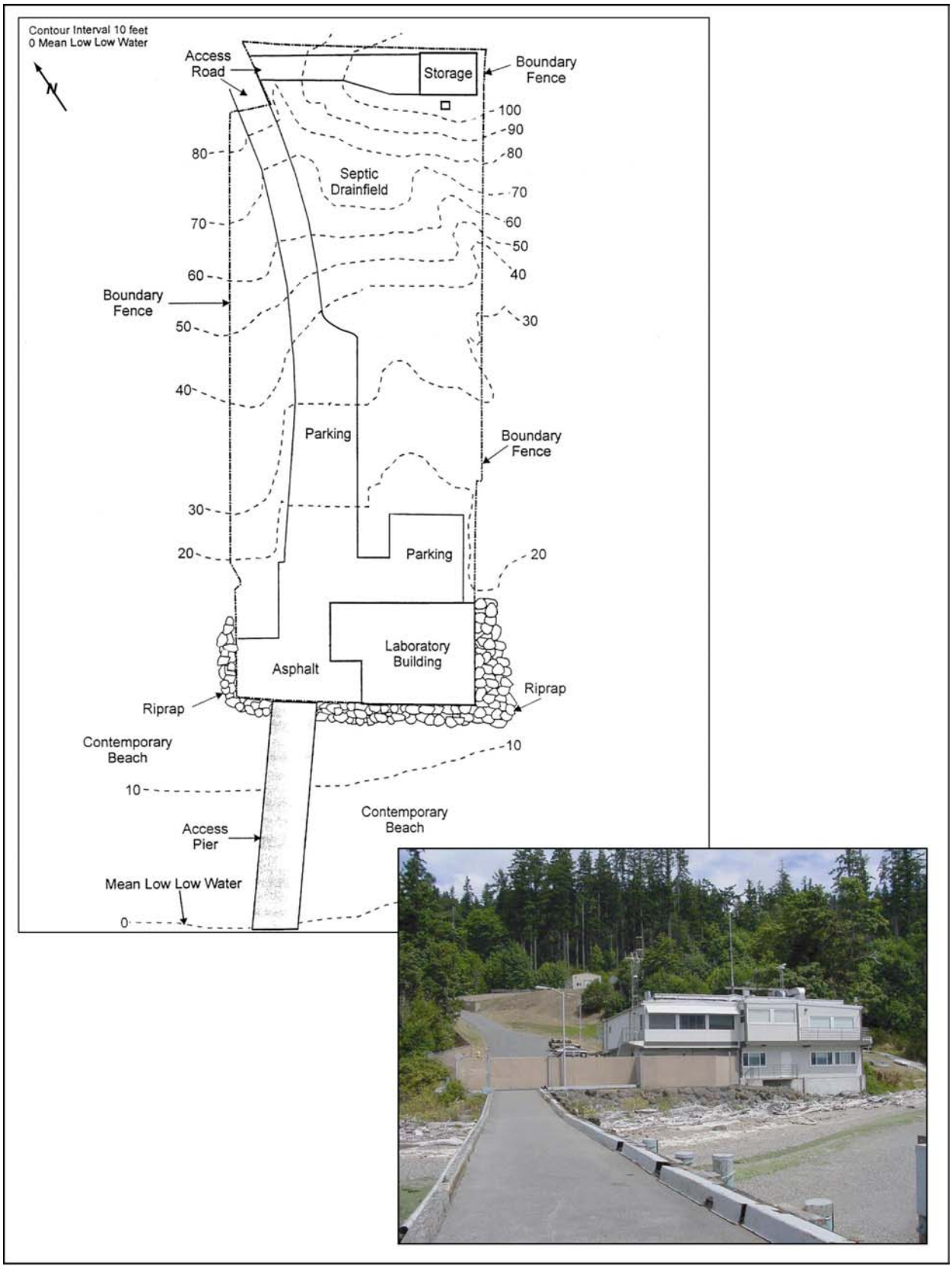


Figure 4. Upland area.

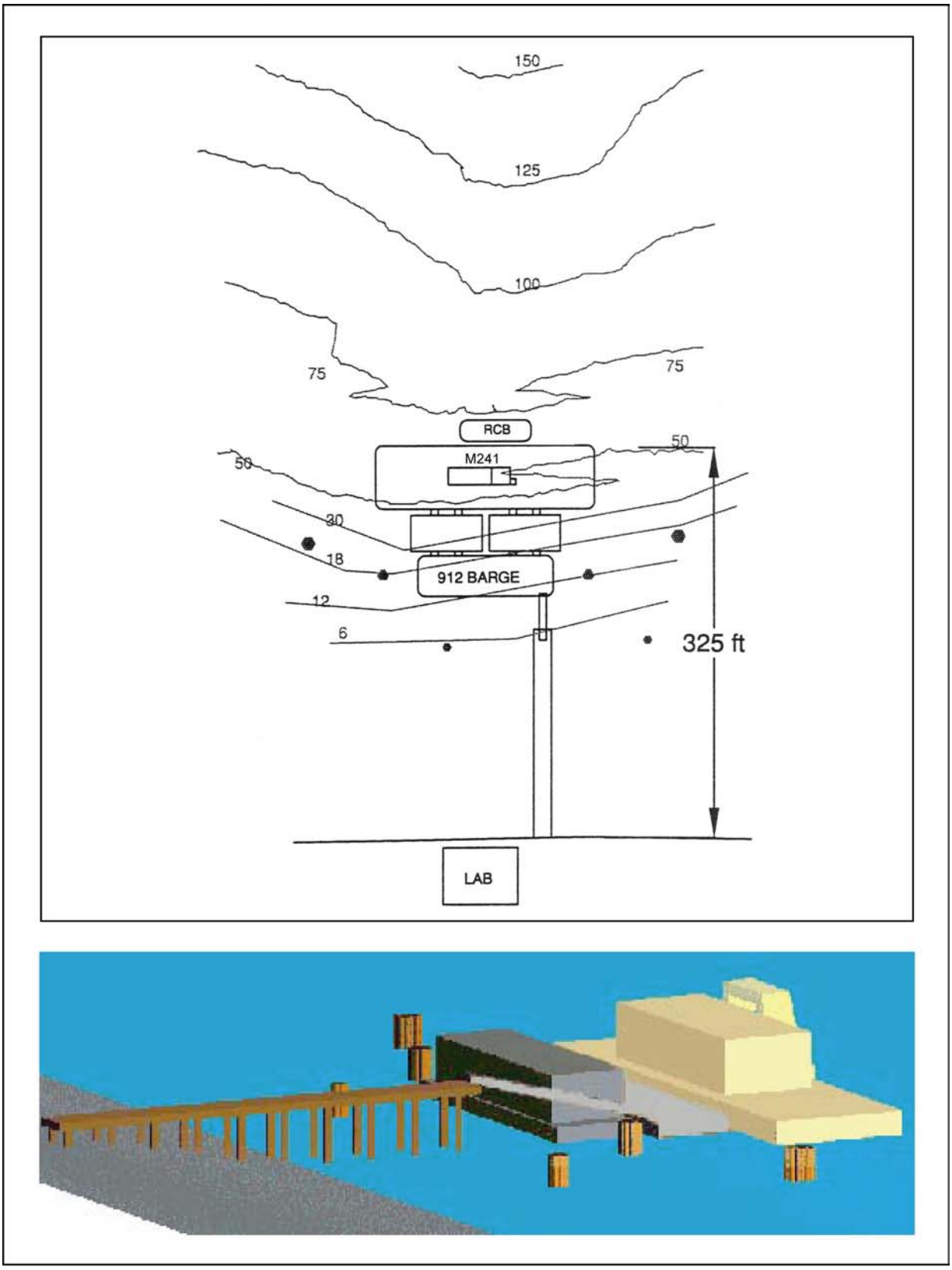


Figure 5. Existing barge configuration.

The M241 Barge is approximately 195 feet (59 m) long by 55 feet (17 m) wide. This barge is the active work area for research and testing conducted at FIL and includes a moon pool, overhead cranes, enclosed work areas, and other support systems used by scientists and engineers. The M241 Barge is moored using anchors and mooring dolphins.

There is a small Remote Crane Barge (RCB), approximately 60 feet (18 m) long by 20 feet (6 m) wide with a truss-like frame used to transfer equipment to and from the barges and/or pier. It is also used to perform other tasks such as deployment / recovery of buoys, anchors and other large field equipment. The RCB was moored on the southeast side of the access pier from 1993 to 2001, when it was moved to deeper water locations adjacent to the barges, in order to eliminate occasional grounding.

There are also several small motorized vessels and skiffs used to move researchers and small equipment to and from platforms when they are moored in the operational area.

2.1.4 Mooring Systems

There are four dolphins used to position the barges. These consist of clusters of between 7 and 21 wood piles in water depths between 0 and –22 feet (-7 m) MLLW (See Figures 6 and 7). Two dolphins are located on each side of the pier. Periodic diving inspections have indicated that the wood piles have experienced considerable deterioration and are in need of replacement.

As shown in Figure 7, anchors have been set in deeper water for purposes of mooring the M241 Barge.

2.1.5 Wood Debris

A significant accumulation of wood debris is found immediately northwest and southeast of the existing pier at FIL (See Figure 8). This accumulation is reported to be the result of floating wood debris being trapped by the piles supporting the access pier (Miller et al., 2002). Through use of aerial photography, the total area of accumulation was calculated to be 7,800 square feet (724 square meters) (Miller et al., 2002). The areas of accumulation northwest and southeast of the pier are approximately 6,000 square feet (557 square meters) and 1,800 square feet (167 square meters), respectively.

Figure 6. Mooring dolphins.

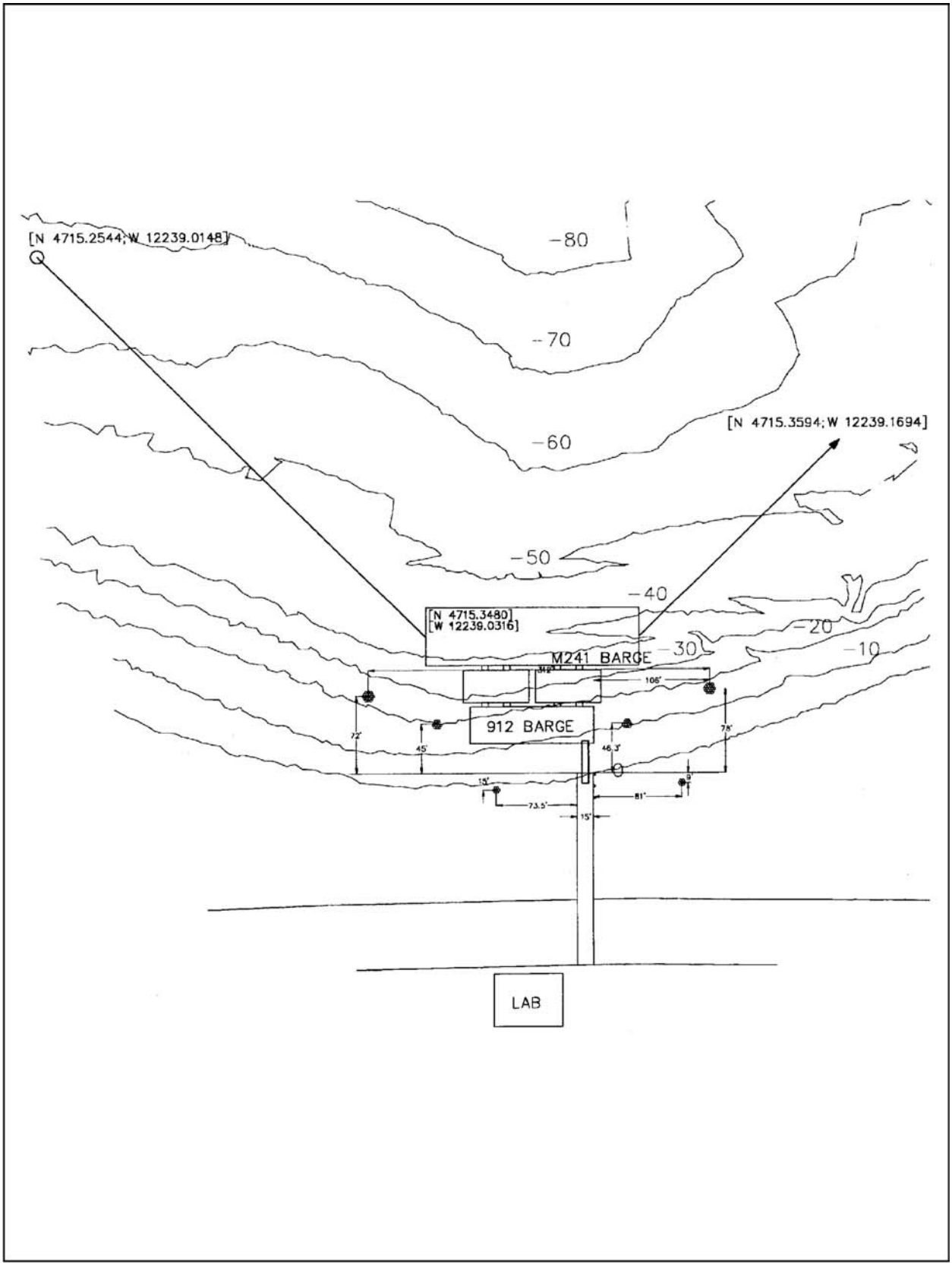


Figure 7. Existing mooring system.

Figure 8. Wood debris adjacent to access pier .

2.2 Alternatives Considered in Detailed Analysis

2.2.1 240-Foot Pontoon (Preferred Alternative)

This alternative would involve installation of a 240-foot (73 m) long by 60-foot (18 m) pontoon at the seaward end of an extended access pier. The 240-foot (73m) pontoon would be created by splitting the 360-foot (110m) pontoon into 240-foot (73m) and 100-foot (30m) sections. (Note that some length is lost through dividing the 360-foot pontoon into smaller sections.) Several modifications to the existing pier and barge configuration would occur.

The Navy currently owns a floating concrete pontoon that is utilized as a tug mooring facility at Naval Station Everett, but is not required in the long term for its current use. This pontoon was once a portion of the Interstate 90 (I-90) floating bridge across Lake Washington, east of Seattle. The pontoon is approximately 60 foot (18 m) by 360 foot (110 m) with 6 feet (2 m) of free board, and a flat surface with a slight crown for water run off. A photograph of the 360-foot (110m) pontoon under tow is shown in Figure 9.

At the seaward end of the existing pier, the sloped section would be removed and a new 15-foot (6 m) pier deck of reinforced concrete would be constructed. The deck would be supported by a new pile cap and precast or coated steel piles. See Figure 10. A new, single-lane, steel girder bridge with open deck grating would replace the existing catwalk. The bridge would be connected to the pier with a center swivel pin and to the pontoon with a roller bearing caster that moves in a guide track on a steel transition plate.

The two small fender barges now in use under the current configuration would be removed for decommissioning at an offsite location. A new 100-foot (30 m) pontoon section would be installed connecting the new steel girder bridge with the 240-foot (73 m) pontoon as shown in Figure 10. Although various options are possible, the typical configuration would be the M241 Barge moored on the seaward side of the pontoon barge. The 912 Barge and the RCB Barge would be moored inboard of the 240-foot (73 m) pontoon barge.

The distance from shore to the outboard side of the M241 Barge would increase approximately 110 feet (34 m) to approximately 435 feet (133 m). The water depth below the most seaward barge would increase from -50 feet (-15 m) to approximately -85 feet (-26 m) MLLW.

Under the 240-Foot Pontoon Alternative, existing mooring components would be replaced (See Figure 7). The existing wood pile dolphins would be removed. This would be accomplished by a barge-mounted crane using vibratory techniques. The creosote-treated wood piles would be transported to an approved site for disposal. Similarly, existing anchoring systems would be removed. Depending on design of the new mooring systems, anchors and associated equipment would be reused at FIL or removed for reuse elsewhere or recycling.

Figure 9. 360' Pontoon Under Tow

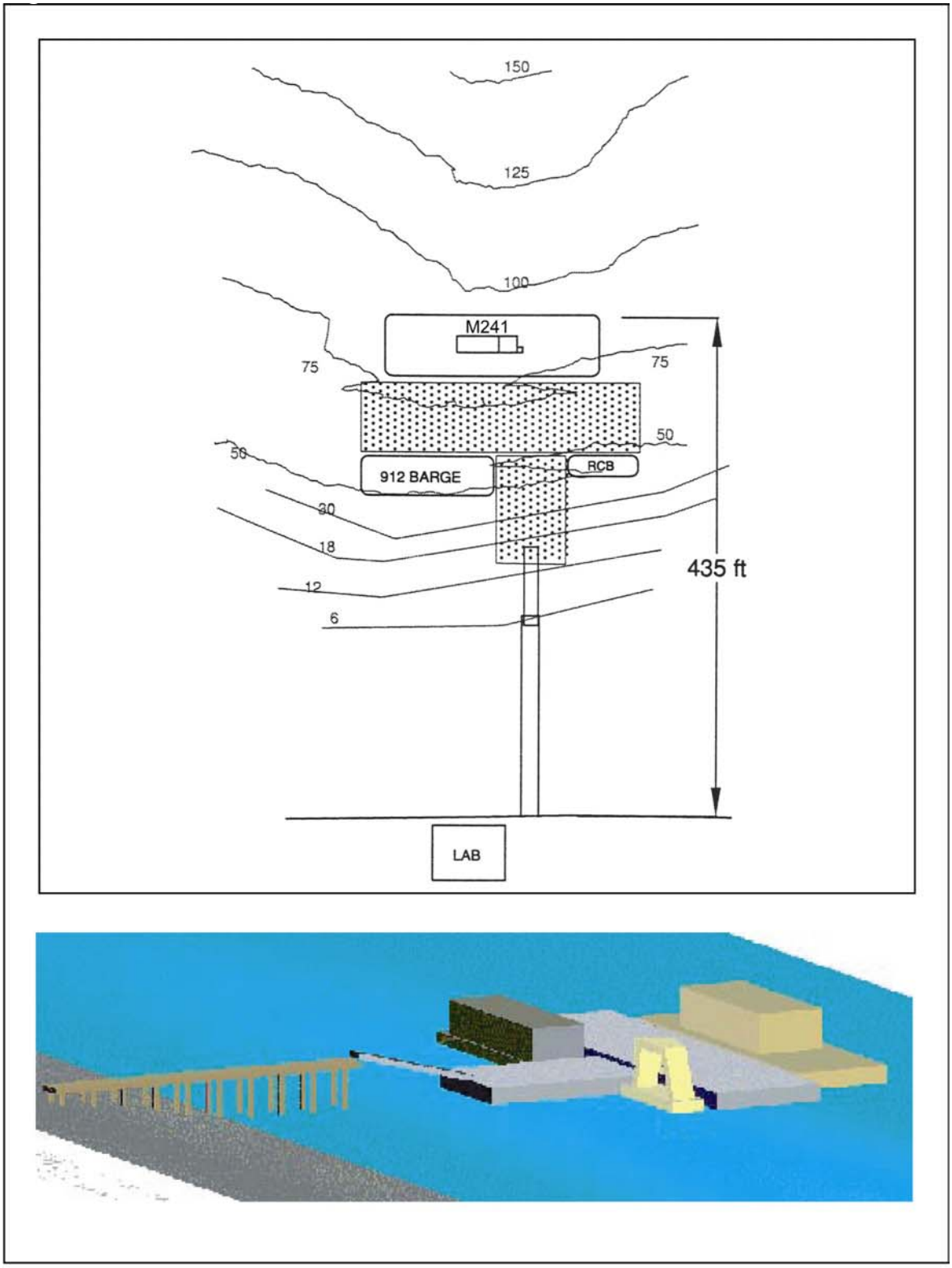


Figure 10. 240' Pontoon Alternative

The primary purpose for replacing the existing mooring system is to provide a secure system with structural integrity, able to sustain the tidal fluctuations and storm conditions experienced in Carr Inlet. In addition, the new mooring system would be designed to minimize periodic low level disturbance of bottom sediments and associated benthic organisms resulting from movement of barges with tides and reconfiguration of barges about the pier. As far as practical, the new mooring system would be designed with elements below the water line in order to reduce visual impacts.

Although design of the new mooring system has not been completed, a conceptual representation of the system is shown in Figures 11 and 12. (Note that although the mooring system is shown for the 240-Foot Pontoon Alternative, which is the Preferred Alternative, the new mooring system would be similar for the 360-Foot Pontoon Alternative.) As shown, ten mooring lines would be installed. Four mooring lines would run from new spud piles installed below grade in the lower intertidal zone to the M241 Barge. Clump weights would be suspended at intermediate points along the mooring lines to minimize dragging of chain and cable on the bottom as the barge rises and falls with the tide. Four anchors would be set approximately 600 feet (184 m) seaward of the barge. Mooring lines would connect these anchors with the barge with clump weights suspended at intermediate points. Finally, two spud pile anchors would be installed in the shallow subtidal zone. Mooring lines approximately 160 feet (49 m) long would connect the spud piles with the barge.

The existing pier would be repaired by removing or replacing deteriorated wood fender piles with steel or concrete piles. The existing pier width of 15 feet (6 m) would remain the same as at present.

As part of this alternative, exposed wood debris on Navy property at the base of the access pier would be removed. Removal is expected to take one to two weeks.

This alternative includes the following monitoring and maintenance activities.

- A survey of the shoreline in the vicinity of FIL was conducted in late spring 2002. Subsequent surveys of the shoreline will be conducted as appropriate to document changes to the beach over time, particularly following any changes to the pier and barge configuration at FIL.
- Similarly, samples of beach material were collected in spring 2002 for grain size analysis. Subsequent samples will be collected for analysis to document changes to the beach over time, particularly following changes to the pier and barge configuration at FIL.
- Exposed wood debris on Navy property would be removed during construction. Subsequently, any additional wood debris accumulating would be removed periodically as it collects on the beach.

2.2.2 360-Foot Pontoon

This alternative would involve installation of a 360-foot (110 m) by 60-foot (18 m) pontoon, parallel to shore, at the approximate location of the existing M241 Barge. This alternative is shown in Figure 13. A number of modifications to the existing pier and barge configuration would be necessary.

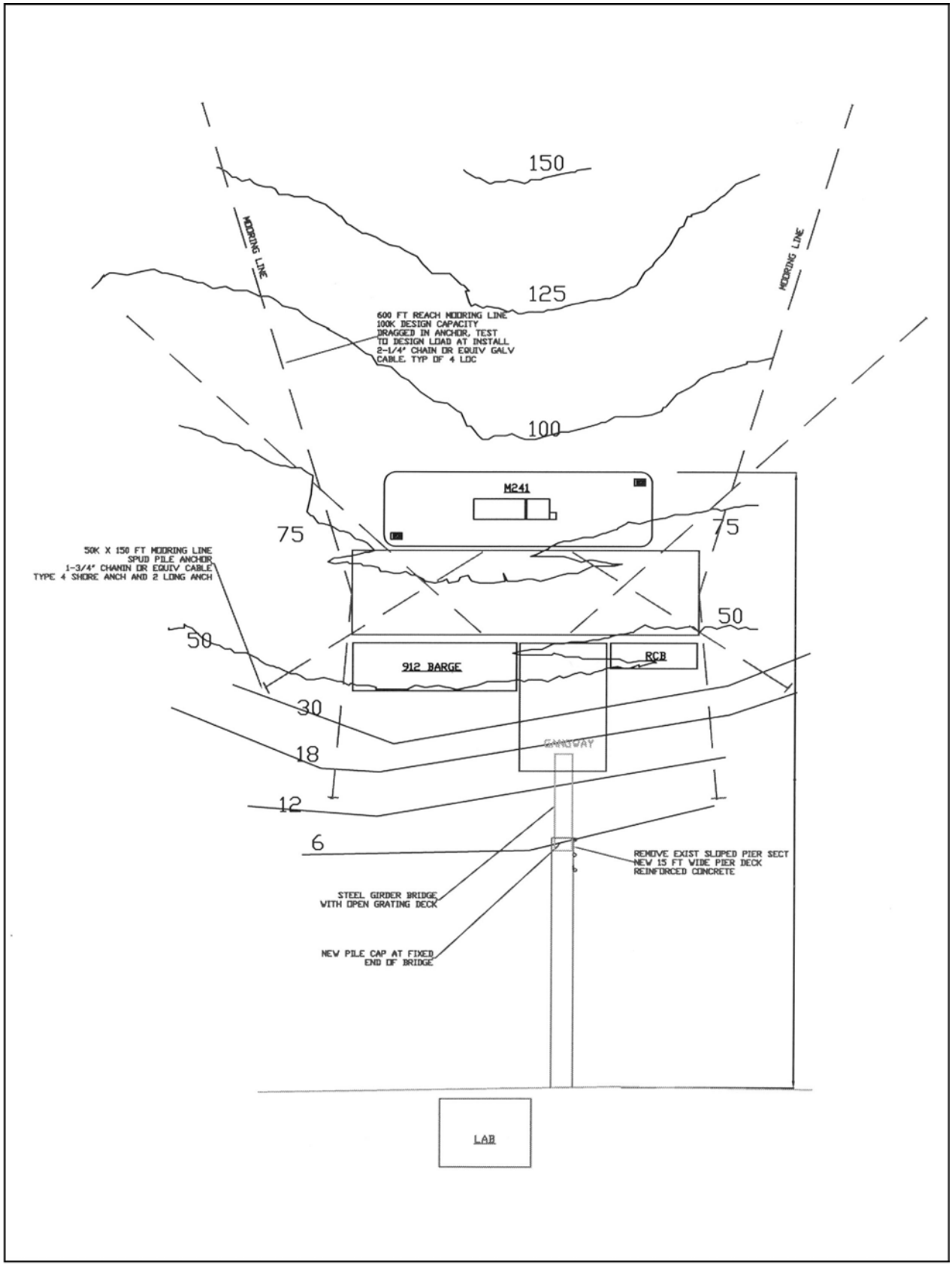


Figure 11. New mooring system.

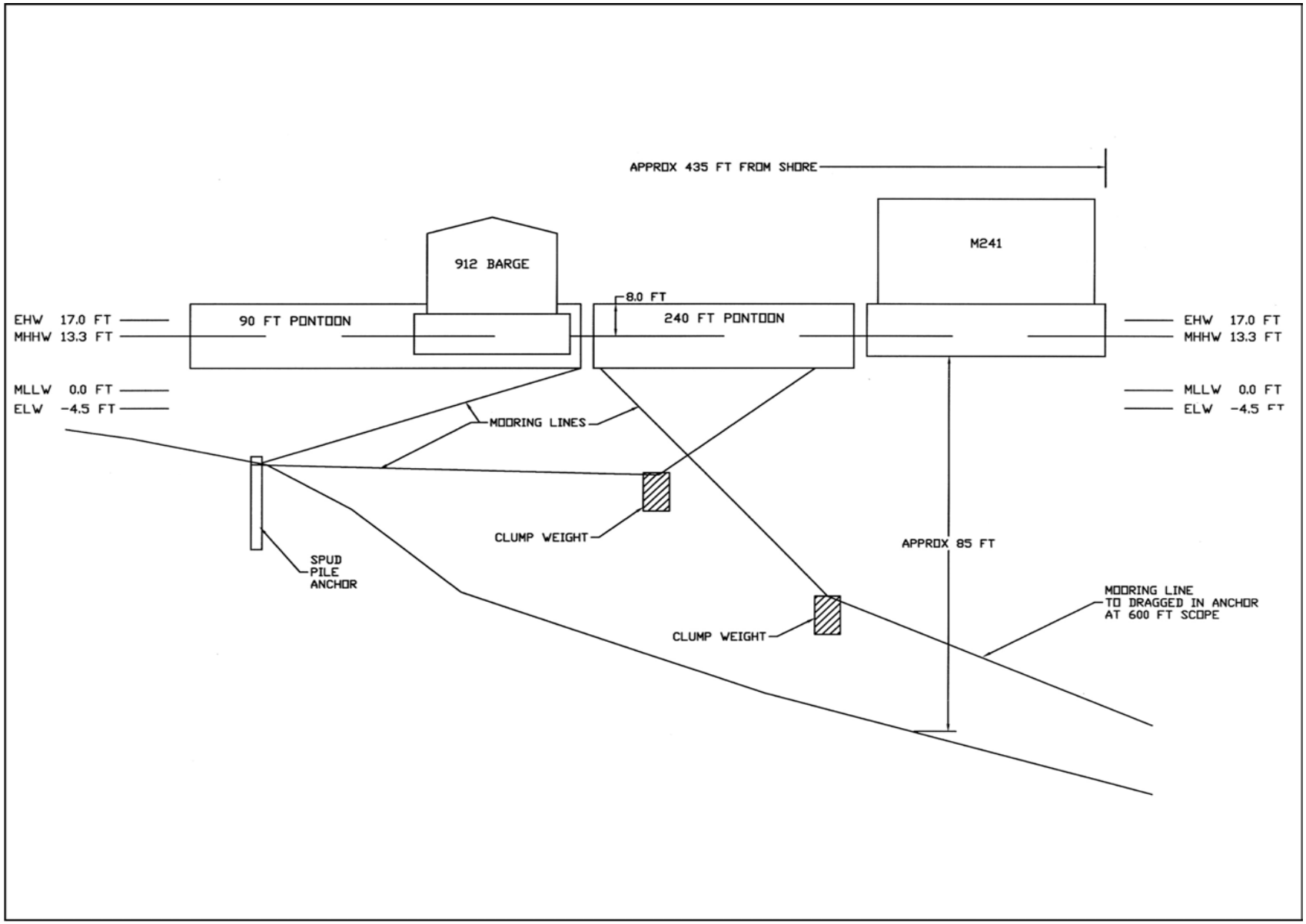


Figure 12. New mooring system (cross-section).

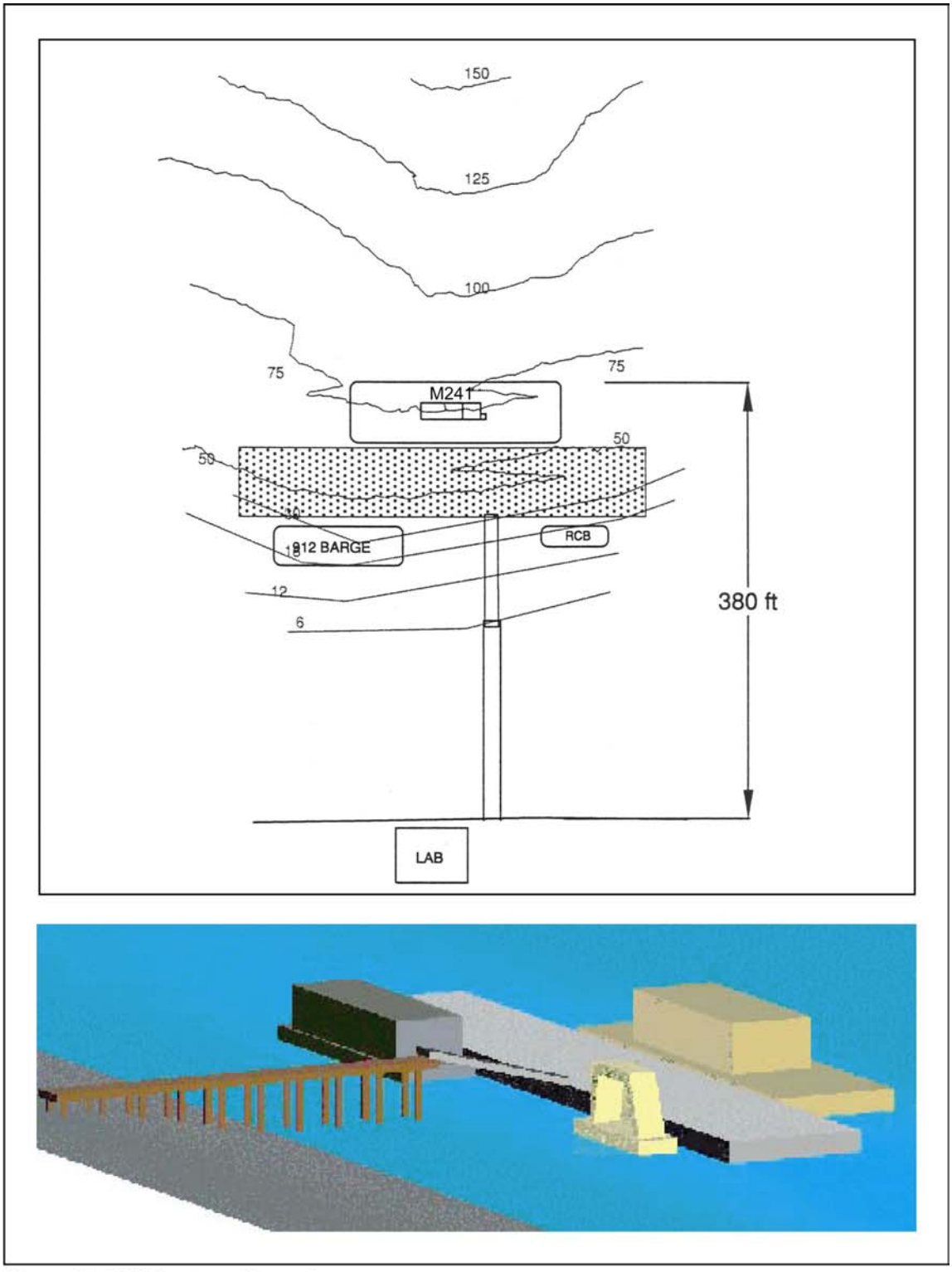


Figure 13. 360' Pontoon Alternative

The two small fender barges now in use under the current configuration would be removed for decommissioning at an offsite location. The pier would be connected with the new pontoon barge by a new steel girder bridge.

With this alternative, the M241 Barge would be moored on the seaward side of the pontoon barge. The 912 Barge, the RCB Barge, and small vessels would be moored on the inboard side of the 360-foot (110 m) pontoon barge.

The distance from shore to the outboard side of the M241 Barge would increase approximately 55 feet (17 m) to approximately 380 feet (116 m). The water depth below the most seaward barge would increase from -50 feet (-15 m) to approximately -75 feet (-23 m) MLLW.

Replacement of the existing mooring system and repair of the pier would be as described above for the 240-Foot Pontoon Alternative.

As with the 240-Foot Pontoon Alternative, exposed wood debris at the base of access pier would be removed and monitoring and maintenance activities would occur as previously described.

2.2.3 Fixed Pier

The Fixed Pier Alternative would consist of installation of a new fixed pier and wharf. This alternative is shown in Figure 14.

The two small fender barges now in use under the current configuration would be removed. The existing pier would be extended to a length of approximately 325 feet (99 m), roughly double its present length. It would connect with a new wharf approximately 240 feet (73 m) by 55 feet (17 m). The fixed pier would be supported by steel and/or concrete piles at depths ranging from -50 to -75 feet (-15 to -23 m) MLLW.

The M241 Barge would be moored on the seaward side of the fixed wharf. The 912 Barge, the RCB Barge, and small vessels would be moored on the inboard side of the 240-foot (73 m) wharf.

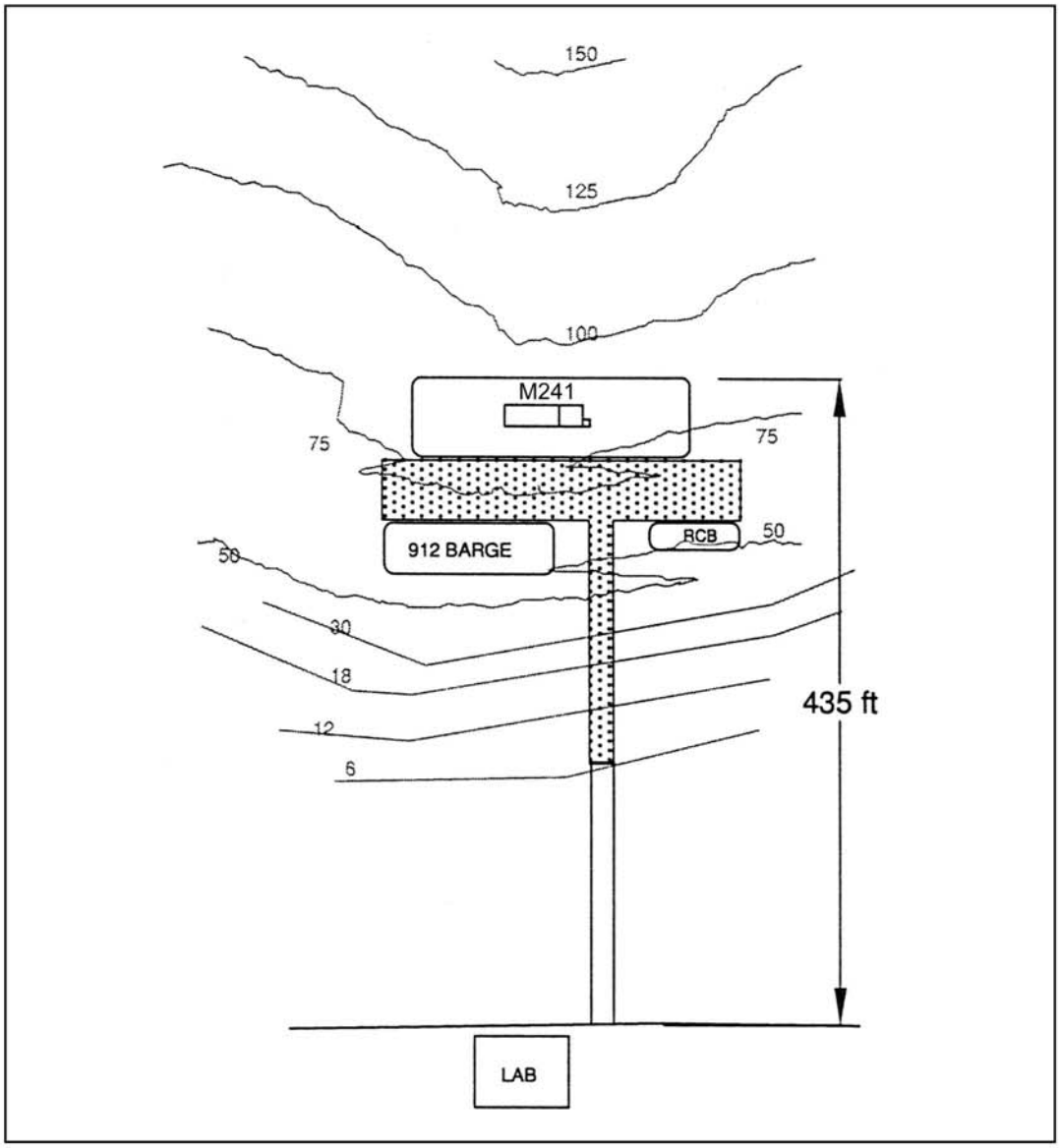
The distance from shore to the outboard side of the M241 Barge would increase approximately 110 feet (34 m) to approximately 435 feet (133 m). The water depth below the most seaward barge would increase from -50 feet (-15 m) to approximately -85 feet (-26 m) MLLW.

As with the 240-Foot Pontoon Alternative, exposed wood debris at the base of access pier would be removed and monitoring and maintenance activities would occur as previously described.

2.2.4 No Action

Under the No Action Alternative, stabilization measures would not be undertaken. The existing pier and barges would remain in the existing configuration. The existing mooring components would remain in place. The configuration under the No Action Alternative is the same as shown in Figure 5.

The first three alternatives are referred to as “action alternatives” throughout the EIS.



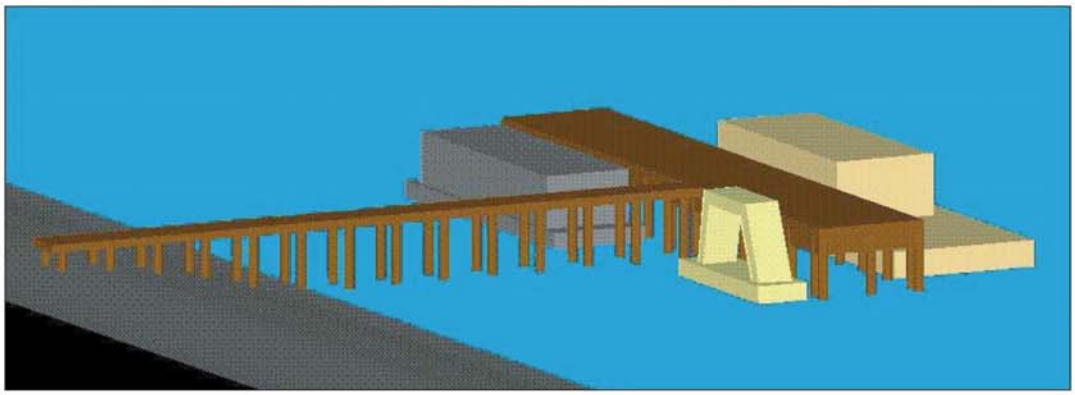


Figure 14. Fixed Pier Alternative

2.3 Alternatives Considered But Eliminated From Detailed Consideration

Over the course of planning, the Navy has considered a number of alternative sites that might be able to support the same mission as Fox Island Laboratory. In evaluating alternative sites, the Navy employed three criteria:

1) A site must meet the Purpose and Need for the Proposed Action;
2) A site must be consistent with the mission of FIL; and
3) A site must provide adequate infrastructure from shore, including access.

More specifically, alternative sites have been evaluated in terms of: environmental requirements needed for RDT&E; available operating area; dedicated or shared use; knowledge of marine environment; communication capability; access to facility; available water depths (with and without shore power); proximity to marine industry support; availability of support vessels (i.e. tugs); security considerations; shipping availability; and costs. These alternatives are described below and the reasons for their elimination identified.

2.3.1 Replace Moorings

Under this alternative, existing mooring systems at FIL would be replaced but there would not be any change to the existing configuration of pier and barges. The new mooring system would be designed to minimize periodic low level disturbance of bottom sediments and associated benthic organisms resulting from the movement of barges with tides and reconfiguration of barges about the pier.

The existing wood pile dolphins would be removed and new mooring lines installed. The new mooring system would include spud piles, clump weights, and anchors, installed below the surface to minimize visual impacts. The existing pier would be repaired by replacing deteriorated wood fender piles with steel or concrete piles. The existing pier width would remain as at present.

This alternative was identified in the Notice of Intent published in the *Federal Register* (67 FR 14921). However, it was eliminated from detailed evaluation because it does not meet the Purpose and Need for the project. Specifically, the Replace Moorings does not address the safety hazards resulting from deteriorated floating equipment.

2.3.2 Dabob Bay Test Range Facility

The Dabob Bay Test Range Facility is located in the northern portion of Hood Canal in western Washington. It is operated by the Naval Undersea Warfare Center (NUWC), Division Keyport and is a multi-use facility supporting proofing, research, and development of underwater systems such as torpedoes, countermeasures, targets, and submarine and ship systems. It is a desirable RDT&E location by virtue of its protected environment with low ambient noise and low to moderate vessel activity. The Dabob Bay Test Range Facility is not dependent on ferry access. Major limitations include: constraints associated with sharing facility with multiple users; insufficient water depth for research and testing operations at Zelatched Point pier; and distance to industrial support and temporary housing (60 minutes to Silverdale and Poulsbo). The Dabob Bay site does not meet the criteria for Purpose and Need and provision of adequate infrastructure support and access.

2.3.3 Southeast Alaska Acoustic Measurement Facility (SEAFAC)

The Southeast Alaska Acoustic Measurement Facility (SEAFAC) is located on Behm Canal near Ketchikan, Alaska. It is operated by the Naval Surface Warfare Center, Carderock Division (NSWCCD), Detachment Bremerton and is a multi-use facility supporting submarine acoustic trials. SEAFAC is a desirable location because it is a protected environment with low vessel traffic and very low ambient noise. It also has good communication systems in place and has good security. Major drawbacks include: dependence on ferry; distance to industrial support and temporary housing (45 minutes to Ketchikan by boat/auto); water depth limitations (pierside) for the M241 Barge; constraints associated with its status as a facility serving multiple users; possible loss of private users resulting from distance from corporate facilities; increased travel time and costs for users; and higher operating costs. The SEAFAC site does not meet the criteria for Purpose and Need and provision of adequate infrastructure support and access.

2.3.4 McNeil Island #1

McNeil Island is located directly south of FIL across Carr Inlet. McNeil Island is the site of a Washington State Department of Corrections (WDOC) Facility and provides docking facilities for transport of prisoners, prison workers, supplies and equipment to and from the Town of Steilacoom on the mainland. McNeil Island #1 would involve continued use of the upland facilities and pier at FIL and moorage of the M241 Barge and other barges / vessels at existing docking facilities at McNeil Island.

A new site at McNeil Island would benefit from proximity to Carr Inlet, a water body familiar to engineers and scientists who have used FIL and one well-suited to research and development of the types conducted at FIL. Limitations include: limited availability of required shore power and secure communication systems; security would require 24-hour manning of the M241 Barge; limited depth availability; and dependency on ferry service to the Town of Steilacoom for transport of personnel, equipment, and supplies. Overall, this alternative poses significant problems for both logistics and operations. Further, splitting the FIL activities between the existing site and a new McNeil Island site presents additional coordination and logistics requirements. The McNeil Island #1 site does not meet the criterion for provision of adequate infrastructure support and access.

2.3.5 McNeil Island #2

McNeil Island #2 involves construction of a new pier, mooring systems, and upland support facilities to replace the existing FIL facilities on Fox Island. This alternative would have the same benefits described above for the existing FIL facility and would avoid the coordination and logistics problems associated with split operations described above in 2.2.3. The major drawback of a dedicated facility at McNeil Island is dependence on ferry service for transport of personnel, equipment, and supplies. The existing FIL facility benefits greatly from its proximity to support facilities on Fox Island, in Gig Harbor, and in Tacoma. For example, supply stores and machine shops in Gig Harbor are used as often as daily during R & D testing at FIL and the Fox Island store is used daily for food and gas for FIL visitors and staff. With the McNeil Island #2 alternative, access time to these support facilities increases from the existing 15 minute drive at FIL to as much as 4 to 8 hours, thereby imposing an unacceptable inefficiency on RDT&E activities Costs involved in closing the Fox Island site and constructing a new, secure site on McNeil Island would be substantial. The McNeil Island #2 site does not meet the criterion for provision of adequate infrastructure support and access.

2.3.6 Other Sites

Several other sites have been briefly considered but rejected because of inability to meet basic site requirements. The need to conduct RDT&E in a saltwater environment eliminated Lake Pend Oreille in Idaho and Lake Seneca in New York from consideration. Freshwater sites do not meet the criterion for achieving the mission of FIL. Unacceptable wind, weather, and sea states eliminate open ocean sites such as the Washington coast off the Quinault River. These sites do not meet the criterion for provision of adequate infrastructure support. Security considerations at test facilities operated under joint custody agreements or outside the waters of the United States eliminated the Nanoose and Jervis Inlet operating areas in Canada and Alaska. These sites do not meet the criteria for achieving the mission of FIL and provision of adequate infrastructure support.

2.4 Comparison of Alternatives

A summary comparison of impacts of the three action alternatives and the No Action Alternative is provided in this section. In addition, more detailed summaries of impacts and mitigation measures by alternative and environmental element are provided in Tables 2-1 and 2-2, respectively.

Table 2-1. Comparison of Impacts

ENVIRONMENTAL RESOURCES	ALTERNATIVES			
	240' Pontoon	360' Pontoon	Fixed Pier	No Action
Physical Resources				
Shoreline	• Slight decrease in size of salient expected.	• Salient expected to grow with increase in sheltered zone.	• Salient expected approximate present size and location.	• No change from present condition.
Sediments	• Minor short-term resuspension during removal installation of piles and anchors • No long-term impacts	• Minor short-term resuspension during removal installation of piles and anchors • No long-term impacts	• Minor short-term resuspension during removal installation of piles and anchors • No long-term impacts	• No change from present condition.
Air Quality	• Minor impacts from construction equipment exhaust • No long-term changes from present	• Minor impacts from construction equipment exhaust • No long-term changes from present	• Minor impacts from construction equipment exhaust • No long-term changes from present	• No change from present condition.
Noise	• Minor impacts from construction equipment • No long-term changes from present levels	• Minor impacts from construction equipment • No long-term changes from present levels	• Minor impacts from construction equipment • No long-term changes from present levels	• No change from present condition.
Water Resources	• Localized turbidity during construction • No long-term impacts anticipated	• Localized turbidity during construction • No long-term impacts anticipated	• Localized turbidity during construction • No long-term impacts anticipated	• No change from present condition.
Biological Resources				
Eelgrass	• Slight benefit as facilities moved to deeper water.	• Slight benefit as facilities moved to deeper water.	• Slight benefit as facilities moved to deeper water.	• No change from present condition.
Benthos	• Slight improvement from present condition.	• Slight improvement from present condition.	• Slight improvement from present condition.	• No change from present condition.
Fish & Shellfish	• No impacts expected.	• No impacts expected.	• No impacts expected.	• No change from present condition.
Marine Mammals	• No impacts expected.	• No impacts expected.	• No impacts expected.	• No change from present condition.

Table 2-1 Comparison of Impacts (Continued)

ENVIRONMENTAL RESOURCES	ALTERNATIVES			
	240' Pontoon	360' Pontoon	Fixed Pier	No Action
Biological Resources (continued)				
Marine Birds	• No impacts expected.	• No impacts expected.	• No impacts expected.	• No change from present condition.
Threatened and Endangered Species	• No impacts expected.	• No impacts expected.	• No impacts expected.	• No change from present condition.
Socioeconomic Resources				
Land & Shoreline Use	• Minor increase in footprint.	• Minor increase in footprint.	• Minor increase in footprint.	• No change from present condition.
Demographics & Employment	• 8-10 people during construction • No long-term change from present time	• 8-10 people during construction • No long-term change from present time	• 10-12 people during construction • No long-term change from present time	• No change from present condition.
Aesthetics	• Slight improvement from removal of fender barges, dolphins and submerging some moorage components.	• Slight improvement from removal of fender barges, dolphins and submerging some moorage components.	• Slight improvement from removal of fender barges, dolphins and submerging some moorage components.	• No change from present condition.
Transportation	• Short-term increase in waterborne and vehicular traffic during construction. • No long-term change from present traffic during construction.	• Short-term increase in waterborne and vehicular traffic during construction. • No long-term change from present traffic during construction.	• Short-term increase in waterborne and vehicular traffic during construction. • No long-term change from present traffic during construction.	• No change from present condition.
Cultural Resources	• No impacts expected.	• No impacts expected.	• No impacts expected.	• No change from present condition.
Tribal Fisheries/Access	• No impacts expected.	• No impacts expected.	• No impacts expected.	• No change from present condition.
Environmental Justice	• No impacts expected.	• No impacts expected.	• No impacts expected.	• No change from present condition.
Children's Health & Safety	• No impacts expected.	• No impacts expected.	• No impacts expected.	• No change from present condition.
Meets Purpose & Need	• Yes	• Yes	• Yes	• No change from present condition.

Table 2-2. Comparison of Mitigation Measures

ENVIRONMENTAL RESOURCES	ALTERNATIVES			
	240' Pontoon	360' Pontoon	Fixed Pier	No Action
Physical Resources				
Physiography, Topography, Bathymetry	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Sediments	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Air Quality	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Noise	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Water Quality	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Biological Resources				
Eelgrass	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Benthic organisms	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Fish & Shellfish	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Marine mammals	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Birds	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Threatened and Endangered Species	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.

Table 2-2 Comparison of Mitigation Measures (continued)

ENVIRONMENTAL RESOURCES	ALTERNATIVES			
	240' Pontoon	360' Pontoon	Fixed Pier	No Action
Socioeconomic Resources				
Land & Shoreline Use	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Demographics & Employment	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Aesthetics	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Cultural Resources	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Tribal Fisheries	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Environmental Justice	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.
Children's Health & Safety	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.	• No Mitigation Measures are necessary.

Chapter 3.0 Affected Environment, Environmental Consequences, and Mitigation Measures

3.1 Physical Resources

3.1.1 Earth Resources

3.1.1.1 Affected Environment

Fox Island Laboratory (FIL) and immediately adjacent properties are located at the base of steep slopes of glacial origin. The lower (southwestern) portion of the FIL site consists of an area near the former bluff line that has been leveled and filled (Miller et al., 2002). The *Coastal Zone Atlas of Washington* (WDOE, 1979) classifies slopes on either side of FIL as "unstable old slide" and the site of the laboratory itself and shoreward uplands as "stable."

The beach in the vicinity of FIL consists of coarse sand and gravel at a slope of approximately 10 horizontal to 1 vertical. Beach material is supplied by the erosion of bluffs composed of glacial till and longshore transport of littoral material; there is no substantial input of sand and gravel from rivers and streams. Till is an assemblage of glacially-derived sand, gravel, and cobbles in a stiff clayey matrix. In the study area, the till is underlain by Lawton Clay, a dense, dark gray to green clay deposited in glacial lakes during the advance of the Puget Lobe of the Vashon Stade, between 15,000 and 13,000 years ago. In locations where Lawton Clay is exposed on the beach, erosion by wave activity can result in oddly shaped clay concretions. A feature of this type can be found several hundred feet northwest of FIL on what is locally known as "Clay Baby Beach."

The beach immediately northwest of FIL does not have any shore protection features, however, further to the northwest, there are numerous structures including bulkheads, revetments, and concrete boat launches. The beach to the southeast of FIL contains fewer structures; an isolated bulkhead exists about one quarter mile to the southeast.

Just offshore, the bathymetry slopes steeply, reaching depths of –50 feet (-15 m) MLLW. A depression in the bathymetry provides deeper water closer to shore at FIL than along adjacent properties. The bathymetry was part of the initial appeal of the site for the Navy, because deep water close to shore facilitates many of the research and testing activities conducted at FIL.

Littoral currents are the result of direct wind effects, tides, and momentum wave transport. These currents move sediment in either direction along the beach, however, there is an apparent divergence of opinion regarding the direction of net transport. The *Coastal Zone Atlas of Washington* (Ecology, 1979) indicates a seasonal variation with southeast transport in spring/summer and northwest transport in winter. Schwartz and Wallace (1986) postulated a net transport to the southeast, based on observations of sediment and debris accumulations on bulkhead structures and ramps. Miller et al. (2002) determined that net transport was to the

northwest, based on wind-wave hindcast analysis. Potential net annual transport was estimated to be approximately 1,960 cubic yards (1,500 cubic meters) during 2000 (Miller et al., 2002). Aerial photographs of the FIL site in 1970 indicate a relatively straight shoreline. Review of aerial photographs over the subsequent period through 2000 indicates the buildup of a prominent gravel salient (i.e., a projection from a line or surface, as from a beach or shoreline) beneath the access pier at FIL (Miller et al., 2002). The salient has developed shoreward of barges that have been moored long axis parallel to shore at the end of the access pier.

Sediments

Sediments in the vicinity of FIL are typical of the Puget Sound region. Beach material is derived from upland sources, transported along shore, sorted and distributed in the process. Periodic failures of glacially-derived sands, gravels, and cobbles that make up the bluffs are the primary source of beach material. Near FIL, gravel and cobble materials occur in higher portions of the intertidal zone and the surface sediments transition to fine sands and silts with decreasing beach elevation. The bottom surface offshore is covered with silty sandy sediments underlain by a layer of dense sand.

In early summer 2002, the Navy conducted an analysis of beach sediments in the vicinity of FIL (HWA Geosciences, Inc., 2002). The purpose of this analysis was to provide baseline data on beach material that could be used by scientists and engineers to identify existing beach processes and to determine potential changes resulting from any structural modifications at FIL. A total of 60 sediment samples were collected in the intertidal zone between mean low tide and mean high tide. The samples were collected along ten transects located between 780 feet (238 m) southeast and 780 feet (238 m) northwest of the access pier. Although minor variations were observed with elevation and location along the beach, sediments are typically olive-gray sand and gravel. Site observations made in July 2002 indicate that the beach southeast of FIL has a greater abundance of sediments, particularly sand and fine gravel size sediments, than does the beach within several hundred feet northwest of FIL. The stiff clay layer underlying the granular beach sediment is exposed in places at the beach face and the beach sediments are cobbly just northwest of FIL. This differs from the beach southeast of FIL where the clay layer is not typically exposed.

The State of Washington has established sediment quality standards (SQS) for marine, low salinity, and freshwater surface sediments. These standards set limits on pollution to reduce and ultimately eliminate adverse effects on biological resources and significant health threats to humans from surface sediment contamination (Washington Department of Ecology (Ecology), 1995).

Several locations throughout Carr Inlet have been analyzed for sediment chemistry and toxicity. The concentrations of chemical contaminants (e.g., trace metals [copper, lead, mercury, and zinc], PCBs, and PAHs) within Carr Inlet are much less than those found in sediments in the industrialized waterways (e.g., Commencement Bay) of Puget Sound. No chemical contamination or toxicity of benthic communities has been documented in the underlying sediments at these locations, and sediment chemical concentrations do not exceed numerical guidelines or Washington State criteria (NOAA, 2002).

Salient and Beach Erosion

The Navy has conducted two investigations of shoreline processes that relate to development of the salient and beach erosion that has occurred northwest of FIL. Both studies have been incorporated into this EIS by reference.

Fox Island Laboratory Shoreline Change Evaluation. In 2001, the Navy conducted a series of studies, the objectives of which were to: a) evaluate shoreline processes in the vicinity of FIL that have led to the development of the salient below the access pier; b) evaluate potential effects of selected FIL modifications on the shoreline; c) survey the wood debris accumulation at the base of the access pier; and d) survey nearshore vegetation including eelgrass and evaluate potential effects of FIL modifications on these resources (Miller et al., 2002). This effort included a review of historical aerial photographs, evaluation of beach processes using U.S. Army Corps of Engineers techniques, application of a numerical model to evaluate wave refraction and diffraction by structures, a diving survey, and beach reconnaissance. These studies provided useful information on the effects of FIL barges on wave action, the formation of the salient, potential effects of removal of the wood debris, and the occurrence and density of eelgrass.

Conclusions of the study are as follows:

- Beach material, consisting of sand and gravel, is derived from erosion of bluffs and uplands, since there are no rivers and streams to provide source material.
- Wind-generated waves transport sediment in both directions, northwest and southeast, along the beach. The predominant wave direction moves more sediment to the northwest than to the southeast.
- Based on wind measurements, the potential net transport rate of sediment to the northwest is estimated to be about 1,960 cubic yards (1,500 cubic meters) during 2000.
- Barges moored at FIL have effectively served as a breakwater sheltering the beach from wave action. Bending of waves around the barges by diffraction reduces wave energy and associated currents and has resulted in sediment building seaward from the beach. The growth of this salient has been tracked through aerial photographs over the period 1970 through 2000.
- The wave energy transmission characteristics of the barge might prevent the salient from reaching the barge. Other factors being equal, mooring the floating structure (i.e. barge) farther offshore would reduce the amount of sheltering of wave energy experienced at the shoreline. The resulting spreading of wave energy from adjacent unsheltered portions of the wave field into the area in the lee of the barge would cause a relative increase in sediment transport potential, possibly reducing the size of the salient. Alternatively, increasing the length of the floating structure would increase the length of the shoreline where sediment transport potential would be reduced, possibly causing the salient to grow.
- Beach sediment trapped in the sheltered area shoreward of the barge does not reach adjacent beaches, however, this process is not 100 percent efficient. Some of the beach material that is transported into the sheltered area is by-passed to beaches to the

northwest and southeast. The amount of by-passing was not determined during this study.

- Development of the salient may have exacerbated erosion by retaining sand and gravel that would otherwise have been transported to adjacent beaches. Other sources of beach material have also been restricted by the installation of man-made structures such as bulkheads and revetments on neighboring properties.
- The pilings of the access pier reduce wave energy only slightly but tend to trap wood debris. This debris accumulates immediately northwest and southeast of the access pier and serves to retain beach sediments by providing additional shelter from wave action.
- Using aerial photos, the areas of accumulation of wood debris are estimated at 6,000 square feet (558 square m) and 1,800 square feet (167 square m) northwest and southeast of the access pier, respectively.
- Removal of wood debris may allow additional beach sediments to be transported along shore, though no estimates are available for the additional volume of transport. This solution, however, only addresses a symptom of the sheltering effect and would have to be repeated periodically to have a lasting effect.
- Replacement of existing wood pile dolphins would have no effect on the development of the salient.
- Installation of a new 360-foot (110 m) long pontoon 40 feet (12 m) further offshore would increase the sheltered zone shoreward of the pontoon and would increase the along shore dimensions of the salient. The additional beach material retained in the salient would be prevented from reaching adjacent beaches until equilibrium is attained.
- Installation of a fixed pier with a dogleg would not change the breakwater function of the barge. Depending on pile density, pile size, and layout of the structure, the pier may have the effect of accumulating sediment because of the sheltering effect of the pilings. The structure may also tend to accumulate floating wood debris.
- If a detached fixed breakwater was constructed, it would act in a similar manner as the present barge configuration, sheltering the shoreline from incident wave energy. In addition, if the breakwater is more effective at blocking wave energy, it may result in the formation of a tombolo, a causeway-like accretion connecting the shore to the breakwater, thereby preventing transport of beach material to adjacent beaches.
- If all the FIL facilities were removed, wave action would most likely erode the salient over time.

***Fox Island Laboratory Beach Change Study*.** The objectives of the second study, conducted in summer 2002, were to a) determine the factors that have led to the current condition of the shoreline; b) estimate the relative contribution of individual factors; and c) identify feasible alternatives to restore the shoreline to its historical condition (circa 1970). The study included literature review, visual observation and assessment of shoreline structures, review of historical aerial photography, examination of topographic and bathymetric survey data, and numerical modeling of wave transformation, sediment transport, and shoreline change (Shepsis, 2002).

This study had the benefit of the bathymetric survey and grain size analysis of beach sediments conducted in spring and early summer 2002.

The study makes the following conclusions:

- Much of the southwest shoreline of Fox Island has experienced beach erosion and bluff retreat. Available historical data indicates an average bluff retreat rate of 0.2 to 0.5 feet (6 to 15 cm) per year over the period 1942 to 1970 (pre-FIL).
- Sediment transport occurs in both northwest and southeast directions in the vicinity of FIL. Waves arriving from the south-southeast approach at a highly oblique angle to the local shoreline, resulting in a relatively strong sediment transport to the northwest. Waves arriving from the west-southwest are typically smaller and arrive at a more normal (perpendicular to shore) angle to the shoreline, creating a comparatively weak southeast sediment transport.
- Construction of in-water facilities at FIL have modified the natural development of the shoreline, causing conditions that have created a salient beneath the FIL access pier. As of summer 2002, the salient extends about 100 feet seaward from the pre-FIL high water line.
- Comparison of 1969 and 2002 bathymetric data indicates that the salient volume is an estimated 7,200 cubic yards. This accumulation has occurred on the upper slope only; no evidence of sediment movement toward deep water was detected.
- In-water structures at FIL do not cause significant blockage of sediment transport from the southeast to the northwest. These structures may capture from 7 to 15 percent of the net sediment transport, a rate "... not significant to the overall transport processes."
- Modeling indicates that the length of shoreline affected by FIL in-water facilities is about 950 feet northwest of the FIL access pier.
- Since 1970, bluff retreat has been restricted through installation of numerous bulkheads and revetments along the shoreline northwest of FIL. Because of salient formation, FIL facilities have also precluded bluff retreat and landward migration of the shoreline. Based on a simple proportion between lengths of shorelines and volume of sediment supply, the relative impact of FIL to bulkheads is estimated to be 1 to 20.
- Beach sediment at locations northwest of FIL is susceptible to erosion as a result of interaction of bulkheads and waves.
- Bulkheads and coastal revetments have resulted in a reduction of sediment supply to the coastal system by restricting bluff erosion. Modeling results indicate that at some locations northwest of FIL, bulkheads in combination with FIL structures might yield more shoreline retreat than would be the case with FIL structures and no bulkheads.
- Because of the complexity of naturally-occurring conditions and manmade factors, there is no feasible alternative to restore the shoreline to the pre-FIL conditions of 1969.

Wood Debris

As described in Section 2.1.5, there is a substantial accumulation of wood debris located immediately northwest and southeast of the access pier. This accumulation has resulted from the pier pilings obstructing longshore transport of floating material and from the reduction in longshore current caused by the barges at the end of the pier. Miller et al. (2002) indicate that the wood debris may act to retain beach sediment. Large wood debris that is beached on the flat, depositional surface of the beach and salient has only a minor stabilizing influence on the sediments comprising those features. If there was a net sediment loss from the salient, wood debris would be removed from the area through beach processes.

Large drift logs have been observed, although not commonly, to lodge in the piles of the access pier during a storm event, remaining there until mechanically removed. During the period of time the logs are lodged under the pier, they can block sediment on the updrift side, sometimes creating a vertical offset of several feet. This occurred in November 2002 following a storm from the south and attests to the intensity of gravel transport caused by storm waves.

3.1.1.2 Environmental Consequences

240-Foot Pontoon

Salient and Beach Erosion

The potential effects of alternative barge configurations at FIL on the shoreline were examined by the Navy as part of the study *Fox Island Laboratory Shoreline Change Evaluation* (M.C. Miller, et al., 2002). This investigation examined the processes that have resulted in the present shoreline condition using U.S. Army Corps of Engineers, Coastal and Hydraulics Laboratory analysis software. The study then employed a numerical model that combines the effects of wave refraction and diffraction to describe the sheltering effects of possible modifications to the FIL's pier and barge configuration. Subsequently, information was generated on beach elevations and sediments in the vicinity of FIL as part of EIS preparation. Based on Miller, et al. (2002) and this new data, Shepsis (2002) provides more detailed evaluation of shoreline processes including modeling of alternatives examined in this EIS. Numerical models (COASTOX and Coast-L) were used to compare shoreline effects of alternatives considered. The 240-Foot Pontoon Alternative would extend the access pier approximately 100 feet further offshore where it would serve as the base for mooring the 240-foot pontoon barge (See Figures 9 and 10). In effect, the new 240-foot pontoon barge would replace the 195-foot (59 m) M241 Barge in intercepting incident wave energy and sheltering the beach near the access pier from this energy. This 20 percent increase would tend to increase the sheltering zone shoreward and tend to increase the volume and alongshore dimension of the salient.

The M241 Barge (seaward side) would be moved from its current position of 325 feet (99 m) offshore from the base of the access pier farther seaward to a position of 435 feet (133 m) from the base of the pier. Because the inboard position of the pontoon would be no different than the current position of the M241 Barge (or equivalent barge), no increase in energy reaching the shoreline would be realized.

Shepsis (2002) has shown that in-water facilities at FIL do not cause significant blockage of sediment transport from the southeast to the northwest. These facilities may capture from 7 to 15 percent of the net sediment transport, a rate "...not significant to the overall transport processes." Modeling has indicated that the length of shoreline affected by the FIL in-water facilities is about 950 feet northwest of the access pier.

Modeling has shown that none of the action alternatives, including the 240-Foot Pontoon Alternative, would result in any significant change in shoreline processes that currently exist in the vicinity of FIL, nor would action alternatives significantly alter the conditions (i.e. naturally-occurring bluff retreat, bulkheads, revetments) that result in beach erosion to the northwest.

Because of the effect of the salient (point consisting of accumulated beach material), the FIL facilities preclude shoreline retreat and landward migration of the shoreline (Shepsis, 2002). This effect is likely to continue under the 240-foot Pontoon Alternative. However, this effect would likely be limited to the immediate vicinity of FIL. Shepsis (2002) has suggested that the contribution of FIL in obstructing natural bluff retreat is minor compared to the contribution of bulkheads, based on a simple comparison of shoreline lengths.

Wood Debris

This alternative assumes that exposed wood debris would be removed from Navy property. Removal of exposed wood debris is expected to take from one to two weeks.

Removal of wood debris would involve use of heavy equipment (e.g., trackhoe, small bulldozer) in the backshore area of the shoreline. Mats may be used to keep equipment moving in the soft sand. Wood debris would be loaded into haul trucks for disposal. Work would occur in dry areas of the beach; in-water work would be avoided. A small bulldozer may be used to regrade the beach following removal of debris. As far as possible, use of adjacent properties would be avoided; however, minor disturbance of adjacent properties during removal of wood debris would be likely. Accumulated beach sediments in the immediate vicinity of the debris area would be disturbed during removal operations. However, these beach materials are highly altered and typically very mobile within the shoreline environment. No significant construction-related impacts on beach materials are anticipated.

Potential long-term impacts resulting from removal of the accumulated wood debris was examined by Miller et al. (2002) as part of their *Fox Island Laboratory Shoreline Change Evaluation*. This evaluation indicated that while removal of wood debris would eliminate one factor causing sediment retention in the vicinity of the access pier, the accumulation of debris is a symptom of shoreline processes altered by the barges and pier, rather than a primary factor causing retention of beach material. Following removal of the wood debris, "...the sediment would not likely be remobilized to adjacent beaches by natural means since the breakwater and pier still reduce the longshore energy...the relative benefits of its removal would be negligible and short-lived because the pier and breakwater would continue to trap..." wood debris and retain sediments.

Dolphins

There are four dolphins consisting of seven to twenty-one wood piles, located in water depths of 0 to –22 feet (0 to –7 m) MLLW. Existing dolphins would be removed using a pile driving barge with a crane. Treated wood fender piles located along the southeast side of the existing pier would also be removed. The wood piles would either be completely extracted or cut off several feet below the mud line and the hole backfilled with clean sand. The piles would be hauled to an approved upland disposal site.

The four timber dolphins will be replaced with submerged dolphin piles composed of materials other than wood (e.g. galvanized or epoxy-coated steel pipe piles, concrete piles). The fender piles on the south side of the pier would also be removed.

Removal of wood piles and installation of new steel or concrete piles would result in localized disturbance of bottom sediments and a limited amount of turbidity in the immediate vicinity of the piles. However, littoral currents at the site generated by tides, direct wind effects, and by momentum transport from waves continuously flow along the Fox Island shoreline. These currents, in conjunction with the small scale of proposed piling installation activities, would dilute any turbidity and reduce the likelihood of low dissolved oxygen concentrations.

Over the last several decades, polycyclic aromatic hydrocarbons (PAH) have probably leached from the creosote-treated wood piles that make up the dolphins into adjacent sediments. During construction, removal of the dolphins may reintroduce sediments and small amounts of associated PAH into the water column. This impact would be short-term in nature and is not expected to be significant.

Over the long-term, removal of all four dolphins would be beneficial to the lower intertidal zone since a source of PAH contamination, though small, would be eliminated. Sediments should quickly return to a condition similar to adjacent sediments following removal of the dolphins. Any remaining PAH would experience microbial and physical degradation (Poston, 2001).

Anchor Systems

Existing mooring systems (See Figure 7) would be replaced by systems designed to minimize disruption of bottom sediments and organisms caused by tidal fluctuations and movement of barges. A conceptual design of new mooring systems is shown in Figures 11 and 12.

Removal of anchors, chain, and cable associated with anchoring systems and installation of new systems would result in localized disturbance of bottom sediments and a limited amount of turbidity in the immediate vicinity of the piles. These impacts would be construction-related and are not expected to be significant.

Over the long-term, use of suspended clump weights or equivalents in conjunction with anchors would reduce, though not completely eliminate, disturbance of bottom sediments caused by the movement of anchor chain and cable across the bottom. More stable sediments are expected to result in more natural environmental conditions for benthic organisms in the vicinity of anchor systems.

Potential impacts on water quality, eelgrass and other benthic organisms associated with removal / installation of piles are discussed in Section 3.1.2.2 and Section 3.2.2 of this chapter.

Monitoring and Maintenance

This alternative would include several monitoring and maintenance activities. These include:

- A survey of shoreline in the vicinity of FIL was conducted in late spring 2002. Subsequent surveys of the shoreline will be conducted as appropriate to document changes to the beach over time, particularly following any changes to the pier and barge configuration at FIL.
- Similarly, samples of beach material were collected in spring 2002 for grain size analysis. Subsequent samples will be collected for analysis to document changes to the beach over time, particularly following changes to the pier and barge configuration.
- Exposed wood debris on Navy property would be removed during construction. Subsequent debris accumulating on the beach would be removed periodically as it may collect on the beach.

360-Foot Pontoon

A new 360-foot (110 m) concrete pontoon would be approximately 165 feet (50 m) longer than the M241 Barge, an increase of approximately 95 percent. Although facilities would be moored 55 feet (17 m) further offshore, about 17 percent further than existing facilities, it's greater length would increase the sheltered zone on the shoreward side of the barge and the shoreward base of the salient (See Figure 13). Additional material retained in the salient would be prevented from reaching adjacent beaches until an equilibrium condition was reached.

As described above, modeling has shown that none of the action alternatives, including the 360-Foot Pontoon Alternative, would result in any significant change in shoreline processes that currently exist in the vicinity of FIL. Nor would the 360-Foot Pontoon Alternative significantly alter the conditions (i.e. naturally-occurring bluff retreat, bulkheads, revetments) that result in beach erosion to the northwest. Any effect is not expected to extend beyond 950 feet northwest of the access pier.

An increase in the size of the sheltered zone under the 360-foot Pontoon Alternative would be expected to increase the contribution of FIL in obstructing natural bluff retreat. However, the benefit would likely be small and limited to the immediate vicinity of FIL. As described in Shepsis (2002), the contribution of FIL in obstructing natural bluff retreat is not consequential compared to the contribution of bulkheads.

Impacts resulting from removal of wood debris and replacement of mooring systems components are the same as discussed above under the 240-Foot Pontoon Alternative. Similarly, this alternative would also include the monitoring and maintenance activities described above.

Fixed Pier

Installation of a fixed pier with a dogleg (See Figure 14) would provide a permanent platform against which the M241 Barge could be moored. It would eliminate the need for most of the mooring system used for the existing pier and barge configuration (No Action Alternative) and other action alternatives.

This alternative would extend the access pier approximately 100 feet further offshore where it would connect with the new 240-foot wharf. As under existing conditions, the 195 foot (59 m) M241 Barge, moored on the seaward side of the Fixed Pier, would continue to be the principal facility intercepting wind and wave energy and sheltering the beach near the access pier from this energy. This would tend to keep the sheltering zone and the volume and alongshore dimension of the salient approximately as at present.

The offshore side of the M241 Barge would be extended from 325 feet (99 m) to 435 feet (133 m) from the base of the access pier. This 33 percent increase would tend to reduce the sheltering zone and the dimensions of the salient.

The pilings supporting the pier would serve to decrease wave energy, contributing to the sheltering effects of the barge and the resulting tendency to accumulate sediment beneath the access pier. The magnitude of this effect would be dependent on pile spacing, pile size, as well as the scale of the structure. The piles may also serve to trap large wood debris floating in the nearshore zone.

As with other action alternatives, the Fixed Pier Alternative would not result in any significant change in shoreline processes that currently exist in the vicinity of FIL. Nor would the Fixed Pier Alternative significantly alter the conditions (i.e. naturally-occurring bluff retreat, bulkheads, revetments) that result in beach erosion to the northwest.

Due to the effect of the salient, the FIL facilities preclude shoreline retreat and landward migration of the shoreline (Shepsis, 2002). The magnitude of this effect would continue to be similar to that which exists at the present time and limited to the immediate vicinity of FIL.

Impacts resulting from removal of wood debris and repair/replacement of mooring systems components are the same as discussed above under the 240-Foot Pontoon Alternative. This alternative would also include the monitoring and maintenance activities described above.

No Action

Under the No Action Alternative, stabilization measures would not be undertaken. The existing pier and the several barges would remain in the present configuration and the existing mooring components would remain in place. The conditions (pier and barge configuration) that have resulted in the salient under the access pier would continue. It is likely that the salient would continue to be a prominent feature of the beach at FIL. Though the impact is small, the salient would continue to serve as an obstruction, restricting the naturally-occurring processes of bluff retreat and shoreline erosion.

The access pier would continue to accumulate wood debris, particularly during storm periods; it is possible that growing accumulations of wood debris would serve to increase the size of the

salient. Chronic low-level disturbance of bottom sediments by anchor systems would continue to occur with tidal fluctuations and periodic movement of barges, as would occasional grounding of barges and support vessels at low tides

3.1.1.3 Mitigation Measures

No mitigation measures are required.

3.1.2 Water Resources

3.1.2.1 Affected Environment

Fox Island Laboratory is located on the shores of Carr Inlet in southern Puget Sound. Circulation throughout Puget Sound is driven by complex forces of freshwater inputs, tides, and winds. While the average residence time for water in the central basin is approximately 120-140 days, it is much longer in the isolated inlets and restricted deep basins in southern Puget Sound (e.g., Carr Inlet) (National Oceanic and Atmospheric Administration (NOAA), 2002). Tides within the study area fluctuate between two high and two low tides per lunar day with usually unequal heights. High and low tides vary on average by 10 ft (3 m) per day but can differ by as much as 15 ft (5 m) between extreme high and low tides. Littoral currents at the site are generated by tides, direct wind effects, and by momentum transport from waves. While sediment moves in both directions along the beach, the predominant direction is to the northwest (Miller et al., 2002).

Facing southwest, FIL is fully exposed to winds and associated waves generated by events originating between the south-southeast and west-northwest, but it is protected from waves generated from all other directions. During intense storm events, strong winds in excess of 50 miles per hour (80 km per hour) and waves up to 3 ft (1 m) can buffet the facility, especially from the most severe storms which tend to arrive from the southwest (Miller et al., 2002).

Carr Inlet is stratified with a layer of less saline (or salty), warmer water overlying colder, more saline water. The salinity of the upper layer is sensitive to the amount of freshwater input and may decrease during extended periods of precipitation. There exists a strong relationship between the physical and biological processes in Carr Inlet – throughout the summer and early fall, variability in wind, rainfall, and sunlight result in fluctuations in temperature and salinity, creating intermittent periods of strong stratification and deep mixing (USEPA, 2002).

The Washington State Department of Ecology (Ecology) has established water quality standards (State Water Quality Standards) for the surface waters of the state. These standards set limits on pollution in surface waters in order to protect water quality. Washington has applied general water uses and criteria classes to surface waters in the State. Carr Inlet is located within an area classified “Class AA” as having “water quality that markedly and uniformly exceeds the requirements for all or substantially all uses” (Ecology, 1997).

The Washington State Department of Ecology operates a surface water quality monitoring station located approximately 3 miles (4.8 km) northwest of Fox Island Laboratory

(ID# CRR001). The site monitors tidal, diurnal, seasonal, and inter-annual cycles and trends in stratification, oxygen, nutrients, water clarity, and phytoplankton abundance and community distribution. Data collected from October 1988 to December 2000 show that at a depth of 1.6 ft (0.5 m) salinity ranges from 26.5 to 30.2 practical salinity units (PSU), water temperature varies between 8.2 degrees Celsius (°C) (46.8 degrees Fahrenheit [°F]) and 16.7 °C (62.1 °F), and dissolved oxygen concentrations vary between 6.68 milligrams per liter (mg/L) and 14.56 mg/L (Ecology, 2002).

Carr Inlet is listed as having: low dissolved oxygen concentrations, limiting concentrations of nitrogen-dissolved nutrients for three consecutive months during the year, moderate concentrations of ammonium, and is subject to "seasonal" density stratification. As a result of this assessment, Carr Inlet has been assigned a "moderate" level of concern for marine water quality (Ecology, 2002). In addition, based on the physical and chemical characteristics of the Inlet and surrounding areas, Carr Inlet is sensitive to eutrophication (Ecology, 2002). Carr Inlet is listed as an impaired water body for fecal coliform and low dissolved oxygen concentrations on the 1998 Clean Water Act (CWA) Section 303[d] list of impaired waters (USEPA, 2002).

The Washington State Department of Health (WDOH) monitors commercial and recreational shellfish areas in Puget Sound to assess toxin and fecal coliform levels. Areas of Carr Inlet have historically registered high concentrations of fecal coliform and paralytic shellfish poison (PSP), resulting in periodic closures of the commercial and recreational shellfish harvests (WDOH, 2001).

3.1.2.2 Environmental Consequences

240-Foot Pontoon

The potential for accidental spills of petroleum products and other potentially harmful fluids during proposed construction and wood debris removal activities under this alternative would be minimized to the greatest extent possible. However, should an accidental spill occur, the guidelines contained in the *Environmental Management Plan* (FIL, 2003) would be followed. Following implementation of any of the action alternatives, no change in water quality from baseline conditions would occur.

Under this alternative, the removal and installation of pilings would result in the resuspension of sediments into the water column, resulting in temporary, localized turbidity plumes. Littoral currents at the site generated by tides, direct wind effects, and by momentum transport from waves continuously flow in and out of Carr Inlet. These currents, in conjunction with the small scale of proposed piling removal and installation activities, would dilute the turbidity plume and reduce the likelihood of low dissolved oxygen concentrations. Furthermore, sediment chemical concentrations would not exceed numerical guidelines or Washington State criteria. Therefore, implementation of this alternative would not result in significant impacts to water quality.

During construction, removal of the dolphins may reintroduce sediments and small amounts of associated PAH into the water column. However, this impact is expected to be minor and of short duration.

During the construction period, contractors would be required to adhere to generally-accepted methods for controlling spills of pollutants from construction equipment. These measures would include storage of fuels solvents, lubricants, etc. in secure areas on floating equipment, careful use of these fuels and chemicals, provision of absorbent materials and booms, and maintenance of equipment in good operating condition.

FIL would adhere to the intent and provisions of the *Environmental Management Plan* (FIL, 2003). The *Environmental Management Plan* describes methods for storage and handling of paints, solvents, lubricants, etc. used on the site. In the event of any minor spills, the plan includes specific measures for cleanup and reporting to appropriate regulatory agencies.

Overall, implementation of the 240-Foot Pontoon Alternative would not result in significant impacts to water quality.

360-Foot Pontoon

Under this alternative, impacts would be similar to those described under the 240-Foot Pontoon Alternative. Therefore, implementation of the 360-Foot Pontoon Alternative would not result in significant impacts to water quality.

Fixed Pier Construction

Under this alternative, impacts would be similar to those described under the 240-Foot Pontoon Alternative. Implementation of the Fixed Pier Alternative would then not result in significant impacts to water quality.

No Action

Under the No Action Alternative, stabilization measures would not be undertaken. The existing pier and barges would remain in the existing configuration. The existing mooring components would remain in place. Under the No Action Alternative, existing conditions as described in Section 3.1.2.1 would remain unchanged. Therefore, implementation of the No Action Alternative would not result in significant impacts to water quality.

3.1.2.3 Mitigation Measures

No mitigation measures are necessary.

3.1.3 Air Quality

3.1.3.1 Affected Environment

For the purposes of this analysis, air quality is defined as the ambient air concentrations of specific pollutants determined by the U.S. Environmental Protection Agency (USEPA) to be of concern to the health and welfare of the general public. These six pollutants (criteria pollutants) include ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than 10 microns in diameter (PM_{10}), and lead (Pb). National Ambient Air

Quality Standards (NAAQS) have been established by the USEPA for these criteria pollutants (USEPA, 2002). The NAAQS define the maximum concentrations of the criteria pollutants that are considered safe, with an additional adequate margin of safety, to protect human health and welfare. The State of Washington has adopted the NAAQS for all criteria pollutants except for SO_2, for which the state has adopted slightly more stringent requirements (Ecology, 2002). Depending on the type of pollutant, these maximum concentrations may not be exceeded at any time, or may not be exceeded more than once per year (USEPA, 2002; Ecology, 2002).

As required by the Clean Air Act (CAA) Amendments of 1990, Washington has prepared a State Implementation Plan (SIP). The SIP is a compilation of goals, strategies, schedules, and enforcement actions that help lead a state into compliance with the NAAQS. Areas not in compliance with the NAAQS can be declared non-attainment areas by the USEPA or by the appropriate state or local agency. Areas in compliance with the NAAQS are defined as being in attainment. Areas that have been reclassified from non-attainment to attainment are designated as attainment/maintenance areas. Areas that lack the monitoring data to demonstrate attainment or non-attainment status are designated as unclassified and are treated as attainment areas for regulatory purposes. Pierce County, including Fox Island, is in attainment of the NAAQS for all six criteria pollutants but is within the Seattle-Tacoma O_3 Maintenance Area (USEPA, 2002).

As described in 40 Code of Federal Regulations (CFR) Part 51, *Determining Conformity of General Federal Actions to State or Federal Implementation Plans* (the "General Conformity Rule"), all federal actions occurring in air basins designated in non-attainment or in a maintenance area must conform to an applicable implementation plan. Should an action alternative result in emissions that exceed *de minimis* levels (based on the non-attainment status for each applicable criteria pollutant in the area of concern), a conformity determination would be required. For Pierce County, the applicable *de minimis* level for O_3 is 100 tons (91 metric tons) per year.

Fox Island Laboratory is situated in a maritime temperate subtropical climate regime. The average annual high temperature is approximately 61 degrees Fahrenheit (°F), ranging between an average summer maximum of 77 °F and an average winter maximum of 46 °F. The average annual low temperature is approximately 44 °F, ranging between an average summer minimum of 55 °F and an average winter minimum of 35 °F. Subfreezing temperatures and snow are rare. The area averages approximately 39 inches of rain a year, with the majority of rain falling in the late fall and winter months (Western Regional Climate Center, 2002). Winds at Fox Island Laboratory are most frequent and strongest from the south-southwest, followed by winds from the south. During intense storm events winds can gust in excess of 30 miles per hour (mph) (Miller et al., 2002).

Fox Island Laboratory is located within the jurisdiction of the Puget Sound Clean Air Agency (PSCAA), which includes Pierce, King, Kitsap, and Snohomish Counties. Ambient air quality monitoring stations are typically located in areas where air quality is of concern. Since air quality at Fox Island is generally good due to its non-urban setting, no air quality data exists. The nearest ambient air quality monitoring station to Fox Island Laboratory is the Pacific Avenue Monitoring Station in downtown Tacoma, located approximately 12 miles (19 km) to the east. Air quality measured at this monitoring station is classified within the "good" range

(Ecology, 2002). Emission sources at FIL include generators, support boats, and personal and government-owned vehicles and are considered minor.

3.1.3.2 Environmental Consequences

Emission thresholds associated with CAA conformity requirements are the primary means of assessing potential air quality impacts. A formal conformity determination is required for federal actions occurring in non-attainment or maintenance areas when the total direct and indirect stationary and mobile source emissions of non-attainment pollutants or their precursors exceed applicable *de minimis* thresholds. Effects to air quality are evaluated based on estimated direct and indirect emissions associated with the action alternatives. Refer to Appendix A, Air Quality Calculations, for detailed emissions assumptions and calculations.

240-Foot Pontoon

Emissions resulting from construction and wood debris removal activities under this alternative have been estimated. Estimated emissions from this action alternative would be below *de minimis* levels; a conformity analysis would not be necessary (Table 3-1). In addition, proposed construction activities would be short-term in nature; no long-term increases in emissions would occur. Therefore, implementation of the 240-Foot Pontoon action alternative would not result in significant impacts to air quality.

Table 3-1. Estimated Emissions Under the 240-Foot Pontoon Alternative

Category	Emissions(tons/year [metric tons/year])				
	VOC[1]	NO_X [1]	CO	SO_X	PM_{10}
240-Foot Pontoon Alternative	1.0 (0.9)	9.0 (8.2)	3.0 (2.7)	1.8 (1.6)	0.5 (0.5)
de minimis threshold	100 (91)	100 (91)	NA	NA	NA
Exceeds *de minimis* threshold?	No	No	NA	NA	NA

Notes: [1] Pierce County is in attainment of the NAAQS for all six criteria pollutants but is in a maintenance area for the federal and state O_3 standards; VOCs and NO_x are precursors to the formation of O_3.
VOC = volatile organic compounds; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = oxides of sulfur; PM_{10} = particulate matter less than 10 microns in diameter; NA = not applicable.

During the construction period, contractors would be required to adhere to generally-accepted methods for controlling air emissions from construction equipment. These may include maintenance of equipment in good operating condition, use of exhaust recycling systems as required, and turning engines off when not in use.

FIL would adhere to the intent and provisions of the *Environmental Management Plan: Fox Island Laboratory* (FIL, 2003) that describes methods for storage and handling of paints, solvents, lubricants, etc. used on the site. In the event of any minor spills, the plan includes specific measures for cleanup and reporting to appropriate regulatory agencies.

360-Foot Pontoon

Under this alternative, impacts would be the same as those described under the 240-Foot Pontoon Alternative. Therefore, implementation of the 360-Foot Pontoon Alternative would not result in significant impacts to air quality.

Fixed Pier Construction

Emissions resulting from construction and wood debris removal activities under this alternative have been estimated as described under the 240-Foot Pontoon Alternative.. Estimated emissions from this alternative would be below *de minimis* levels; a conformity analysis would not be necessary (Table 3-2). In addition, proposed construction activities would be short-term in nature; no long-term increases in emissions would occur.

Therefore, implementation of the Fixed Pier Alternative would not result in significant impacts to air quality.

Table 3-2. Estimated Emissions Under the Fixed Pier Alternative

Category	Emissions(tons/year [metric tons/year])				
	VOC[1]	NO_X [1]	CO	SO_X	PM_{10}
Fixed Pier Alternative	1.5 (1.3)	14.1 (12.8)	4.8 (4.4)	2.8 (2.5)	0.9 (0.8)
de minimis threshold	100 (91)	100 (91)	NA	NA	NA
Exceeds *de minimis* threshold?	No	No	NA	NA	NA

Notes: [1] Pierce County is in attainment of the NAAQS for all six criteria pollutants but is in a maintenance area for the federal and state O_3 standards; VOCs and NO_x are precursors to the formation of O_3.
VOC = volatile organic compounds; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = oxides of sulfur; PM_{10} = particulate matter less than 10 microns in diameter; NA = not applicable.

No Action

Under the No Action Alternative, stabilization measures would not be undertaken. The existing pier and barges would remain in the existing configuration. The existing mooring components would remain in place. Under the No Action Alternative, existing conditions as described in Section 3.1.3.1 would remain unchanged. Therefore, implementation of the No Action Alternative would not result in significant impacts to air quality.

3.1.3.3 Mitigation Measures

No mitigation measures are necessary.

3.1.4 Noise Environment

3.1.4.1 Affected Environment

For the purposes of this analysis, noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise considered an annoyance. The physical characteristics of sound include its level, frequency, and duration. Sound is commonly measured with instruments that record instantaneous sound levels in decibels (dB), which are based on a logarithmic scale (e.g., a 10-dB increase corresponds to a 100 percent increase in perceived sound). A-weighted sound level measurements (dBA), which de-emphasize low and high frequencies and emphasize mid-range frequencies, are used to characterize sound levels that are heard especially well by humans. All sound levels presented in this EIS are A-weighted.

Washington and Pierce County have developed maximum permissible environmental noise levels for receiving properties. Situated in a primarily residential setting, the overall noise environment within the vicinity of FIL can be described as quiet suburban with average noise levels ranging between 45 and 55 dBA. However, both Washington and Pierce County have exempted noise generated from temporary construction activities, provided such activities do not occur between the hours of 10:00 p.m. and 7:00 a.m. (Ecology, 2000; Pierce County, 2001).

Situated in a non-urban setting, the overall noise environment within the vicinity of FIL can be described as "quiet suburban." Sources of manmade noise within the vicinity of FIL include truck and automobile traffic, waterfront operations, and research and testing activities. Natural sources of noise include rain, wind, and breaking waves. At times (e.g., during intense storms), these natural sources of noise can dominate the noise environment.

Within the waters of Carr Inlet, noise generated by boat traffic (e.g., heavy tugs/ferries) typically represents the dominant source of underwater noise. The closest potentially sensitive noise receptors are single-family residences located immediately adjacent to either side of FIL.

Fox Island Laboratory is a minor source of noise, generating low levels of noise through use of skiffs and small vessels, transfer of equipment to and from barges, occasional use of tugs, and motor vehicle traffic to and from the laboratory. Most of the generators, engines, hoists, and other noise producing sources used on a day-to-day basis are enclosed. In some instances, however, depending on the nature of the testing and evaluation project, some noise may be produced by on-deck or in-water equipment. In addition, there is an emergency diesel generator used on occasions when there is a loss of power. In these cases, FIL staff works to reduce noise levels to below nuisance levels and to minimize the duration of noise-generating activities.

3.1.4.2 Environmental Consequences

240-Foot Pontoon

Under this alternative, noise producing activities would include removing timber dolphins and fender piles, driving new replacement dolphins and fender piles, placement of anchor systems, and maneuvering construction and material barges about the site. Noise would also be produced by generators and construction vehicles. Construction activities would last from one to three months between the hours of 7:30 a.m. and 4:30 p.m., although, depending on the time of year (i.e., winter or summer), construction activities may run slightly longer or shorter. In addition, exposed wood debris accumulated on the beach would be removed over a period of one to two weeks.

Proposed construction and wood debris removal activities would create localized, temporary noise impacts. As the typical average sound level produced by construction activities is approximately 85 dBA at a distance of 50 feet (15 meters) and construction noise levels decrease by approximately 6 dBA with each doubling of distance, average sound levels at a distance of approximately 800 feet (243 meters) during construction activities would be approximately 61 dBA. However, pile driving activities can generate vibrations and maximum noise levels between 93 and 105 dBA at a distance of 50 feet (15 meters) (depending on the type of equipment used), and would therefore dominate the noise environment during their use (Oregon Department of Transportation, 1999).

While limited studies are available, pile driving activities do have the potential to affect fish behavior. Juvenile salmon appear to avoid pile driving activities; however, the prevalence of fish schools does not change significantly with or without pile driving and no impacts on feeding have been observed (Feist et al., 1996). While fish within the immediate study area could temporarily be affected (i.e., avoid area), no significant impacts are expected.

As noted in Section 3.3.1, both the State of Washington and Pierce County have exempted noise generated from temporary construction activities, provided such activities do not occur between the hours of 10:00 p.m. and 7:00 a.m. (Ecology, 2000; Pierce County, 2001). With the completion of proposed construction activities, the noise environment would revert to baseline conditions (45 to 55 dBA). Noise from truck and automobile traffic, waterfront operations, research and testing activities, and at times, natural sources of noise such as rain, wind, and breaking waves would continue to dominate the noise environment. Therefore, implementation of the 240-Foot Pontoon Alternative would not result in significant impacts to the noise environment. During the construction period, contractors would be required to adhere to generally-accepted methods for controlling noise from construction equipment. These measures may include: maintenance of equipment in good operating condition; limiting hours of operation of noise-generating equipment; shielding noise generators; and use of mufflers where feasible.

360-Foot Pontoon

Under this alternative, impacts would be similar to those described under the 240-Foot Pontoon Alternative. Therefore, implementation of the 360-Foot Pontoon Alternative would not result in significant impacts to the noise environment.

Fixed Pier

Under this alternative, impacts would be similar to those described under the 240-Foot Pontoon Alternative. Implementation of the Fixed Pier Alternative would not, then, result in significant impacts to the noise environment.

No Action

Under the No Action Alternative, stabilization measures would not be undertaken. The existing pier and the several barges would remain in the existing configuration. The existing mooring components would remain in place. Under the No Action Alternative, existing conditions as described in Section 3.3 would remain unchanged. Therefore, implementation of the No Action Alternative would not result in significant impacts to the noise environment.

3.1.4.3 Mitigation Measures

No mitigation measures are necessary.

3.2 Biological Resources

3.2.1 Affected Environment

3.2.1.1 Site Analysis

The analysis of the site included review of existing information and a site survey. A review of the Washington Department of Natural Resources (WDNR) Natural Heritage Program database revealed no current records of wetlands, rare plants, or rare plant communities in the vicinity of the Proposed Action (WDNR, 2002). No freshwater wetlands are mapped in the vicinity of the Proposed Action (NWI, 1987). Other sources of information included aerial photographs, *Fox Island Laboratory Shoreline Change Evaluation* (Miller et al., 2002), and review of United States Geological Survey, Fox Island quadrangle (1968), and the National Wetlands Inventory (NWI), Fox Island quadrangle (1987) maps. A field visit was performed in July 2002.

Upland Environments

FIL is located on a 1.3-acre (0.5-hectare) site which rises approximately 100 feet (30.5 meters) from the Puget Sound shoreline to the southwest. The site is largely developed, and vegetation is predominantly limited to the northern half of the site.

Vegetation on the northwestern portion of the FIL property is predominantly mowed lawn, with a few shrubs located along the east fenced property boundary. A small portion of the site is located west of the western property fence, and is vegetated with native trees and shrubs. No spring or other surface water was observed on the site during the July 2002 field survey. The surrounding habitat, like most high-bluff habitat along Puget Sound, is mixed forest dominated by Douglas fir (*Pseudotsuga menzeisii*), and red alder (*Alnus rubra*), with an understory of salal (*Gaultheria shallon*) and sword fern (*Polystichum munitum*). Associate tree species include Pacific madrone (*Arbutus menzeisii*), and big-leaf maple (*Acer macrophyllum*). More than half of the shoreline on the southwest side of Fox Island is made up of glacial till and considered unstable (KGI, 1999). Breaks in the canopy or areas of ground slumping are typically vegetated with Pacific blackberry (*Rubus ursinus*), ocean spray (*Holodiscus discolor*), snowberry (*Symphoricarpos albus*), and bracken fern (*Pteridium aquilinum*) (Adams and Hamilton, 1999). An area of mowed grass exists between the laboratory building parking area and the storage

building at the northeast end of the property. A rockery abutting the laboratory building separates the upland habitat from the backshore area of the shoreline.

Upper Beach and Backshore Areas

The backshore on the FIL property is predominantly unvegetated. The substrate is primarily gravel and cobble. Wood debris covers approximately 7,800 square feet (725 square meters) of the beach adjacent to FIL (Figure 8) (Miller et al., 2002). This area supports a plant community consisting of tree, shrub, and herbaceous species common to beach environments in the region (Miller et al., 2002). Plant species including Puget Sound gumweed (*Grindelia integrifolia*), plantain (*Plantago maritime juncoides*), beach pea (*Lathrus japonicus*), saltbush (*Atriplex patula*), and Canada thistle (*Cirsium arvense*) are present. The beach located immediately off-site to the northwest of FIL also contains large amounts of wood debris, and is more heavily vegetated. In addition to the species listed above, Douglas fir, Pacific madrone, red alder saplings, red elderberry (*Sambucus racemosa*), Himalayan blackberry (*Rubus armeniacus*), and curly dock (*Rumex crispus*) are present. Most of the trees and woody shrub species occur in backshore areas with vegetation density and structural complexity decreasing waterward of the shoreline (Figure 8). Removal of wood debris from the upper beach is not part of scheduled maintenance at FIL, but this was a common activity through the mid-1980's. Wood debris is actively removed from the beach by the surrounding landowners. As a result, the collection of wood debris that fronts FIL is the largest concentration on the southwest shoreline of Fox Island.

Beach and Nearshore Aquatic Habitat

The intertidal area adjacent to FIL is mapped by the NWI (1987) as estuarine intertidal unconsolidated shore regularly flooded wetland. Beach substrate consists of sand, gravel, and cobble throughout the higher intertidal zone. The beach fronting FIL has a slope of approximately 1 to 10 (Miller et al., 2002). Substrates decreased in size in subtidal zones with the amount of fine sand and silt increasing with depth toward the drop off at between 6 feet (1.8 meters) and 18 feet (5.4 meters) (Figure 5). Beyond the drop off at approximately 10 feet (3 meters) in depth, the bottom is characterized as typical of other soft bottom habitats in Puget Sound (Miller et al., 2002).

Macroalgae including fucus (*Fucus distichus*) and sea lettuce (*Ulva lactuca*) were observed at low tide (Figure 15). Eelgrass beds are present within nearshore areas adjoining FIL at depths ranging from 2.8 feet (0.85 meter) to 14.5 feet (4.4 meters) (Miller et al., 2002). No eelgrass was observed at depths in excess of 15 feet (4.6 meters) due mainly to the rapid decent of the bottom beyond this depth (Miller et al., 2002). Eelgrass beds in the immediate vicinity (within 120 feet [36.6 meters]) of the access pier are characterized as being small and sparse (less than 10 shoots per patch). The size and density of the eelgrass beds generally increase toward the north and south (Figure 16), but are still located in small to medium sized patches. This patchy condition is common for southern Puget Sound (Miller et al., 2002). Eelgrass generally is present over about 2 percent to 5 percent of shoreline areas in Southern Puget Sound (Baily et al., 1998). The relatively lower abundance and density of eelgrass adjacent to the access pier is attributed to boating activity, barge shading, and occasional vessel grounding at low tides (Figure 17).

Figure 15. Intertidal habitat.

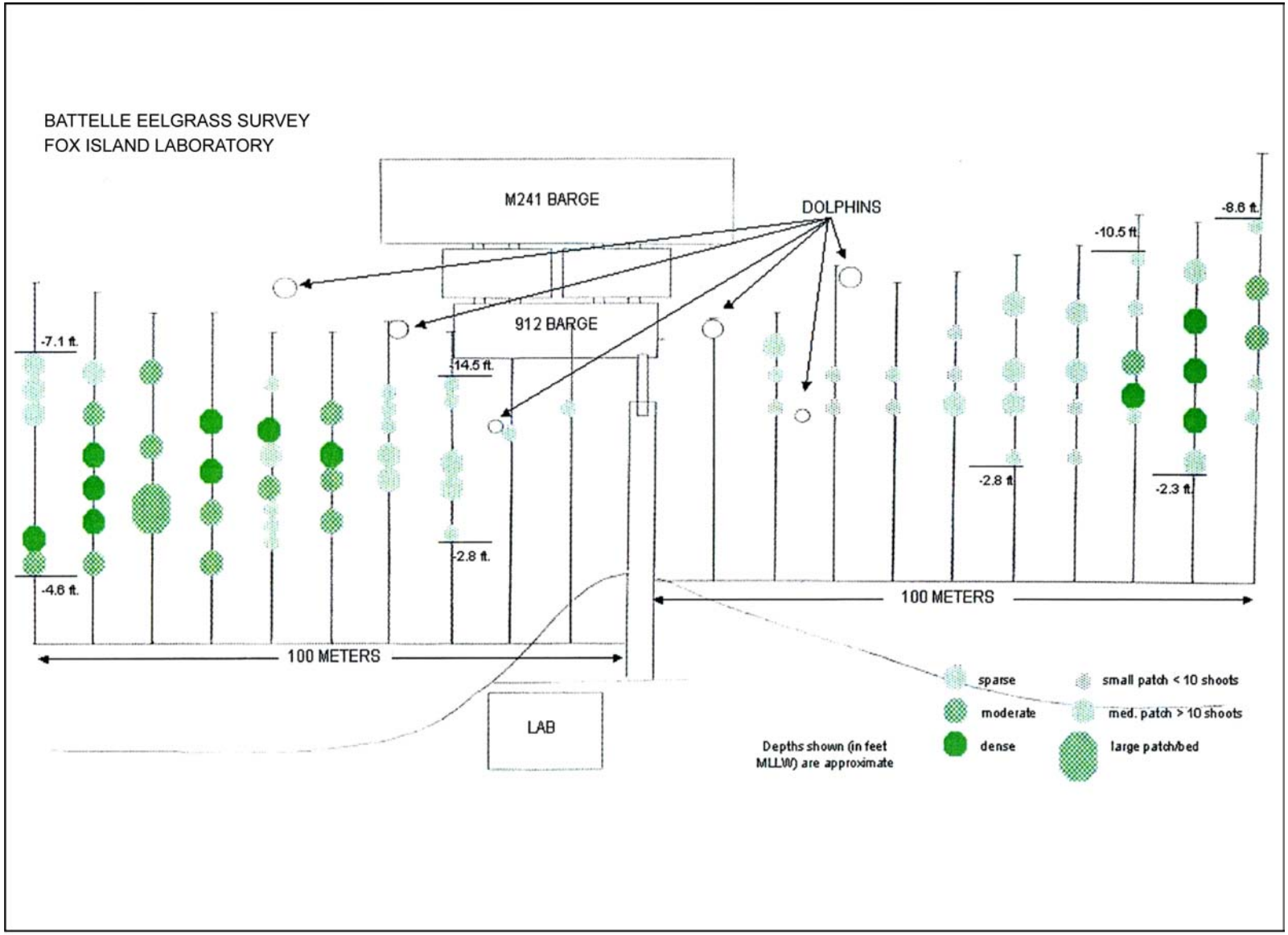


Figure 16. Eelgrass distribution at Fox Island Laboratory.

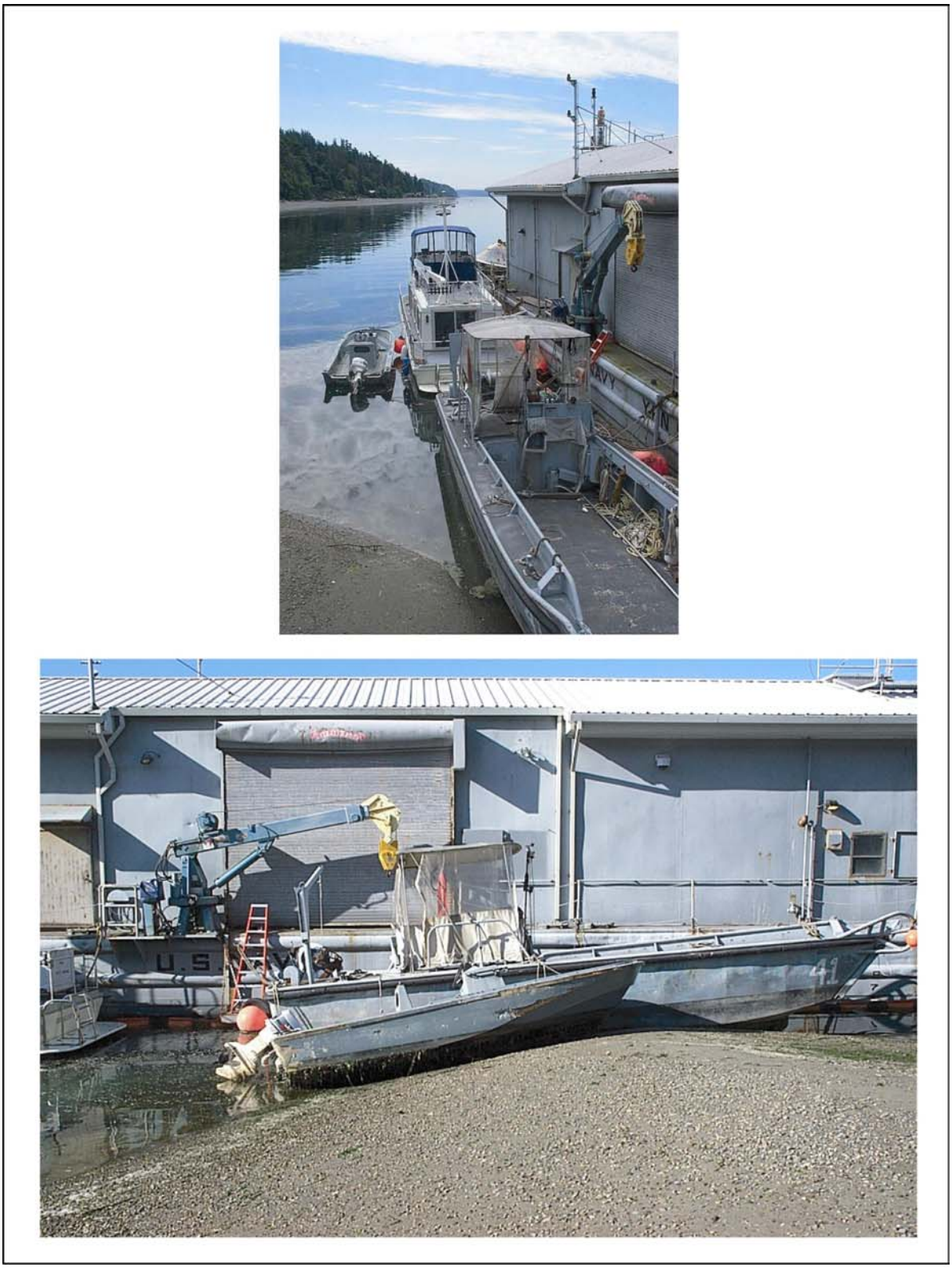


Figure 17. Boats moored inboard of Barge 912.

3.2.1.2 Fish, Shellfish, and Benthos

No freshwater streams are mapped on Fox Island (Williams et al., 1975; WDFW, 2002). The NWI (1987) identifies a spring on the hillside northwest of the FIL site, but no surface water was observed from the adjacent shoreline during site visits conducted in the spring and summer of 2002. Several small streams located on the Gig Harbor Peninsula drain to Hale Passage and Wollochet Bay northeast of Fox Island. These streams include Warren Creek, Artondale Creek, Sulivan Gulch Creek, and one unnamed drainage. Numerous small tributary streams feed Henderson Bay northwest of Fox Island. Lacky Creek, Minter Creek, Burley Creek, Purdy Creek, and McCormick Creek are the larger streams in the basin (Williams et al., 1975). The mouths of these streams are 7 miles (11 kilometers) to 9 miles (11 kilometers) north of FIL. Washington Department of Fish and Wildlife (WDFW) operates a salmon hatchery located near the mouth of Minter Creek. The Nisqually, Puyallup, and Squaxin Island Tribes have Usual and Accustomed fishing rights in Carr Inlet (Walter, personal communication, 2002).

Miller et al. (2002) recorded observations of finfish while conducting the eelgrass survey at FIL. Species observed in the vicinity of FIL included shiner surfperch (*Cymatogaster aggregata*), striped surfperch (*Embiotoca lateralis*), staghorn sculpin (*Leptocottus armatus*), pinpoint gunnel (*Pholis laeta*), and unidentified flatfish (*Bothidae* or *Pleuronectidae* spp). Coho salmon were observed in nearshore areas during the July 2002 field visit to the site. In addition to these species, beach seine samples collected on McNeil Island (opposite Carr Inlet from Fox Island) included chinook salmon, chum salmon, pink salmon, rock sole (*Plueronectus bilineatus*), speckled sand dab (*Citharichthys stigmaeus*), starry flounder (*Platichthys stellatus*), pile surfperch (*Rhacochilus vacca*), juvenile smelt (family Osmeridae), smoothhead sculpin (*Artedius lateralis*), saddleback gunnel (*Pholis ornata*), rockweed gunnel (*Apodichthys fucorum*), sturgeon poacher (*Podothecus acipenserinus*), and threespine stickleback (*Gasterosteus aculeatus*) (Washington State Department of Corrections (WDOC), 1989). Similar species are likely to occur within nearshore habitats on Fox Island in proximity to FIL. Cabezon (*Scorpaenichthys marmoratus*), spiny dogfish (*Squalus acanthias*), greenling (*Hexagrammos* spp.), Pacific cod *(Gadus macrocephalus*), pollock (*Pollachius virens*), skate (*Raja* spp), whiting (*Merluccius* spp), rockfish (*Sebastes spp*), and Pacific salmon (*Onchorhynchus spp*) occur in and around Carr Inlet (Pierce County Department of Planning and Land Services (PALS), 2001). Along with the finfish mentioned above, nearshore areas within the vicinity of FIL support spawning habitat for sandlance (*Ammodytes hexapterus*) and herring (*Clupea pallasi*). Most sandlance and herring spawning areas occur along Hale Passage on the northeastern shoreline of Fox Island. No sandlance, surfsmelt, or herring spawning areas are mapped on the southwestern side of Fox Island in proximity to FIL (WDFW, 2002).

Benthic life in intertidal and subtidal environments adjacent to FIL is similar to other beaches in southern Puget Sound. Sampling on McNeil Island identified 16 species of shellfish on beaches along Carr Inlet (WDOC, 1989). This study found horse clam (*Tesus capax*), littleneck clam (*Protothaca staminea*), manila clam (*Venerupis japonica*), butter clam (*Saxidomus giganteus*), soft shell clam (*Mya arenari*), cockle (*Clinocardium nuttalli*), moon snail (*Polinices lewisi*), Dungeness crab (*Cancer magister*), red rock crab (*C. productus*), spider crab (*Pugettia producta*), barnicle (*Balanus* spp.), and mussel (*Mytilus* spp.). Geoduck (*Panopea generosa*) are found subtidally along the southwestern shoreline of Fox Island (Bradbury and Sizemore, 1995;

WDFW, 2002). Other common subtidal organisms found in nearshore and deep water habitats in Carr Inlet include sea anemones (*Metridium senile*), abalone (*Haliotis kamtschatkana*), razor clam (*Siliqua* spp), Pacific oyster (*Crassostrea gigas*), Olympia oyster (*Ostrea lurida),* octopi (*Octopus dofleini*), sea urchins (*Strongylocentrotus droebachiensis*), sea cucumber (*Parastichopus californicus*), scallops (*Hinnites multirugosus*), shrimp (*Pandalus* spp), and multiple species of seastars including sunflower star (*Pycnopodia helianthoides*) (PALS, 1999; PALS, 2001).

The wood piles and other in-water structures support communities of invertebrates. Mussels, barnacles, spider crab, seastars, and sea anemones were observed clinging to piles at the facility during the July and September 2002 site visits. It is likely that these in-water structures support other species of sessile marine organisms.

3.2.1.3 Fisheries

Carr Inlet and Hale Passage support several commercial and recreational fisheries. The Nisqually, Puyallup, and Squaxin Island Tribes has Usual and Accustomed fishing rights in Carr Inlet (Walter, personal communication, 2002). Minter Creek Hatchery located northwest of Fox Island supports a commercial fishery, harvesting surplus fish returning to the stream. Coho salmon (*Oncorhynchus kisutch*) have been the commercially dominant species within Carr Inlet due to the large escapement of hatchery fish. Chinook salmon (*Oncorhynchus tshawytscha*) have also been commercially important within this area of the Kitsap Peninsula. Sport fishing around the Kitsap Peninsula, which includes Carr Inlet and Hale Passage, is popular near Minter Creek and Burley Lagoon. Winter blackmouth (chinook sub-adults) fishing occurs in these waters as large numbers of these immature salmon occur off of the Gig Harbor Peninsula year-round. The most concentrated sport fisheries are found in the areas of heavy currents, tide rips, and back eddies where food organisms are abundant (Williams et al., 1975). Recreational fishing also occurs at the Fox Island Public Fishing Pier located on the northeastern side of Fox Island.

Fox Island beaches support an important recreational fishery for shellfish. Public shellfish beaches on Fox Island are located mainly along Hale Passage near the bridge connecting Fox Island to the Kitsap Peninsula (PALS, 2001). Hale Passage is also mapped as a significant area for Dungeness crab (WDFW, 2002). Concentrations of hard-shell clams within Carr Inlet and Henderson Bay are found at Burley Lagoon, at Gibson Point (southern end of Fox Island), and on Raft Island. Bradbury and Sizemore (1995) identify six potentially commercial geoduck tracts in the vicinity of Fox Island. A lower density, non-commercial geoduck tract is mapped along the entire southwestern shoreline of Fox Island. FIL is adjacent to this tract.

Beaches within Carr Inlet, including beaches along Hale Passage and the northern portion of Fox Island, are periodically closed to recreational shellfishing by the Washington State Department of Health (WDOH). Recreational shellfishing is most commonly closed as a result of high fecal coliform concentrations or high biotoxin (e.g., red tide) concentrations (PALS, 2001). These beaches, including the beach adjacent to FIL were identified as closed as a result of biotoxin during the summer of 2002 (WDOH, 2002).

Carr Inlet also supports commercial shellfishing, although commercial shellfish beds have been periodically closed or restricted as a result of high biotoxin levels and high fecal coliform levels

(WDOH, 1999; WDOH, 2001). Commercial shellfish production occurs mainly within Burley Lagoon at the mouth of Burley Creek near Purdy, Washington, and at the mouth of Minter Creek. Both of these streams drain into Henderson Bay. The primary commercial beds of geoduck in the vicinity are located within Hale Passage and adjacent to Nearns Point (northern end of Fox Island). No commercial shellfish beds are identified along the southwestern shoreline of Fox Island.

3.2.1.4 Marine Mammals

Seven species of marine mammals are present in Puget Sound including: harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californicus*), harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), minke whale (*Balaenoptera acutorostrata*), orca (*Orcinus orca*), and gray whale (*Eschrichtius robustus*) ((Johnson and O'Neil, 2001).

Although several species of marine mammals have been observed at FIL, no systematic recording of observations has been made. Sea lions have been occasionally sighted near McNeil Island from boats operating out of FIL Over long intervals (several years). Orca are sighted in Carr Inlet, Porpoises and gray whales have not been sighted off of FIL.

Harbor seals are common, year-round residents of the sound; a harbor seal and California sea lion haul-out is located approximately 2.6 miles (4.1 kilometers) from the FIL site on Gertrude Island (Miller et al., 2002; WDFW, 2002). Gertrude Island, the largest haulout for harbor seals in south Puget Sound, is included in the South Puget Sound Wildlife Area – a protected marine area of 4,575 acres (1,853 hectares) (http://www.wa.gov/puget_sound/shared/volume2/intro.html, August 2002).

Adult and sub-adult male California sea lions migrate to Puget Sound in late summer from breeding grounds in California, and remain until spring, when they return south (Johnson and O'Neil, 2001). Non-breeding Steller sea lions occur in Puget Sound as well (see Threatened and Endangered Species below). Dall's porpoise and harbor porpoise live year-round in Puget Sound. Orca are Puget Sound residents, although transient orca may also enter the sound occasionally. Gray whales are sighted in Puget Sound each year, although the only year-round resident gray whales live in northern Puget Sound around Whidbey Island (Johnson and O'Neil, 2001). All of these species of cetaceans and pinnipeds may use the nearshore marine and deep marine habitats near FIL.

3.2.1.5 Marine and Shore Birds

Birds characteristic of Puget Sound marine habitats include various species of loons, grebes, cormorants, scoters, jaegers, gulls, terns, and alcids (Hunn, 1985). Marine bird populations are highest in Puget Sound from September to November (Hunn, 1985). There are no breeding colonies of marine birds in the vicinity of the FIL property (WDFW, 2002; Johnson and O'Neil, 2001). Scoters, common murres, common and Barrow's goldeneye, common and red-throated loons, western grebe, American and Eurasian widgeon are commonly observed in southern Puget Sound (Hunn, 1985; Johnson and O'Neil, 2001). Cormorants, gulls, and alcids forage in the deeper waters and tidal convergent areas of Carr Inlet during the summer months (Johnson and O'Neil, 2001).

Shorebird species that may use the intertidal habitat at low tide include western sandpiper, semipalmated sandpiper, sanderling, dowitchers, and killdeer. Killdeer, which are solitary nesters common to beach and upland sites in the Puget Sound region, may use the gravel and sand portion of the backshore habitat for nesting, although they were not observed in July 2002. Osprey have nested on Fox Island in the past (KGI, 1999; WDFW 2002), although no osprey have nested on Fox Island since 2001 (Brookshire, personal communication, 2002).

3.2.1.6 Threatened and Endangered Species

Section 7 of the Endangered Species Act (ESA) requires that the effects of a Proposed Action upon listed species must be evaluated for proposed federal actions. If an agency determines that its action may affect listed species or their critical habitats, the agency should consult in accordance with 50 CFR § 402 with the appropriate service. Consultation has been initiated by the data requests sent to the National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) and the United States Fish and Wildlife Service (USFWS) in May 2002 for records of threatened or endangered species or their designated critical habitat within the study area. Agency correspondence may be found in Appendix B. Consultation with the Services is on-going.

Information provided by NOAA Fisheries (2002) found in Appendix B, identified that the Proposed Action may occur within the general range of the following listed species under their jurisdiction:

- Humpback Whale (*Megaptera novaeangliae*). Endangered
- Leatherback Sea Turtle (*Dermochelys coriacea*). Endangered
- Puget Sound ESU Chinook Salmon (*Oncorhynchus tshawytscha*). Threatened.
- Steller Sea Lion (*Eumetopias jubatus*). Threatened

USFWS (USFWS, 2002) found in Appendix B, identified that the Proposed Action may occur within the general range of the following listed species under their jurisdiction:

- Bald Eagle (*Haliaeetus leucocephalus*) Threatened.
- Marbled Murrelet (*Brachyramphus marmoratus*) Threatened.
- Coastal/ Puget Sound Bull Trout (*Salvelinus confluentus*) Threatened.

The Action Proponent has prepared a Biological Assessment in accordance with 50 CFR § 402.12 to facilitate the consultation process (Appendix C).

3.2.1.7 Essential Fish Habitat

Potential impacts to relevant commercially exploited and federally-managed fisheries species are regulated by NOAA Fisheries pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSA establishes Essential Fish Habitat (EFH) for a variety of

fish species including Pacific salmon, groundfish and coastal pelagic fish species. EFH for Pacific salmon includes all fresh water streams, lakes, ponds, wetlands, and other currently viable water bodies and most of the habitat historically accessible to salmon. EFH for Pacific coast groundfish is generally defined as the aquatic habitat from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths seaward. EFH for coastal pelagic species is generally defined as all marine and estuarine waters from the shoreline offshore above the thermocline. Because of the location of FIL with Puget Sound, marine and nearshore areas are included within the range of EFH regulated under the MSA. 50 CFR § 600.920 requires agencies to consult with NOAA Fisheries on activities that adversely affect EFH.

3.2.2 Environmental Consequences

3.2.2.1 Impacts Common to All Action Alternatives

Site Analysis

Upland. There are no changes to upland areas at FIL as part of any action alternative. There are no impacts to existing upland vegetation (lawn and small trees) expected as a result of any of the alternatives. All of the land-based construction access, staging, and stockpiling of material would occur from the existing access pier, from barges, or on paved surfaces within established parking areas.

Upper Beach and Backshore Areas. Action alternatives would include the removal of exposed wood debris located on the backshore portion of the site; it is assumed that this activity would take one to two weeks to complete. Removal of this exposed wood debris would necessitate use of heavy equipment. This activity would result in the removal of much of the vegetation currently growing within the wood debris. Annual plants such as saltbush are likely to return to the site the following spring as a result of the remaining seed-bank. Perennials such as Puget Sound gumweed and beach pea would either be uprooted or would have above-ground portions of the plant removed. Perennial species would likely return to the site either from remaining rootstock or from seedstock. This removal of wood debris would be repeated periodically, with the same impact to vegetation occurring.

Beach and Nearshore Aquatic Habitat

The wood pile dolphins used to moor the existing in-water facilities would be removed under all alternatives. This would reduce the potential for nearshore areas to be further affected by any PAH leaching from the wood piles. Replacement pilings under all alternatives would be coated steel and/or pre-cast concrete and would not contain PAH.

Each action alternative would involve in-water structures that would cover the water surface resulting in shading of nearshore areas. The level of potential shading would vary for each action alternative, increasing or decreasing the amount of shading that currently exists. Shading would result from either the fixed structures (all action alternatives), moored barges and vessels (all action alternatives), or the pontoons (two alternatives). These over-water structures would

create a shade footprint over the bottom. The area and intensity of shading depends on the size of the over-water structure, the height of the structure over the water, the ability of the structure to move with the wind, current, and tides, and the depth of the water (Nightingale and Simenstad, 2001). Shading in nearshore areas by over-water structures can reduce the density and abundance of aquatic vegetation, including eelgrass and may result in the loss of eelgrass under the structure (Shafer, 2002; Thom et al, 2001; Dennison, 1987; Visconty, 1997). The specific area of over-water structure is identified under each alternative. The existing access pier, which would be retained under all action alternatives, covers approximately 2,500 square feet (230 square meters) of the intertidal zone and nearshore areas.

During in-water work, the Navy would comply with applicable permit conditions and other measures to protect water quality. Care would be taken to prevent any petroleum products, chemicals, or other toxic or deleterious materials from entering the water. All construction activities would be conducted in conformance with FIL's *Environmental Management Plan* (FIL, 2003).

Fish, Shellfish, and Benthos

Each of the action alternatives would require in-water construction associated with the removal of existing wood piles, replacement of the existing mooring system, and the reconfiguration of over-water structures. Proposed in-water work would result in disturbances to the bottom substrates in the immediate vicinity of both the existing mooring system components during removal and the new mooring system components during installation. The wood piles would be removed under all action alternatives. Sessile organisms that have colonized each of the existing piles would be lost by their removal.

All action alternatives would require similar mooring systems that would have a similar level of impact to fish and wildlife. Each action alternative would involve the installation of spud piles in the nearshore areas and anchors in deeper marine areas at approximately the same locations. The dragging of mooring lines in response to the tides and currents could disturb the bottom directly adjacent to the lines. The dragging of mooring lines would be reduced by the use of clump weights. The bottom sediments would be disturbed by the clump weights if they were to contact the bottom; however, the clump weights would result in the vertical movement of the lines, and would reduce the horizontal movement that would disturb a greater area of the sea floor. Overall, less bottom area would be disturbed with the new mooring system than with the existing system.

Densities of shellfish and other benthos could be temporarily reduced by the construction necessary to install the piles, anchors, and other mooring system components. It is likely that, over time, shellfish and other benthic organisms would re-colonize temporarily disturbed areas following construction.

Fish-life may avoid the work areas during in-water construction as a result of localized increases in turbidity or other disturbances. The severity of the effect of turbidity depends largely on the size, shape, and composition of the suspended solids and the duration of fish exposure. Lethal effects from turbidity are rare and are unlikely in marine environments (Nightingale and

Simenstad, 2001). Chronic effects of turbidity are more commonly observed in natural environments. Healy (1991) and Beauchamp et al. (1983) observed salmonid avoidance when levels of suspended solids exceeded background levels.

Construction would require the use of heavy machinery located on barges or operated from the existing access pier or upland areas on-site. Replacement or repair of in-water facilities could involve welding, concrete drilling, and painting. Although not likely, accidents such as spills of hazardous materials (typically paint, fuel, and hydraulic fluid) or unanticipated additional construction impacts could occur which could be toxic to fish.

A Hydraulic Project Approval (HPA) from the Washington Department of Fish and Wildlife (WDFW) would be required for the Proposed Action. The HPA would identify specific seasonal restrictions for in-water construction. In-water work is generally prohibited in Carr Inlet (part of Tidal Reference Area 3) between mid-March and mid-June to protect juvenile salmon and October and mid-April to protect forage fish such as Pacific herring and surf smelt (WAC 220-110-271).

This "in-water work window" is a specification included in all HPAs and is intended to reduce the level of harm to fish that may result from turbidity or other disturbance during sensitive periods of their life cycle such as during spawning and migration to and from spawning grounds. Avoiding construction during periods of peak habitat use would minimize the short-term impacts resulting from turbidity or noise disturbance. Avoiding work between mid-October and mid-June would reduce potential impacts to juvenile salmon and forage fish such as surf smelt and Pacific herring.

Fisheries

None of the action alternatives would change how the beach may be used related to fishing or shellfishing once construction is complete. The public would be excluded from recreational fishing or shellfishing from the beach, nearshore, and marine areas during on-going construction activities. Since fishing and shellfishing occurs only occasionally at FIL and since work would be limited to a maximum of three months, these temporary exclusions would not adversely affect recreational fish or shellfish harvest in the vicinity of the Proposed Action.

Any alteration in the abundance or density of eelgrass, as well as regular disturbances of nearshore areas may change the abundance and diversity of fish and shellfish occurring in nearshore areas adjacent to FIL. Over 19 species of fish and shellfish have been identified as dependent on eelgrass habitats during all or part of their life cycle. Impacts that reduce the abundance and density of eelgrass or result in regular disturbance of nearshore areas would similarly reduce habitat opportunities for dependent fish and shellfish. Of the many species of fish and shellfish that occur in association with eelgrass beds and other nearshore areas, many are commercially important. These include Pacific salmon, Pacific cod, lingcod, Dungeness crab, English sole, pollock, surf smelt, and Pacific herring (Nightingale and Simenstad, 2001).

The existing configuration of in-water facilities at FIL covers either the same or more nearshore areas as any action alternative. Although the 240-Foot Pontoon, the 360-Foot Pontoon, and the

Fixed Pier alternatives have larger overall footprints, they each represent less coverage in nearshore areas that support eelgrass (i.e. areas less than 20 feet [6 meters] in depth). FIL fronts a small area of the southwestern shoreline of Fox Island. The 150 feet (48 m) of beach frontage at FIL represents less than 0.5 percent of the approximately 5 miles (8 km) of shoreline along Carr Inlet. As a result of these factors, no significant impacts to commercially utilized fish and shellfish stocks are expected under any of the action alternatives.

Marine Mammals

The Marine Mammal Protection Act (MMPA) prohibits the "taking" of any marine mammal. In this context, taking means to harass, hunt, capture, collect, or kill a marine mammal. Amendments to the MMPA in 1994 further refine the description of harassment by describing two potential levels of harassment. Under this definition, Level A harassment includes the potential to injure a marine mammal in the wild, while Level B harassment includes the potential to disrupt marine mammal behavior patterns. Pile driving underwater sound pressure levels may be in the range of 195 dB//µPa, but they are typically low in frequency (less than 150 Hertz (Hz)) (Richardson, 1995). This is below the hearing threshold of pinnipeds, including Steller sea lions, whose optimal hearing is above 1,000 Hz (Richardson, 1995). During construction activities, construction noise and other activities may cause marine mammals to avoid the vicinity of FIL. Due to the small proportion of marine habitat in Carr Inlet potentially affected by construction at FIL, and the availability of extensive additional foraging habitats for marine mammals, the effects upon the normal behavior patterns of these species is likely negligible. This avoidance is anticipated to be a minor and temporary change in behavior, with no adverse affect to behavior patterns. However, due to the infrequent presence of marine mammals in the vicinity of FIL, impacts associated with construction are unlikely to occur.

Noise and vibrations generated by pile driving and the use of generators and power machinery during construction are also likely to cause whales and porpoises to avoid the vicinity of FIL. Turbidity associated with mooring removal and replacement is likely to be both temporary and localized, resulting in little effect to either marine mammals or their forage species. Therefore, the proposed action would not result in a "take" of marine mammals.

Marine and Shorebirds

The Migratory Bird Treaty Act (MBTA) protects all native migratory bird species and makes it illegal to "pursue, hunt, take capture, kill, attempt to take, capture or kill …migratory birds, eggs or nests." Human activity and noise are likely to cause marine birds to avoid the FIL site during construction activity. Marine bird species would temporarily avoid the area during construction hours, and return to the site during non-work hours. Forage fish species may also keep away from the area during construction activities that result in turbidity. Shorebirds may continue to use the beach adjacent to FIL during portions of the construction, but are likely to vacate the area during pile-driving or installation of large structures. Shorebirds would avoid the area during wood debris removal (one to two weeks). Removal of wood debris would disturb any killdeer nesting that might be occurring. Killdeer nesting in the Puget Sound region commonly occurs between mid-March and mid-July (Hunn, 1985). The in-water work window for the Proposed Action is anticipated to limit work to between mid-June and October. Work may be further limited to mid-July to October if killdeer are nesting at FIL.

Threatened and Endangered Species

The Biological Assessment (BA) that accompanies this EIS concludes that no adverse effects to listed or proposed species regulated under the ESA are anticipated under the Preferred Alternative (Appendix C). The BA will be submitted to USFWS and NOAA Fisheries for review and concurrence in compliance with Section 7 of the Endangered Species Act, because of the discrimination of "may affect not likely to adversely affect" for some of the listed species.

The evaluation concludes that the Preferred Alternative would have "no effect" on the following listed species:

- Humpback Whale
- Leatherback Sea Turtle

The rationale for this effect determination for these species is based on lack of habitat use by these species in the vicinity of the Preferred Alternative and/or that potential impacts as a result of noise, habitat disruption, or direct harm to these species is unlikely to occur.

The evaluation found that the Preferred Alternative "may affect, but is not likely to adversely affect" the following listed species:

- Chinook Salmon
- Bull Trout
- Bald Eagle
- Marbled Murrelet
- Steller Sea Lion

The rationale for the "may affect" determination for these species is based on the fact that these species are known or anticipated to use habitats in the vicinity of the Preferred Alternative during some phase of their life history. These habitats may be disturbed by noise during construction or in-water work. The rationale for a "not likely to adversely affect" determination for each species is based on the fact that the potential to harm these species is minimal as a result of the timing of the Preferred Alternative, the small area of habitat effected, and anticipated level of use by these species at the FIL site. For example, Stellar sea lion are uncommon visitors to Puget Sound, and Carr Inlet is a small inlet in the southern portion of Puget Sound. Therefore, the effects of construction upon Steller sea lions would likely be negligible. Marbled Murrelet may forage in the waters of Carr Inlet, but likewise, due to very low number of individuals of the species in Puget Sound, and high availability of foraging habitat, use of the FIL project area is likely to be negligible.

The type and level of potential impacts to chinook salmon and bull trout would be similar to that discussed above for other fish, and would be related primarily to disturbance and increased turbidity during construction and the level of impact to eelgrass beds and other nearshore habitats.

Impacts to bald eagle would be of a similar type as described previously for marine and shorebirds and would be related to construction noise and indirect effects to its prey base. In addition, FIL is located within the range of the recommended construction buffer zone (600 to 800 feet [180 to 240 meters]) from a bald eagle nest. As recommended in Recovery Plan for the Pacific Bald Eagle (USFWS 1986), construction activities would be timed to avoid bald eagle nesting activity. Prior to scheduling construction, Navy biologists would determine from USFWS and WDFW if the nest territory adjoining the FIL site is in active use. If the nest is active, the nest would be monitored and noise intensive activities such as piling removal or pile driving would not occur until the young eagles have fledged, which usually occurs in mid- to late-July. The action alternatives would create noise and activity which may disturb bald eagles and their prey species, but is unlikely to result in a substantive change in their habitat, nesting, or foraging success (Adolfson, 2002). Potential impacts to the prey base of bald eagles are addressed related to potential impacts on marine birds, shorebirds, and fish.

Essential Fish Habitat

Potential effects to EFH would be similar to the effects on the habitat of ESA listed fish and other fish stocks found in nearshore and marine areas adjacent to FIL. The type and level of potential impacts from the action alternatives to EFH would be related to disturbance and turbidity during construction and limited affects to eelgrass beds and other nearshore habitats. The action alternatives would result in in-water and over-water construction that may temporarily affect turbidity and water quality in localized areas that are designated EFH.

The action alternatives would not result in the loss or permanent alteration of EFH. The rationale for this determination is based on the fact that the potential to harm EFH is minimal as a result the small area of habitat effected, the limited duration of construction, anticipated level of use by MSA regulated species at the FIL site, and the implementation of measures developed to conserve ESA listed fish and wildlife. Conservation measures to avoid and minimize impacts to ESA listed species (Appendix C) would also protect other fish stocks, including groundfish, coastal pelagic species, and Pacific salmon regulated by the MSA, but not listed as threatened or endangered. The Navy has concluded that the proposed action would have "no adverse affect" on designated EFH, therefore consultation with NOAA Fisheries is not required.

3.2.2.2 240-Foot Pontoon

Site Analysis

Construction of the 240-Foot Pontoon Alternative would not result in additional impacts to existing upland vegetation. Impacts associated with the removal of wood debris would be the same as described under impacts common to all action alternatives.

The 240-Foot Pontoon Alternative would result in approximately 35,200 square feet (3,270 square meters) of total over-water coverage, an approximately 93 percent increase over existing conditions (see Table 3-3). Over water coverage at depths 20 feet (6 m) or less, depths where shading may affect eelgrass, would decrease from existing conditions to 3,200 square feet (300 square meters), or approximately 27 percent. This reduction in shading at these depths would tend to benefit eelgrass growth and propagation.

Table 3-3. Shading of Intertidal / Subtidal Areas by Alternative

Area (ft^2/m^2)	240' Pontoon	360' Pontoon	Fixed Pier	No Action
Total Overwater Footprint	35,200 ft^2 (3,270 m^2)	37,400 ft^2 (3,470 m^2)	26,600 ft^2 (2,471 m^2)	18,250 ft^2 (1,695 m^2)
Percent Change From No Action	+92.9%	+104.9%	+45.8%	0.0%
Footprint Under 50' (15 m) in Depth	7,200 ft^2 (670 m^2)	21,000 ft^2 (1,960 m^2)	3,200 ft^2 (300 m^2)	12,000 ft^2 (1,120 m^2)
Percent Change From No Action	-40%	+75%	-73.3%	0.0%
Footprint Under 20' (6 m) in Depth	3,200 ft^2 (300 m^2)	3,000 ft^2 (280 m^2)	1,500 ft^2 (140 m^2)	4,400 ft^2 (410 m^2)
Percent Change from No Action	-27.3%	-31.8%	-65.9%	0.0%

The 240-Foot Pontoon Alternative would allow small boats and skiffs to be safely moored in deeper water. This alternative would then avoid the occasional grounding and disturbance of lower intertidal and shallow subtidal vegetation that now occurs. Avoidance of this impact would provide a modest beneficial impact on nearshore vegetation.

Fish, Shellfish, and Benthos

Under the 240-Foot Pontoon Alternative, impacts would be similar to those described above under Impacts Common to All Action Alternatives. Shading of intertidal and shallow subtidal areas would be reduced as facilities are moved further from shore. Similarly, disturbances of bottom sediments by small vessels and skiffs grounding at low tide would likely be eliminated as these could be moored in water of greater depth than at present. This would result in a slight positive benefit on lower intertidal and shallow subtidal organisms. It would tend to encourage growth and propagation of eelgrass in the vicinity of the access pier. The new mooring system would be designed to minimize impacts on the bottom caused by dragging of anchors and mooring cables through tidal changes and vessel movements.

Marine Mammals

Although the pontoon would be located 110 feet further offshore than the existing facility, use of this area by marine mammals is currently uncommon, as discussed in Section 3.2.2.1, and would likely continue to be uncommon. With the exception of the longer construction period (approximately two months), there are no additional impacts to marine mammals expected as a result of construction of the 240-foot pontoon.

Marine and Shorebirds

There are no additional impacts to marine and shorebirds expected as a result of this alternative.

Threatened and Endangered Species

There are no additional types of impacts to threatened and endangered species as a result of replacement or repair of the moorings that are not discussed as an impact common to all action

alternatives. The type and level of potential impacts to chinook salmon and bull trout would be similar to that discussed above for other fish. Impacts to bald eagle would be of a similar type and level as described above for marine and shorebirds and would be related primarily to construction noise during the nesting period. The 240-Foot Pontoon Alternative would result in the second highest level of coverage of shallow nearshore areas. The potential to adversely affect nearshore areas as a result of boat operations and grounding during low tide would be reduced since these facilities would be located further offshore.

3.2.2.3 360-Foot Pontoon

Site Analysis

Construction of the 360-Foot Pontoon Alternative would not result in additional impacts to existing upland vegetation. Impacts associated with the removal of wood debris would be the same as described under all action alternatives.

As shown in Table 3-3, the 360-Foot Pontoon Alternative would result in approximately 37,400 square feet (3,470 square meters) of total over-water coverage, an approximately 105 percent increase above existing conditions. Over water coverage at depths 20 feet (6 m) or less, depths where shading may affect eelgrass, would decrease from existing conditions to 3,000 square feet (280 square meters), or approximately 32 percent. This reduction in shading at these depths would tend to benefit eelgrass growth and propagation.

As with the 240-Foot Pontoon Alternative, this alternative would allow small boats and skiffs to be safely moored in deeper water. The 360-Foot Pontoon Alternative would avoid the occasional grounding and disturbance of lower intertidal and shallow subtidal vegetation that now occurs. Avoidance of this impact would provide a modest beneficial impact on nearshore vegetation.

Fish, Shellfish, and Benthos

Under the 360-Foot Pontoon Alternative, impacts would be similar to those described above under Impacts Common to All Action Alternatives. Shading of intertidal and shallow subtidal areas would be reduced as facilities are moved further from shore. The 360-Foot Pontoon Alternative would result in the highest level of total over-water coverage, but it would reduce the amount of coverage (shading) over shallow subtidal areas. Under this alternative, impacts to nearshore areas as a result of boat operations and grounding during low tide would be eliminated as the facilities would be located further offshore. These factors would result in a slight positive benefit on lower intertidal and shallow subtidal organisms. It would tend to encourage growth and propagation of eelgrass in the vicinity of the access pier.

Marine Mammals

There are no additional impacts to marine mammals expected as a result of construction of this alternative . Although the pontoon would be located 55 feet further offshore than the existing facility, use of this area by marine mammals is currently uncommon, and would likely continue to be uncommon as was described under the 240-Foot Pontoon alternative above.

Marine and Shorebirds

There are no additional impacts to marine and shorebirds expected as a result of this alternative.

Threatened and Endangered Species

There are no additional types of impacts to threatened and endangered species as a result of construction or repair of the moorings that are not discussed as an impact common to all action alternatives. The type and level of potential impacts to chinook salmon and bull trout would be similar to that discussed above for other fish. Impacts to bald eagle would be of a similar type and level as described above for marine and shorebirds and would be related primarily to construction noise during the nesting period. The 360-Foot Pontoon Alternative would result in the second highest level of coverage of shallow nearshore areas. The potential to adversely affect nearshore areas as a result of boat operations and grounding during low tide would be reduced since these facilities would be located further offshore. The 360-Foot Pontoon Alternative would have less potential to impact chinook salmon and bull trout than other action alternatives. This action alternative would require one to three months to complete.

3.2.2.4 Fixed Pier

Site Analysis

Construction of the 325-foot (99 meter) Fixed Pier Alternative would not result in additional impacts to existing upland vegetation. Impacts associated with the removal of wood debris would be the same as described under all action alternatives.

The Fixed Pier Alternative would result in approximately 26,600 square feet (2,670 square meters) of total over-water coverage, an approximately 46 percent increase over current conditions (see Table 3-3). Over water coverage at depths 20 feet (6 m) or less, depths where shading may affect eelgrass, would decrease from existing conditions to 1,500 square feet (140 square meters), or approximately 66 percent. This reduction in shading at these depths would tend to benefit eelgrass growth and propagation.

As with the 240-Foot Pontoon Alternative, this alternative would allow small boats and skiffs to be safely moored in deeper water. This alternative would avoid the occasional grounding and disturbance of lower intertidal and shallow subtidal vegetation that now occurs. Avoidance of this impact would provide a modest beneficial impact on nearshore vegetation.

Fish, Shellfish, and Benthos

The Fixed Pier Alternative would result in the second lowest level of total over-water coverage and the lowest level of coverage over shallow nearshore areas (see Table 3-3.) The Fixed Pier Alternative would result in the barges and other in-water facilities being located as far or farther offshore than other alternatives. These factors would result in positive impacts on fish, shellfish, and benthos in the lower intertidal and shallow subtidal area. This positive impact would be countered in part by the installation of pilings necessary to support the fixed pier. Although design is not complete and the number of pilings required is not known, installation of the pilings would result in the loss of small amount of bottom habitat at depths of between –50 and –70 feet (-15 to –23 m) MLLW.

Marine Mammals

Under this alternative, construction would last between one and three months. It would include more pile driving compared to the other action alternatives. The noise and vibration generated by these activities would likely cause any marine mammals to avoid the construction area for a greater proportion of the construction period, corresponding to the length of time when piles are being driven. Although the pier would be located 110 feet (33.5 meters) further offshore than the existing facility, use of this area by marine mammals is currently uncommon, and would likely continue to be so.

Marine and Shorebirds

There are no additional impacts to marine and shorebirds expected as a result of this alternative, with the exception of a greater amount of piledriving. As stated above, birds are likely to avoid the vicinity of FIL during construction activity. No impacts to birds are expected as a result of construction operations of this alternative.

Threatened and Endangered Species

There are no additional types of impacts to threatened and endangered species as a result of construction or repair of the moorings that are not discussed as an impact common to all action alternatives. The type and level of potential impacts to chinook salmon and bull trout would be similar to that discussed above for other fish. Impacts to bald eagle would be of a similar type and level as described above for marine and shorebirds and would be related primarily to construction noise during the nesting period. The Fixed Pier Alternative would result in the highest level permanent modification to shallow nearshore areas from the piles needed to support the structure. The Fixed Pier Alternative would have more potential to impact chinook salmon and bull trout than the two pontoon alternatives. Although the Fixed Pier Alternative would disturb more of the shallow nearshore areas during construction, the area of shallow nearshore areas altered by this alternative would be less than that the area of nearshore habitat modified by boat grounding and operation inboard of the 912 Barge under the No Action Alternative. The Fixed Pier Alternative would involve the placement of many more pilings than the other action alternatives, therefore there this action alternative would have the highest potential to adversely affect bald eagles as a result of construction disturbance.

3.2.2.5 No Action

Site Analysis

Under the No Action Alternative, there would be no changes to the upland areas of the site and there would be no impacts to vegetation in upland or backshore locations.

Under the No Action Alternative, the current configuration of barges and vessels would be maintained. Small boats and skiffs would continue to be moored on the shoreward side of the 912 Barge, where they occasionally ground at low tide. This occasional grounding would continue to create chronic, low-level disturbance to lower intertidal and shallow subtidal vegetation.

Although not an impact of significance, nearshore areas would also continue to be affected by PAH leaching from the wood piles used to moor in-water facilities. Most of the leaching of PAH has already occurred due to the age of the wood piles (greater than 20 years old).

Fish, Shellfish, and Benthos

Under the No Action Alternative, there would not be any change to the configuration of the mooring system or in-water facilities. There would be no impacts to fish or shellfish resources beyond those that may occur with existing facilities.

Fisheries

The FIL property extends to the "the extreme low tide line" that includes much of the exposed beach available for recreational shellfish harvest. There is no public access to the beach at FIL and the beach is not managed to provide recreational fishing or shellfishing opportunities. Recreational fishing and shellfishing are not specifically prohibited and the beach is used sporadically for these uses (Bass, personal communication, 2002). More productive and accessible fishing and shellfishing areas occur along Hale Passage and at Point Nearns. There would be no impact to recreational, commercial, or tribal fisheries as a result of the No Action Alternative. Current uses of the beach and nearshore areas would remain unchanged.

Marine Mammals

Use of the marine and nearshore environment in the FIL vicinity would remain unchanged under the No Action Alternative.

Marine and Shorebirds

Use of the marine, nearshore, intertidal, and backshore environment in the FIL vicinity would remain unchanged under the No Action Alternative.

Threatened and Endangered Species

Use of the habitats occupied or potentially occupied by threatened or endangered species in the vicinity of FIL would remain unchanged under the No Action Alternative.

3.2.3 Mitigation Measures

No mitigation measures are necessary for vegetation, fish, selfish and benthos, marine mammals, marine and shore birds, threatened and endangered species and essential fish habitat.

3.3 Socioeconomic Resources

3.3.1 Land and Shoreline Use

3.3.1.1 Affected Environment

Regulatory Environment

Coastal Zone Management Act

The Coastal Zone Management Act (Title 16 U.S.C. Chapter 33) was passed by Congress in 1972 to encourage the appropriate development and protection of the nation's coastal and shoreline resources. The Coastal Zone Management Act gives states the primary role in managing shoreline areas. Washington State developed its Coastal Zone Management Program in 1976. The Washington State Department of Ecology's Shorelands and Environmental Assistance Program is responsible for implementing Washington's program (Ecology, 2000). Washington's Coastal Program applies to 15 counties with marine shorelines, including Pierce County.

Under the Washington Coastal Zone Management Program, activities that affect any land use, water use, or natural resource of the coastal zone must comply to the "maximum extent practicable" with the "enforceable policies" established by six laws:

- Shoreline Management Act (including local government shoreline master programs);
- State Environmental Policy Act (SEPA);
- Clean Water Act;
- Clean Air Act;
- Energy Facility Site Evaluation Council (EFSEC); and
- Ocean Resource Management Act (ORMA).

Activities undertaken by a federal agency, activities that require federal approval, or activities that use federal funding must demonstrate compliance with these laws and policies through the development of a "federal consistency determination." The determination describes the activity, potential impacts to coastal resources, and consistency with the six laws. The Washington State Department of Ecology has up to 60 days to concur with, or object to, in writing, with the determination (Ecology, 2000). Guidance published by Ecology lists federal activities, licenses, and permits subject to federal consistency review, including:

- Planning, construction, modification, or removal of public works, facilities, or other structures;
- Operation or conduct of new or existing uses when such operation would result in physical changes in the coastal zone such as air and water pollution, covering of water surface, removal of vegetation or new construction (Ecology, 2001);
- Federal activities occurring on federal property with no effects outside of the federal land are not subject to Coastal Zone Management Act consistency requirements;
- The Proposed Action involves alternatives that would affect non-Federal lands, as the existing and proposed in-water structures extend beyond the land owned by the U.S. Navy (see Land Ownership below). Additionally, in-water work to stabilize facilities has the potential to affect coastal resources as defined by the Washington Coastal Zone Management Program and associated Ecology guidance. Accordingly, the Navy would prepare a Coastal Consistency Determination documenting the Proposed Action's consistency with the relevant provisions of the Washington Coastal Management Program, following review of comments on the DEIS. The determination would be submitted to the Washington Department of Ecology. Within 60 days, Ecology would issue a letter of concurrence or offer objections to the Coastal Consistency Determination.

Washington Shoreline Management Act

The Washington Shoreline Management Act of 1971 (RCW 90.58) establishes a broad policy giving preference to uses that support the goal "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." (Ecology, 1999). Cities and counties have the primary responsibility for implementing the Shoreline Management Act (SMA), but the state, through Ecology, has authority to review local programs and permit decisions. Under the SMA, each city and county adopts a shoreline master program, based on state guidelines but tailored to their specific jurisdiction. Local shoreline master programs incorporate both planning and regulations for the shoreline environment.

Pierce County Shoreline Master Program

Title 20 of the Pierce County Code, Shoreline Management Use Regulations, codifies the Pierce County Shoreline Master Program (adopted March 4, 1974) and establishes shoreline environment designations and development regulations and procedures. Fox Island has three shoreline environment designations, as established by this code (PCC, §20.18.180). Generally, the northeast side of the island is designated Rural-Residential. The northwest tip and the

southwest side of Fox Island are designated Conservancy, with the exception of the Nearns Point spit, which is designated Natural.

The Shoreline Environment designation at FIL is Conservancy. Chapter 20.14 of the Pierce County Code provides the definition and purpose of the Conservancy designation:

> The Conservancy Environment is designed to protect, conserve, and manage existing natural resources and valuable historic and cultural areas in order to ensure a continuous flow of recreational benefits to the public to achieve sustained resource utilization. This environment should also include areas of steep slopes which present potential erosion and slide hazards, areas prone to flooding, and areas which cannot adequately deal with sewage disposal.

Chapter 20.14 of the Pierce County Code also establishes general regulations, policies, and preferred uses within the Conservancy Environment. General regulations and policies include:

- Areas should maintain their existing character;
- Developments which do not consume the natural physical resource base should be encouraged; and
- Substantial and non-substantial developments which do not lead to significant alterations of the existing natural character of an area should be encouraged. (PCC 20.14.020)
- Preferred uses within areas designated as conservancy environment include:
- Outdoor recreation activities;
- Commercial timber harvesting; and
- Passive agricultural uses (pasture and range lands). (PCC 20.14.030)

Fox Island Laboratory and associated facilities were built prior to adoption of the Coastal Zone Management Act, Shoreline Management Act (1971) and Pierce County Shoreline Master Program. Section 20.04.410 of the Pierce County Shoreline Management Use Regulations defines "nonconforming use" as "a lawful use of land or structure in existence on the effective date of this Master Program or at the time of any amendments thereto which does not conform to the use regulations of the environment in which it is located". Under Pierce County's Shoreline Management Regulations, modification or expansion of a nonconforming use in the shoreline environment would require either a Substantial Development Permit and/or an Expansion of Nonconforming Use Permit. The Navy would submit a description of the Preferred Alternative along with the copy of the Coastal Consistency Determination to Pierce County. The County would determine if a Substantial Development Permit and/or Expansion of Non-Conforming Use permit would be required for the Preferred Alternative.

Land Ownership

Upland and intertidal portions of FIL are located on property owned by the United States Navy. The property is approximately 150 feet x 380 feet, about 1.3 acres(0.5 hectares) and extends to "the extreme low tide line" according to Pierce County Assessor's legal description. The

portions of the in-water structures at FIL extending beyond the extreme low tide line are located on submerged aquatic lands, owned by the State of Washington and managed by the Washington State Department of Natural Resources (WDNR). Use of the submerged lands for in-water facilities at FIL is authorized under a 1953 permit issued to the United States by WDNR. The permit authorizes the United States to use and occupy parcels of submerged land on Carr Inlet "...for an indeterminate period of time as long as the parcels are used for the purpose for which this permit is granted".

Properties northwest and southeast of FIL are privately owned and developed with single-family residential homes. These properties front 3rd Avenue and ownership extends to the mean high tide line, according to the Pierce County Assessor's legal descriptions.

Land Use, Zoning, Comprehensive Plan Designations

Land and Shoreline Use

The facility consists of a pier, several barges, mooring components, and associated upland structures. Fox Island Laboratory was originally developed in the 1950s as the Carr Inlet Acoustic Range (CIAR) for research studies and special noise trials serving both diesel and nuclear submarines. As such, 33 CFR §334.1250 establishes Carr Inlet as a "naval restricted area," defined as:

> ...the waters of Carr Inlet bounded on the southeast by a line running from Gibson Point on Fox Island to Hyde Point on McNeil Island, on the northwest by a line running from Green Point to Penrose Point; plus that portion of Pitt Passage extending from Carr Inlet to Pitt Island, and that portion of Hale Passage extending from Carr Inlet southeasterly to a line drawn perpendicular to the channel 500 yards northwesterly of the Fox Island Bridge. (Figure 1)

Originally, the naval restricted area was open to navigation except when the acoustic range was in use or the hydrophone buoys were being calibrated. Five beacon lights on signal towers located at Gibson Point, Green Point, Penrose Point, Pitt Island, and Hyde Point were used to signal acoustic range activity and restrict passage. In 1992, acoustic range activities were moved to Southeast Alaska Acoustic Measurement Facility (SEAFAC). Subsequently, the hydrophone buoys were removed and the five beacon lights have been removed or are no longer operated. Although the primary mission and activities at FIL have changed, the designation of Carr Inlet as a naval restricted area is still in effect. When special operations or activities at FIL are scheduled that require the restriction to be enforced, the Navy informs the U.S. Coast Guard and applicable information is published in the *Local Notice to Mariners*.

Surrounding properties are developed as single-family residential homes used as primary and/or vacation residences. Some residential properties include private boat ramps and bulkheads. Current shoreline uses includes boating and recreation by both residents and the public (see the Recreation Section of this chapter for further discussion).

Zoning

Fox Island Laboratory property and surrounding parcels are zoned by Pierce County as "Rural Residential, Rural 10." Development standards for density, setbacks, and height limitations in the Rural Residential Zones are established in Pierce County Code, Chapter 18.35.020. However, county zoning regulations and permitting procedures do not apply to federal facilities on federally-owned land.

Comprehensive Plan

The *Pierce County Comprehensive Plan* (Pierce County, 1994) is codified as Title 19A of the Pierce County Code. The land use plan designations are currently implemented by zoning classifications that mirror the plan designations in name and location. Fox Island Laboratory and surrounding properties are designated "Rural 10." Section 19A.40.020D of the *Comprehensive Plan* establishes density requirements in Rural Residential areas. The Rural 10 designation allows a density of one unit per 10 acres with minimum lot size of one acre for new lots.

The Pierce County Comprehensive Planning program also incorporates several community plans. Community plans indicate specific land use designations, appropriate densities, and design standards. Currently, five community plans are in the process of being developed in Pierce County. Fox Island is included in the *Gig Harbor Peninsula Community Plan* (Pierce County, 2002). Adopted on March 12, 2002, the *Community Plan* includes that portion of Pierce County located west of the Tacoma Narrows Bridge, north to Kitsap County, west to Burley Lagoon and the Purdy Bridge, as well as Fox Island. Consistent with the Pierce County Zoning Code and *Comprehensive Plan* designations, Fox Island is identified as a Rural 10 area in the *Gig Harbor Peninsula Community Plan* (Pierce County, 2002).

3.3.1.2 Environmental Consequences

Impacts Common to All Action Alternatives

No changes in use or intensity of operations at FIL are proposed under any of the action alternatives evaluated. Distinctions between each action alternative's impacts to water and land use are confined to differences in facility design, such as footprint area and distance from shore. Impacts associated with shoreline erosion are discussed in Section 3.1.1.2.

Table 3-4 compares each alternative, based on their respective components, footprint area (based on plan-view square footage), and maximum distance seaward from the base of the existing access pier. The last column of the table shows the approximate depth of Carr Inlet below the moon-pool opening of the M241 Barge. That is, the greater the distance from shore the greater the depth below the M241 Barge, which is the active work area where much of the in-water research and testing is conducted. As Table 3-4 shows, all action alternatives would increase the in-water facility footprint and the distance from the base of the existing access pier. The Fixed Pier Alternative would increase the footprint the least (8,124 sq. ft.) while the 360-Foot Pontoon Alternative would increase the footprint the most (19,015 sq. ft.). The 360-Foot Pontoon Alternative would increase the distance from the base of the access pier the least (380 ft.) while both the 240-Foot Pontoon and Fixed Pier Alternatives would increase this distance the most (435 ft.).

Table 3-4. Changes in Pier and Barge Characteristics by Action Alternative

Alternative	Dimensions of Facility Components[1]	Total Facility Footprint[2] (square feet - net increase or decrease from current configuration)	Distance from Base of Access Pier to Seaward Side of M241 Barge	Depth below center of M241 Barge (i.e., depth below moon pool)
240-Foot Concrete Pontoon	Pontoon: 2 sections: 240'x60' and 100'x60'; Barges 912, M241, and RCB	35,200 ft^2 (3,270 m^2) 92.9%	435' (133 m)	85' (26 m)
360-Foot Concrete Pontoon	Pontoon: 360'x60'; Barges 912, M241, and RCB	37,400 ft^2 (3,470 m^2) 104.9%	380' (116 m)	75' (23 m)
Fixed Pier	Extension of access pier: 160'x15'; Main Pier: 240'x40'; Barges 912, M241, and RCB	26,600 ft^2 (2,471 m^2) 45.8%	435' (133 m)	85' (26 m)
No Action	912 Barge: 112'x36'; M241 Barge: 195'x55'; 2 Fender Barges: each 30'x60'; RCB: 18'x60'	18,250 ft^2 (1,690 m^2) 0.0%	325' (99 m)	50' (15 m)

[1] Excludes existing access pier.
[2] All dimensions, depths and distances are approximate. Total facility footprint includes plan-view dimensions of all in-water components for each alternative, excluding the existing extent of the access pier.

Implementation of any of the action alternatives would comply with applicable regulations and permitting requirements for construction. These include requirements of the Pierce County Shoreline Management Program, the Washington Shoreline Management Act, and the federal Coastal Zone Management Act. The Navy believes that the Proposed Action would be consistent to the maximum extent practicable with the enforceable policies of the Washington Coastal Zone Management Program and would complete a Coastal Consistency Determination in accordance with the CZMA after consideration of comment on the DEIS.

No Action Alternative

The No Action Alternative would not result in land or shoreline use impacts.

3.3.1.3 Mitigation Measures

No mitigation measures are necessary.

3.3.2 Transportation

3.3.2.1 Affected Environment

Upland Transportation

The Fox Island Bridge provides motor vehicle access across Hale Passage between the island and the Gig Harbor Peninsula. The Fox Island Bridge Road becomes 3rd Avenue between Bella Bella Drive and Cove Road. This section of 3rd Avenue is classified as a secondary arterial. Fox Island Laboratory is located at the south end of 3rd Avenue (Figure 2). The section of 3rd Avenue from Cove Road south to FIL is unclassified. 3rd Avenue near FIL is an unstriped gravel and asphalt road, approximately 12 feet wide without a formal shoulder (see Figure 18).

Figure 18. 3rd Avenue – aspect north from FIL

Third Avenue is a county road maintained by the Pierce County Public Works and Utilities Department, Transportation Services Division. There are no major capital improvement projects for 3rd Avenue identified in the Pierce County 2001-2006 Transportation Improvement Program (Pierce County, 2000). However, Pierce County conducts periodic maintenance on small roads such as 3rd Avenue, primarily by chip seal resurfacing. There has been periodic landslide activity and road slumping along 3rd Avenue near FIL. In 1999, Pierce County Transportation Services Division installed a curtain drain above a portion of 3rd Avenue. Since that time, there have been no landslides or incidents of road slumping.

Existing traffic at FIL is generated by permanent staff, normal deliveries, and occasional project activity. During normal operations, six to ten full time staff travel to and from the facility daily. According to the *Institute of Transportation Engineers Trip Generation Manual*, average weekday vehicle trips per employee at a research and development center are 2.67, making daily weekday traffic generated at FIL approximately 16 trips per day (Institute of Transportation

Engineers, 1991). During periods of special operations or activities at FIL, up to 25 additional personnel may travel to the facility. Typically these personnel would carpool to the facility from temporary housing facilities in the Gig Harbor area. A surface parking area is located on the site along the driveway between the electric substation and the main office/laboratory building (see Figure 19.). This area typically handles all vehicles at FIL; there is no parking of FIL vehicles outside the site entrance.

Figure 19. Driveway and Parking Lot

Other traffic on 3rd Avenue near FIL is primarily generated by residents northwest of the facility. There are no commercial, office, or industrial property along 3rd Avenue from Cove Road south to Fox Island Laboratory.

Marine Transportation

Waterborne traffic in Carr Inlet associated with FIL generally consists of several small motorized vessels and skiffs used to move researchers and small equipment throughout the naval restricted area. Occasionally, larger barges are moved about the inlet by tug as part of research and testing operations. As described in section 2.1.3, there are several barges currently in use at FIL, ranging in size from a small Remote Crane Barge (RCB) to the larger research and testing barge (the M241 Barge). Commercial tugboats are occasionally used to haul barges to Tacoma for repairs or maintenance that cannot be conducted at the FIL facility.

Pierce County operates vehicular and passenger ferry service daily from the Steilacoom Ferry Terminal to Anderson Island and Ketron Island. The Washington State Department of

Corrections regularly operates vessels to transport supplies, prisoners, personnel, and visitors from Steilacoom to the McNeil Island Corrections Center.

Other waterborne traffic on Carr Inlet is primarily associated with recreational boating and fishing and occasional commercial fishing activity.

Waterborne traffic in the vicinity of FIL is subject to the provisions of 33 CFR § 334.1250 (2001), which establishes Carr Inlet as a "naval restricted area" (see Land and Shoreline Use section of this chapter). When special operations or activities at FIL are scheduled that require the restriction to be enforced, the Navy informs the U.S. Coast Guard and pertinent information on construction activities is published in the *Local Notice to Mariners*.

3.3.2.2 Environmental Consequences

Impacts Common to All Action Alternatives

Impacts to transportation associated with all of the action alternatives under consideration would be temporary in nature, confined to periods of construction.

Generally, impacts to transportation during construction are considered minimal. Impacts include transport of construction workers to and from the facility; transport of construction materials to the facility by barge and/or roadway; and transport of demolition materials by barge (i.e., removed pilings and dolphins) from the facility to disposal sites. Given the width and nature of 3rd Avenue (12 feet wide, no stripes, no paved shoulder), impacts to residential and other traffic along 3rd Avenue during construction could involve temporary blockages when large equipment or materials are transported to the facility by roadway. These impacts to transportation are considered minimal since the largest equipment and materials (pile drivers, pilings, etc.) would be transported by barge and the total duration of construction activity is anticipated to be no greater than three months. Additionally, potential traffic and safety hazards along 3rd Avenue would be minimal provided that standard construction traffic control measures are employed. All worker vehicles, construction equipment, and materials would be contained within the FIL property boundary. Construction-related traffic would occur primarily during daylight hours, usually between 7:30 a.m. and 4:30 p.m.

Short-term waterway traffic impacts are considered minimal as the Coast Guard and Pierce County would be notified prior to all construction-related waterborne traffic and activity. Additionally, information on construction activity would be published in the *Local Notice to Mariners* prior to construction.

Impacts to transportation between action alternatives include differences in number of workers, and methods of transporting equipment and materials required for each alternative. Table 3-5 below identifies these differences.

Table 3-5. Transportation Impacts by Action Alternative

Action Alternative	Construction Duration	Number of Construction Workers	Equipment and Material Transport Methods
240 ft. Pontoon (1)	One to three months	8-10	Large construction equipment and materials transported to/from site by barge. Some materials and equipment transported by land.
360 ft. Pontoon (1)	One to three months	8-10	Large construction equipment and materials transported to/from site by barge. Some materials and equipment transported by land.
Fixed Pier (1)	One to three months	10-12	Large construction equipment and materials transported to/from site by barge. Some materials and equipment transported by land. Onshore operations and staging area would be greater than with other alternatives.

Note: (1) Replacement of mooring systems would occur with any of the action alternatives.

Removal of exposed wood debris is expected to take two to four workers from one to two weeks. All mobilization would occur on the FIL site. Construction equipment are expected to be transported to the site by land and debris would likely be hauled from the site by truck.

3.3.2.3 Mitigation Measures

No mitigation measures are necessary.

3.3.3 Demographics and Employment

3.3.3.1 Affected Environment

Employment opportunities on Fox Island consist of the Fox Island grocery store, gas station, several service businesses (e.g. construction, landscaping, plumbing, etc.), and a few private businesses and activities at the Nichols Community Center and Fox Island Yacht Club. Most of the Fox Island work force is employed at off-island locations. Relative to the overall Pierce County workforce, the Fox Island workforce is concentrated in executive, administrative and professional sectors. Conversely, there are low percentages of skilled laborers and military personnel living on the island. Many Fox Island workers commute to Tacoma, an approximately 40 minute drive across the Tacoma Narrows Bridge.

The median household income for Fox Island residents in 2000 was $69,000, compared to $52,000 for Pierce County as a whole, and $45,000 for the State of Washington as a whole (U.S. Census Bureau, 2000).

FIL employs six to ten people on a full-time basis. During periods when testing and evaluation of equipment is being conducted, up to 25 additional scientists, engineers, and technicians may be working at FIL for periods ranging from a few days to several months.

3.3.3.2 Environmental Consequences

Impacts Common to All Action Alternatives

The impact of construction on employment is likely to be slight. As shown previously in Table 3-5, the number of construction workers is expected to range from eight to twelve for all action alternatives. An additional two to four workers would be needed to remove accumulated wood debris.

Construction workers would be needed for one to three months Of all the action alternatives, construction of the Fixed Pier Alternative would probably take the longest amount of time.

There would be no long-term change in employment at FIL.

No Action

Under the No Action Alternative, no construction activities would take place. There would not be any short- or long-term changes in employment at FIL.

3.3.3.3 Mitigation Measures

No mitigation measures are necessary.

3.3.4 Aesthetics

3.3.4.1 Effects Analysis

Views, noise and odors contribute to the overall aesthetic experience and are common components in an aesthetic analysis. Noise impacts are assessed in Section 3.1.4. Emphasis of this analysis is on views from public vantage points and impacts of the proposal on the existing visual environment from those vantage points. Because they have the potential to affect a greater number of people, public views are generally considered more valuable in an environmental analysis than private views. However, potential impacts to private views are also discussed in this section.

3.3.4.2 Affected Environment

Setting

Fox Island is a small island approximately 5 miles long (8 km) and 1 mile wide (1.6 km) located in southern Puget Sound. Two hills, rising from sea level to about 300 – 400 feet (91 – 122 m) are the major landforms. The hillsides are green year-round with the typical northwest mixed coniferous forest, dominated by Douglas fir, with red alder, bigleaf maple, and madrona providing deciduous color. The island is rural in character with its 2,800 residents living in

homes tucked into hillsides and woodlands. The southwestern side of the island is predominantly medium to low bank, interspersed with areas with no bank. The water is exceptionally clear, the beach largely unobstructed with in-water structures. The area is tranquil and serene, typical of a rural island setting in the Pacific Northwest. From this southwestern side of the island there are picturesque views of Mt. Rainier to the south and the Olympic Mountains to the west. Similar aesthetic qualities are also prevalent along the opposite shore across Carr Inlet.

The tranquil setting is one of the major reasons the Navy originally located this research facility at the island in 1953 for testing of submarines. To some degree, FIL has contributed to maintaining that tranquil character with the designation of the restricted navigation zone in Carr Inlet between Green Point and Gibson Point. The laboratory with its in-water facilities is the major man-made landmark on this side of the island's shoreline.

The upland facilities at FIL have an institutional scale and look. The main building is a large, concrete structure with metal clad finish, chain-link fencing, and various communication towers. The driveway with its slope to the shore is visible from the water but screened from adjacent properties by vegetation. See Figure 4.

Although FIL is a Navy facility, in-water facilities have an industrial scale and appearance, similar to facilities found in port areas. Several barges are moored to the access pier as are several small motorized vessels and skiffs. From a visual perspective, the largest features are the 912 Barge and the M241 Barge. Both barges have large superstructures on deck, constructed to enclose shops and work areas. The M241 Barge is the largest of the two and is normally moored on the seaward side of the complex. It is a large, metal-clad, rectangular structure. The two small fender barges, located between the two larger barges, are partially screened from shore by the 912 Barge. There is a small Remote Crane Barge (RCB) with a truss-like frame used to transfer equipment to and from the barges and/or pier. It moves about the pier and barge complex, as well as assisting in deployment and recovery of buoys, anchors, and other large field equipment. Small cranes, machinery, and other miscellaneous equipment are found in various locations about the pier and barge decks. Some diesel odors may be detected very near the facility during operations, but dissipate quickly with the offshore air movement. The facility is lit from dusk to dawn with a mixture of sodium vapor, metal halide, and incandescent light fixtures in a variety of wattage and configurations for safety and security. FIL is implementing a program to replace older fixtures with newer fixtures that reduce glare and spillover.

The existing mooring system is comprised of four wood-pile dolphins and their associated anchoring systems. The dolphins consist of clusters of between 7 and 21 wood piles. While the dolphins are unique to the waters along the western shoreline of Fox Island, they are in and of themselves fairly innocuous structures with a rustic appearance not incompatible with the rural character of the island. (See Figure 6)

Public Views

The only view of the lab and in-water facilities from a public right-of-way is from 3rd Avenue, the county access road shared by the property owner to the southeast of the laboratory (Figure 19). The lab, driveway, staff parking lot and in-water facilities and activities are visible

by the limited number of people using this access point, when gates are open. In late 2002, privacy screening was added to the chain link fencing to limit visibility.

Public views of FIL are most prominent from watercraft on Carr Inlet. Views from several vantage points near surrounding mainland landforms were investigated. On clear days, FIL can barely be detected from nearshore waters off these mainland landforms, with views becoming more prominent the closer the approach to the laboratory. Because it is lit from dawn to dusk, FIL can similarly be detected during nighttime hours. These approximate vantage points are identified on Figure 20 Key Map for Visual Analysis and pictured below in Figures 21 through 29 (Note: Photos taken with Kodak DC3400 camera with 38mm equivalent lenses at up to 2X zoom; objects may appear closer than they would normally appear).

Private Views

The in-water FIL facilities are a dominant visual feature from adjacent residences and beaches northwest and southeast of the laboratory. Except from immediately adjacent properties, the upland structures are likely not very visible from other residences due to screening by the mixed forested canopy buffer along the northwestern property line. Views of the in-water facilities from upslope private properties are possible depending on season and vegetative cover.

3.3.4.3 Environmental Consequences

240-Foot Pontoon

This alternative would result in short-term aesthetic impacts during construction. Equipment and activities associated with removal of existing mooring systems and installation of new mooring systems would temporarily increase the activity and change the visual character of in-water facilities at FIL. Construction activities would involve anchoring construction and material barges, removal of the wood pile dolphins, driving replacement steel and/or concrete piles, repositioning construction barges, and removal/replacement of fender piles on the access pier. Equipment could include: a barge with crane and diesel pile-driver; a material barge for replacement piles and temporary storage of removed wood piles, and a tug or work boat. Equipment on the barge could also include an electric generator. This equipment and activity may result in noise, lighting, odor, turbidity, and boat traffic typical of marine construction activity. As far as practical, elements of the new mooring system would be installed under the water surface. Installation of the new mooring system should then have a slight positive aesthetic impact.

On-shore, there would be the addition of upland equipment such as pickup trucks, concrete trucks and pumps, and generators. Storage and staging activity can be expected to also increase noise, odor, lighting and visual impacts. The duration of construction, including replacement of mooring systems, is expected to be one to three months. While construction activity is infrequent at FIL, these activities and equipment are not unlike those that occur with testing and evaluation projects conducted at FIL. Consequently, aesthetic impacts are not expected to be consequential, since they would be localized and of a short-term nature.

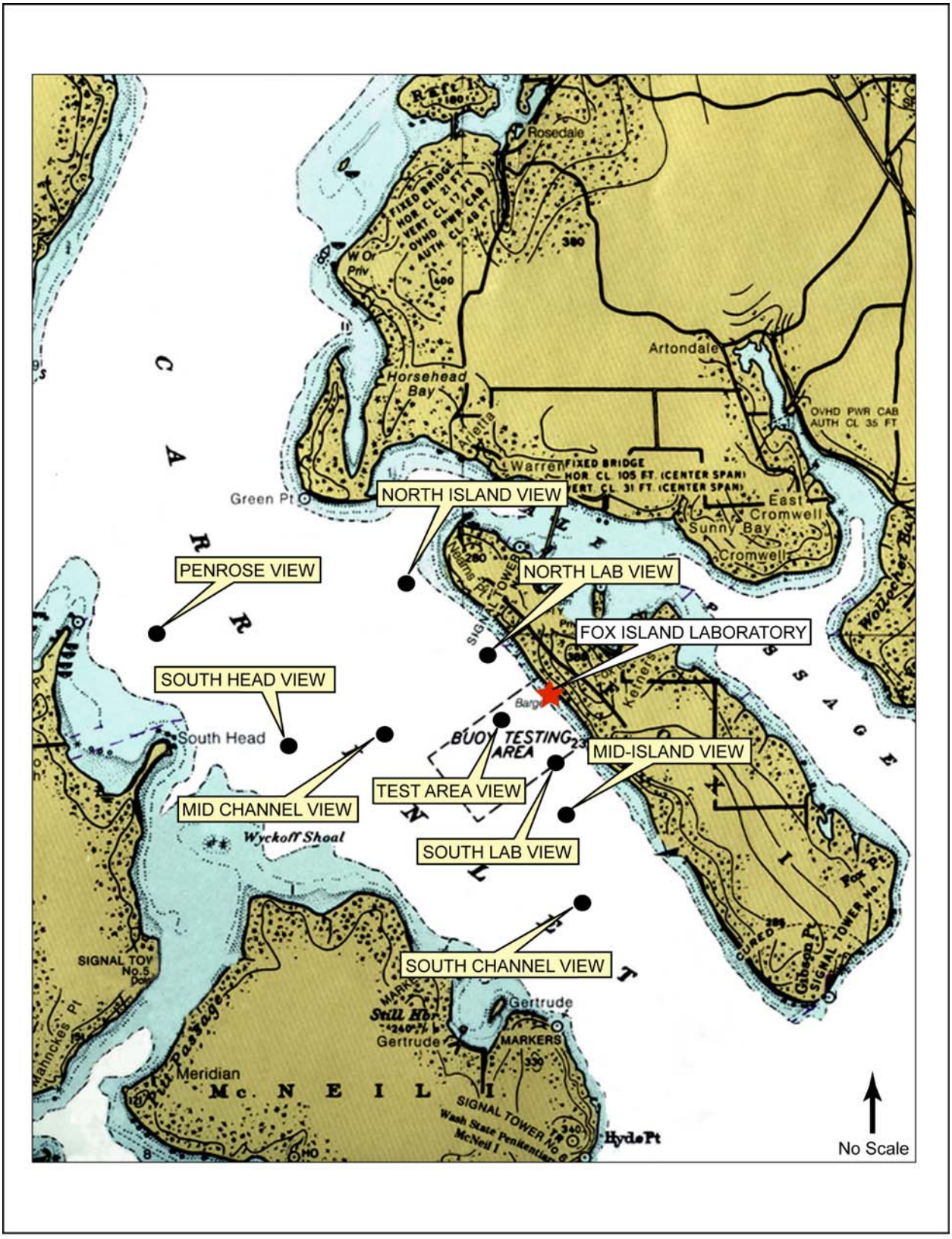


Figure 20. Key map for visual analysis. (Source: NOAA Coast Survey; Puget Sound, Southern Part.)

Figure 21. North Lab View

Figure 22. North Island View

Figure 23. Penrose View

Figure 24. South Head View

Figure 25. Mid Channel View

Figure 26. South Channel View

Figure 27. Mid Island View

Figure 28. South Lab View

Figure 29. Test Area View

A photograph of the concrete pontoon similar to the one that would be used for this alternative is shown in Figure 9, although approximately 30% shorter in length**.** A representation of the probable configuration of the 240-foot Pontoon Alternative is shown in Figure 10. The new pontoon would likely be installed between the 912 Barge and the M241 Barge. The new pontoon is approximately 45 feet (14 m) longer than the M241 Barge which is usually the most visible vessel as viewed from Carr Inlet. The combination of the 100-foot (30 m) connecting pontoon and the width of the 240-foot pontoon would increase the extent of the in-water facilities to 435 feet (133 m) from the base of the access pier.

The 240-foot Pontoon Alternative would increase the overall waterside image slightly over what is observed now. From offshore locations, the 240-foot pontoon would be partially screened by the M241 Barge. The new pontoon deck is approximately 6 feet (2 m) above the waterline, whereas the M241 Barge reaches 32 feet (10 m) in height. Overall, the maximum height of facilities would not change with this alternative.

Views of in-water facilities from private residences and views from watercraft in nearshore waters northwest and southeast of FIL would be altered by the increased horizontal dimensions of the facilities and associated lighting during nighttime hours. With the addition of the 240-foot pontoon and 100 foot (30 m) connecting pontoon, the seaward extent of the facility as measured from the bulkhead at the base of the access pier increases from 325 feet (99 m) to 435 feet (133 m), a 34 percent increase. This increase in scale would be moderated to some degree by locating the M241 Barge seaward approximately 110 feet (34 m) farther than its current location, increasing the distance from viewers on shore.

No changes in the types or intensity of activity conducted at FIL are anticipated.

The overall aesthetic impact of the 240-foot Pontoon Alternative is expected to be minor because of the low profile of the new pontoon; more unified configuration; and increased distance of the M241 Barge from shore. The increased width of the pontoon and connecting section, scale, and lighting of this alternative would be noticeable from nearby shoreline residents and boating public in nearshore waters northwest and southeast of FIL. Views of in-water facilities from offshore waters of Carr Inlet should not change appreciably. The lightening concerns raised by the adjacent residents during scoping would be addressed during the design phase.

360-Foot Pontoon

Construction impacts would be similar to those described above for the 240-Foot Pontoon Alternative.

A representation of the probable configuration of the 360-Foot Pontoon Alternative is shown in Figure 13. With the 360-foot pontoon in place, views from the middle of the navigation channel of Carr Inlet landward would be of a larger scale facility at FIL. The length of the new in-water facilities parallel to shore would be increased by an additional 165 feet (50 m). Views from nearby private residences northwest and southeast of FIL would similarly be affected by the increased length of facilities and associated nighttime lighting.

Views from more distant shoreline residences and beaches would be less affected than with the 240-Foot Pontoon Alternative because the new FIL facilities would not extend as far seaward. The 360-Foot Pontoon Alternative would extend approximately 380 feet (116 m) from shore, about 55 feet (17 m) less than with the 240-Foot Pontoon Alternative. Facilities would extend seaward about 55 feet (17 m) beyond existing facilities. As with the 240-Foot Pontoon Alternative, there would be no change in the height of pier and barge facilities.

The overall aesthetic impact would be moderate due to increased bulk, scale and lighting noticeable from watercraft in Carr Inlet and from nearby private residences and beaches to the northwest and southeast of FIL.

Fixed Pier

Construction-related aesthetic impacts for the Fixed Pier Alternative would be similar to those described above for the 240-Foot Pontoon Alternative. Construction is expected to last between one and three months.

Views of the new Fixed Pier Alternative from offshore locations in Carr Inlet would change only slightly from those that now exist. As shown in Figure 14, construction would entail doubling the length of the existing pier and construction of a new 240 x 55 foot (73 x 17 m) wharf. From offshore locations, depending on tide level, the Fixed Pier would be partially screened by the M241 Barge, which would be moored on the seaward side of the pier. The new fixed pier deck would be approximately 15 feet (5 m) above mean tide level, whereas the M241 Barge reaches 32 feet (10 m) in height above the water line. The 240-foot (73 m) wharf would extend about 45 feet (14 m) beyond the M241 Barge.

Views of in-water facilities from nearby private residences and beaches and from nearshore watercraft northwest and southeast of FIL would be affected by the increased profile of the Fixed Pier with the addition of the 141 foot (43 m) walkway and higher vertical profile of the wharf. From nearby private residences northwest and southeast of FIL, the height of the Fixed Pier above the water would range from 5 to 20 feet (2 to 6 m), depending o tidal condition.

As with other action alternatives, it is assumed there would be no change in the type or intensity of activity conducted at FIL.

Overall aesthetic impact would be moderate due to increased height, bulk, scale, and lighting noticeable from private residences and beaches to the northwest and southeast of FIL and from passing watercraft.

No Action

Since no construction would occur, no short-term or long-term changes to the aesthetic character of the FIL in-water facilities are expected.

3.3.4.4 Mitigation Measures

No mitigation required.

3.3.5 Cultural Resources

3.3.5.1 Affected Environment

In spring and summer 2002, a cultural resource assessment was conducted to satisfy the cultural resource requirements of various laws and regulations, including NEPA and Section 106 of the National Historic Preservation Act (NHPA), as amended. Section 106 requires agencies to:

> …take into account the effect of the undertaking on any district, site, building, structure, or object [historic properties] that is included in or eligible for inclusion in the National Register.

Research to identify historic properties included the definition of an Area of Potential Effects (APE); a records search for recorded cultural resources sites within the APE; examination of historical and archaeological literature pertinent to the APE; field examination of the APE; and completion of a report that included an assessment of the eligibility of the FIL facility for the National Register of Historic Places (NRHP). This assessment would be submitted to the Washington State Office of Archaeology and Historic Preservation (OAHP) for review and comments.

A record search was conducted at the State Office of Archaeology and Historic Preservation (OAHP) in Olympia, Washington. No previously identified cultural properties were located in, or within the vicinity of, the APE. Materials at the University of Washington libraries were examined. General Land Office (GLO) maps and corresponding tract book entries at the National Archives and Records Administration, Pacific Alaska Region, were reviewed for historic-period structures, trails, and features located within the study area.

No archaeological investigations were required to update the cultural resources reconnaissance undertaken by Lewarch et al. in 1997. On June 26, 2002, a historian visited the site to evaluate the facility for NRHP eligibility, toured the facility, and noted extant buildings and structures that date to the historic period (50 years old and older). Photographs and maps were used to record and analyze the information gathered during this survey.

Prehistory

The cultural sequence that has been derived for this region is usually divided into three developmental periods: Early Period (ca. 12,000 to 7,500 years B.P.), Middle Period (ca. 7,500 to 1,000 years B.P.), and Late Period (ca. 1,000 to 250 years B.P.).

Expected site types for the study area include shell middens and/or transitory campsites and resource harvesting sites. Such locations characteristically occur at headlands, particularly where shallow reefs or shoals extend seaward (Claxton and Elliot, 1994), and are unlikely in the study area.

Ethnography

At the time of Euro-American contact, the study area and its vicinity was occupied by three Southern Coast Salish Southern Lushootseed-speaking groups; the Puyallup, Nisqually, and Squaxin Island Indians.

All three Southern Coast Salish groups may have used Fox Island as a seasonal home, calling it "Bu Teu" or sea person. The island's numerous streams and protected coves made it an ideal resting place for traveling Indians. Fox Island, with its flourishing salmon and shellfish populations, provided an abundant food supply.

When the Indian War of 1854-1855 began, the government assigned the non-warring Indians to six temporary reservations throughout Puget Sound, including one on Fox Island. As the war progressed, members of the warring groups were also delivered to the island, which became something more akin to an internment camp than a reservation. With the end of the war, Indians detained at Fox Island were gradually allowed to go to their assigned reservations at Puyallup, Nisqually, and Squaxin Island. In March 1857, the Fox Island Reservation was discontinued and the remaining Indians sent to their respective reservations (Lewarch et al., 1997). Following the dissolution of the reservation, Indians continued to use the island as a place to camp and gather food (Miller, 1993).

Through the present day, Carr Inlet continues to be part of the "usual and accustomed fishing areas" for Native American tribes. These include the Nisqually Tribe, the Puyallup Tribe, and the Squaxin Island Tribe. For information on the fish and shellfish resources of Carr Inlet and fishing activity in the vicinity of FIL, refer to Section 3.2 Biological Resources.

Historical Overview

Fox Island received its present name in 1841. Lieutenant Charles Wilkes of the United States Exploring Expedition named the place Fox Island after the expedition's assistant surgeon, Lieutenant John L. Fox (Miller, 1993). During the period that the Fox Island Reservation existed, white settlers began establishing homes on the island. John Swan, who was the Indian subagent overseeing the reservation, built the first permanent non-native home on Fox Island in 1856. In 1869 and 1887 additional settlers came to the island. The population continued to slowly expand, and by 1910 it supported 66 families (Lewarch et al., 1997; Miller 1993).

The development of Fox Island followed a pattern typical of many early settlements in southwestern Washington. Initially, settlers logged the island's trees to clear land for small farms. Agriculture was another important economic activity on Fox Island. Farmers grew crops and raised livestock, which they supplemented with wild edibles such as clams and salmon. In addition to farming and logging, several small industries were established on Fox Island in the mid-nineteenth and early twentieth centuries. As early as 1853, John Swan and local Indians were packing salmon in barrels for export. From 1871 to 1873, the North Commercial Company operated a dogfish processing plant on the south shore of the island. Oysters were also raised commercially, beginning in the 1860s. Another early industry was the Fox Island Brick

Manufacturing Co. (later renamed the Fox Island Clay Works), which operated from 1884 to 1900.

Until 1954, Fox Islanders relied on boats of various types to maintain contact with one another and the mainland. In the early twentieth century, the steam-powered, wood-fired ferry, *Transit*, served the island until the *Fox Island* replaced her in the early 1920s (Miller, 1993). When the Fox Island Bridge was constructed in 1954, it eliminated the need for ferries (Lewarch et al., 1997).

3.3.5.2 Environmental Consequences

Impacts Common to All Action Alternatives

No cultural resources were identified during the 1997 survey of the study area (Lewarch et al., 1997). Sub-tidal resources were excluded from investigation by this evaluation and the 1997 survey report, since the probability of encountering such resources is considered low. This is due to both previous disturbances and local topography. During the establishment of the facility in the 1950s, an access pier and mooring systems were constructed, disturbing the study area and greatly reducing any potential for intact sub-tidal resources (Bass, personal communication, 2002).

Lewarch et al. (1997) reported that the shellfish along the beach in front of the facility are low, both in number and variety. This is due to the intensity of wave action and shoreline exposure—the shore is steep and drops to depths of 50 feet (15 m) close to the shoreline and the beach is narrow and exposed to shifting winds (Lewarch et al., 1997; Miller et al., 2002). The low shellfish productivity and the topography of the beach further limit the likelihood of encountering sub-tidal resources.

None of the existing buildings or structures at FIL dates to the historic period, nor does the study area meet historic district eligibility criteria. The original pier was constructed in 1969 and the original laboratory was constructed in 1970, and the building further modified in 1988. The waterfront was modified in 1992, resulting in the movement of the barge and reduction of the footprint area. The bulkhead and parking lots are the only extant original features on the property (Bass, personal communication, 2002). Neither of these meets criteria for National Register of Historic Places eligibility.

None of the existing structures at Fox Island Laboratory are over fifty years old, which is the minimum requirement for eligibility. Nor are any of the structures "exceptionally important," warranting their eligibility within the last fifty years (NPS 1990:25). Overall, buildings and structures found at Fox Island Laboratory do not retain sufficient physical integrity to convey historic significance and appear to be ineligible for inclusion on the National Register of Historic Places.

Based on documentary and field investigations, the study area has little or no potential for containing intact subsurface archaeological resources. None of the extant buildings or structures

meets criteria for National Register of Historic Places eligibility. Construction is unlikely to have any effect on historical resources.

No Action Alternative

Under the No Action Alternative, no impacts to cultural resources are expected to occur.

3.3.5.3 Mitigation Measures

No mitigation measures are necessary.

3.3.6 Recreation

3.3.6.1 Affected Environment

Fox Island

Recreational activity on Fox Island is primarily associated with boating, fishing, and shellfish harvesting. Pierce County Department of Parks and Recreation maintains several recreational facilities on Fox Island (Pierce County, 2002). Recreational facilities on Fox Island include:

- **Towhead Island**: Located on the south side of the Fox Island Bridge, this undeveloped one acre park provides salt water beach front and a boat launch. The Washington Department of Health (WDOH) has classified this area as an approved, public recreational shellfish harvesting site (WDOH, 2002).
- **Fox Island Boat Launch**: Located on Hale Passage, south of Ketners Point at Fox Drive and 9th Avenue, this site is used for boat launching.
- **Fox Island Fishing Pier**: This fishing pier, at 1453 Ozette Drive, was built by WDFW and is managed by the Pierce County Department of Parks and Recreation. Facilities include a dock, a paved pathway, and parking.
- **The Nichols Community Center**: Located at 690 9th Avenue, this is a historic building used for banquets and other functions. The facility is owned and operated by the Fox Island Community and Recreation Association, and includes meeting rooms, a lighted stage, children's playground, picnic shelter/gazebo, and baseball field.
- **Tanglewood Island Salmon Pen**: The State of Washington maintains a holding pen for salmon at Tanglewood Island on the northeast side of Fox Island off Hale Passage.

Regional Facilities

Pierce County Department of Parks and Recreation and the Washington State Department of Parks and Recreation maintain recreational facilities on the Gig Harbor Peninsula near Fox Island (Pierce County, 2002; Mueller, 1999). These facilities are identified and briefly described below.

Pierce County Department of Parks and Recreation

- **Rosedale Playfield and Tennis Courts**: Located at 86th Avenue NW in Gig Harbor, this two acre facility contains a soccer field, softball diamond, and two outdoor tennis courts.
- **Hales Pass Community Center**: This facility, at 3507 Ray Nash Drive NW in Gig Harbor, is used for banquets, meetings, and social events. Outdoor facilities include a large covered area, one softball diamond, two outdoor tennis courts and open space.
- **Peninsula Recreation Area**: Located at 6077 SR 16 & Rosedale Street near Gig Harbor, this 22-acre site is undeveloped open space.

Washington State Department of Parks and Recreation

- **Kopachuck State Park**: This park is located north of Horsehead Bay on Carr Inlet. This 107 acre park provides 3,500 feet of shoreline access for walking, swimming, fishing, picnicking, boating, paddling, and scuba diving. Facilities include campgrounds, hiking trails, an underwater marine park, and two mooring buoys. The Washington Department of Health has classified this area as an approved, open recreational shellfish harvesting site (WDOH, 2002).
- **Cutts Island Marine State Park**: Located in Carr Inlet, north of Kopachuck State Park, this five and one-half acre island provides 2,100 feet of shoreline access for walking, swimming, fishing, boating, paddling, and scuba diving. Facilities include 10 mooring buoys and an underwater marine park (shared with Kopachuck State Park). The Washington Department of Health has classified this area as an approved, public recreational shellfish harvesting site (WDOH, 2002).
- **Penrose Point State Park**: Across Carr Inlet from Fox Island and north of McNeil Island, this 152-acre park provides 11,751 feet of shoreline access for walking, swimming, fishing, picnicking, and paddling. Facilities include campgrounds, hiking trails, and eight mooring buoys. Shellfish harvesting also occurs here, but the WDOH has not formally classified this site for recreational harvesting (WDOH, 2002).

3.3.6.2 Environmental Consequences

Impacts Common to All Action Alternatives

No significant impacts to recreational facilities are identified for any of the action alternatives. Implementation of any of the action alternatives would not restrict access or use of any park or recreational facility.

During construction periods ranging from one to three months, noise, construction activity, and marine traffic may slightly alter the recreational experiences of nearby residents, particularly in the immediate vicinity of FIL. However, any disturbance or inconvenience to recreational boaters or residents using the beach in the vicinity of FIL is expected to be minor and temporary in nature. Temporary impacts are not considered significant impacts in the context of recreational opportunities on Fox Island and throughout the surrounding area.

No Action Alternative

Under the No Action Alternative, no impacts to parks and recreational facilities are expected to occur.

3.3.6.3 Mitigation Measures

No mitigation measures are necessary.

3.3.7 Environmental Justice

3.3.7.1 Affected Environment

In February 1994, the President issued Executive Order 12898, that requires all federal agencies to "...make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States..."(Executive Order 12898). In accordance with the Executive Order, the Department of Defense (DoD) issued its Strategy on Environmental Justice in March 1995. Consistent with this DoD strategy, the Navy has established policies and responsibilities with the objective of preventing disproportionately high and adverse human or environmental effects on minority or low-income populations. The DoD strategy has established NEPA as the principal mechanism to implement provisions of the Executive Order.

The area of influence for the analysis of environmental justice is defined as the census tract that encompasses Fox Island (Census Tract 724.10/Blocks 1 and 2). Racial and ethnic characteristics of Fox Island are shown in Table 3-6. As shown, Fox Island census blocks exhibit a lower percentage of racial and ethnic minority residents than Pierce County as a whole. Compared to Washington State and the United States overall, the Fox Island census tracts have lower percentages of Hispanics, African Americans, Asians, and Native Americans (See Appendix C).

The Nisqually, Puyallup, and Squaxin Island Tribes have primary fishing rights in Carr Inlet as part of their "usual and accustomed fishing places" as established by the Point No Point Treaty of 1853. These tribes fish regularly in the Carr Inlet area for salmon, geoduck, crab, shrimp, and other shellfish. The Navy has been in contact with these tribes regarding use of the Carr Inlet area by tribal fishermen and more specifically, use of the waters in the immediate vicinity of FIL (See Appendix B).

Table 3-6. Demographic and Employment Character
Fox Island and Pierce County

	Fox Island	Pierce County
DEMOGRAPHICS		
Total Population (2000)	2,803	700,820
Age Structure (2000)		
median age	41.5	34.1
18 and over	2,038	510,251
65 and over	321	71,620
Race and Ethnic Categories		
White	2,637 (94.1%)	549,369 (78.4%)
Hispanic	52 (1.9%)	38,621 (5.5%)
African American	18 (0.6%)	48,750 (7.0%)
Asian	46 (1.6%)	35,583 (5.1%)
Native American	21 (0.7%)	9,963 (1.4%)
Other	31 (1.1%)	18,220 (2.6%)
EMPLOYMENT AND INCOME		
(population 16 years and over)		
In labor force	1,404(67.3%)	352,677 (66.4%)
Civilian labor force	1,404 (67.3%)	335,830 (63.2%)
Armed Forces	___ (0.1%)	16,847 (3.2%)
Occupation		
Management/professional	648 (48.5%)	94,546 (30.1%)
Service occupations	132 (9.9%)	51,126 (16.3%)
Sales and Office	361 (27%)	84,105 (26.8%)
Farming/fishing/forestry	-	1,683 (0.5%)
Construction	102 (7.6%)	35,335 (11.2%)
Production/transportation	-	47,364 (15.5%)
2000 Median Household Income	$69,135	$45,204
Households by income category		
Less than $10,000	-	18,639 (7.1%)
$10,000 to $14,999	-	13,841 (5.3%)
$15,000 to $34,999	104 (10%)	64,963 (24.9%)
$35,000 to $49,000	150 (14.4%)	46,521 (17.8%)
$50,000 to $74,999	329 (31.6%)	58,734 (22.5%)
$75,000 to $99,000	128 (12.3%)	30,989 (11.9%)
$100,000 to $149,999	200 (19.2%)	19,130 (7.3%)
$150,000 or more	115 (11.1%)	8,080 (3.1%)
HOUSING		
2000 Median House Value	$260,300	$149,600
2000 Median Rent	$1,285	$624

Source: Derived from U.S. Census Bureau, Census 2000

3.3.7.2 Environmental Consequences

Impacts Common to All Action Alternatives

The action alternatives are intended to stabilize a facility that has been in this location since 1953. While modifications to the existing pier and barge configuration would occur under each of the alternatives, the overall level of activity at the facility is not expected to increase over historic levels.

While Carr Inlet is part of "usual and accustomed fishing places" for the Nisqually, Puyallup, and Squaxin Island Tribes, tribal fishing activity in the immediate vicinity of FIL is infrequent.

Review of census data for Fox Island indicates that minority and low-income populations on the island are low on both a percentage and absolute basis compared to other areas in Pierce County, Washington State, and the United States as a whole. Further, there is nothing to indicate that FIL has generated any impacts on these populations in the past.

For these reasons, none of the action alternatives are expected to have a significant impact on minority or low-income populations.

No Action Alternative

Under the No Action Alternative, the existing pier and barge facility at FIL would remain in its current configuration and no stabilization measures would be implemented. No impacts on minority or low-income populations have been identified for the existing facility and none are expected to occur under the No Action Alternative.

3.3.7.3 Mitigation Measures

No mitigation measures are necessary.

3.3.8 Public Safety and Environmental Hazards to Children

3.3.8.1 Affected Environment

In April 1997, the President issued Executive Order 13045, which requires all federal agencies to "...make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks." (Executive Order 13045). The Navy has established policies and responsibilities with the objective of preventing disproportionate risks to children resulting from environmental health and safety risks. Environmental review as implemented through NEPA is the principal mechanism to implement provisions of the Executive Order.

All the FIL research and testing activities occur at the pier and on the open waters of Carr Inlet. Upland areas at FIL are primarily used for support including storage, power, communications, and administration. The FIL site does not serve as a storage facility for fuels or munitions. On-site fuels, solvents, lubricants, are limited to those needed for operation and maintenance of vessels and equipment. Access to the upland portion of the facility is restricted (i.e. fenced and gated) as is access to the pier and barges. Children are not permitted in these areas, with the exception of occasional escorted tours of the facility.

As described in the Noise Section of this chapter, FIL is not a substantial noise generator. In fact, research and testing operations typically require a low ambient noise environment. Any noise generated by the facility (e.g. tug and barge operations) is buffered from much of Fox Island by the laboratory's location at the base of a forested bluff.

Children from Fox Island travel by bus to schools on the Gig Harbor Peninsula. These schools include Voyager Elementary School (5615 Kopachuk Drive N.W., Gig Harbor), Kopachuk Middle School (10414 – 56th Street N.W., Gig Harbor), and Gig Harbor High School (5101 Rosedale Street, Gig Harbor). These schools are approximately 3.5 (5.6), 3.5 (5.6) and 5 (8.0) miles (km) from FIL, respectively. Nichols Community Center supports a wide variety of activities and classes for both children and adults. It is located approximately 1.4 miles (2.3 km) from FIL. None of these facilities is in a location that might be affected by activities at FIL.

3.3.8.2 Environmental Consequences

Impacts Common to All Action Alternatives

The action alternatives are intended to stabilize a facility that has been in this location since 1953. While modifications to the existing pier and barge configuration would occur under each of the alternatives, the overall level of activity at the facility is not expected to increase over historic levels. The FIL facility has not been a historic source of pollution or health risks and this is not expected to change in the future.

Access to the upland area, pier, and barges at FIL is restricted. The upland portion of the site is fenced and gated with 24-hour security. Access to the pier from the beach is controlled by fencing above the beach and the height of the pier above the beach.

No public schools are located on Fox Island. The nearest schools are located off the island, over three miles distant on the Gig Harbor Peninsula.

For these reasons, none of the action alternatives are expected to have a significant safety and environmental health impacts on children.

No Action Alternative

Under the No Action Alternative, the existing pier and barge facility at FIL would remain in its current configuration and no stabilization measures would be implemented. No impacts on the safety and environmental health of children have been identified for the existing facility and none are expected to occur under the No Action Alternative.

3.3.8.3 Mitigation Measures

No mitigation measures are necessary.

Chapter 4.0 Cumulative Impacts and Irreversible / Irretrievable Impacts

4.1 Cumulative Impacts

The Council of Environmental Quality's (CEQ) regulations (40 CFR §§ 1500 – 1508) implementing the provisions of the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. §§ 4321 *et seq.*) provide the definition of cumulative impacts. Cumulative impacts are defined as:

> "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR § 1508.7)."

"Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (OPNAVINST 5090.1B CH-2, 9 September 1999). A cumulative impact results from the additive effect of all projects in the same geographical area. Generally, an impact can be considered cumulative if: a) effects of several actions occur in the same locale; b) effects on a particular resource are similar in nature; and c) effects are long-term in nature.

4.1.1 Cumulative Projects

As part of the evaluation of cumulative impacts, a review of other shoreline projects in Carr Inlet and adjacent waters was conducted. The primary source of this information was the shoreline section of Pierce County's Department of Planning and Land Services (PALS).

4.1.1.1 Second Tacoma Narrows Bridge

By far, the largest project in the southern Puget Sound region involving marine waters and shorelines is the Second Tacoma Narrows Bridge project. It would be constructed just south of the existing Tacoma Narrows Bridge, which connects Tacoma with the Gig Harbor Peninsula and Kitsap Peninsula. The total project cost is $849 million. Construction is expected to begin in late 2002 with completion expected in 2008. An EIS has been prepared for the project by the Washington State Department of Transportation. Among mitigation measures proposed is the development of a new deepwater environment for bottomfish.

4.1.1.2 Shoreline Projects on Fox Island

A survey of pending Pierce County shoreline permit applications for Fox Island was conducted in late summer 2002. This survey was not meant to be comprehensive, but rather was intended to provide an indication of construction activity on Fox Island shorelines at a particular point in time. Typically, shoreline permit applications are required for projects in the shoreline zone if the construction cost exceeds $1,500. Eight permit applications were identified. All but one

involved private waterfront residences. Projects included: new pier construction, timber pier replacement, new bulkhead construction, new boat ramps and floats, and replacement of damaged piling.

4.1.2 Impacts

4.1.2.1 Second Tacoma Narrows Bridge

The proposed Second Tacoma Narrows Bridge Project would involve placement of suspension bridge footings in the waters of the Tacoma Narrows. The project would not involve any construction on, or modification of adjacent beaches. The nature of the project and the distance from FIL, 7.6 miles (12.2 km), indicate that the Second Tacoma Narrows Bridge Project should not be a factor with regard to cumulative impacts.

4.1.2.2 Shoreline Projects on Fox Island

Historically, certain projects of these types have been designed and/or constructed without incorporating adequate information on the effects of wind and waves on naturally-occurring beach processes. The results have changed natural shoreline processes in ways described in Miller et al. (2002) and Shepsis (2002), specifically, obstructing bluff retreat that provides source material and thus causes accelerated beach erosion. Currently, shoreline projects on Fox Island are subject to environmental review by Pierce County and the Washington State Department of Ecology.

Any effects of FIL on shoreline processes are limited to the immediate vicinity of the access pier and barges. Shoreline modeling by Shepsis (2002) indicates that "...the shoreline length to the north of the FIL (sic) that is affected by in-water facilities is about 950 feet." Shorelines southeast of FIL are not affected in any significant manner. Based on this analysis, no cumulative impacts are expected to result from the combined impacts of action alternatives and other shoreline projects on Fox Island beyond the immediate vicinity of FIL.

4.1.2.3 Shoreline Projects in the Vicinity of Fox Island Laboratory

As described in the Earth Resources Section of Chapter 3, the growth of the salient beneath the access pier is attributed to the presence of FIL barges intercepting incoming wave energy and acting as a de facto breakwater, reducing energy input to the shoreline (Miller et al., 2002). Adjacent property owners have expressed concern that the development of the salient has contributed to erosion of beaches northwest of FIL by retaining sand and gravel that would otherwise be transported by littoral currents.

Potential impacts, including potential cumulative impacts, of proposed changes of in-water facilities at FIL have been a focal point for recent analyses (Miller, et al., 2002; Shepsis, 2002) of shoreline processes on the southwest side of Fox Island, and specifically in the immediate vicinity of FIL. There are several conclusions from these studies that relate directly to cumulative impacts. These include:

- Shoreline erosion and bluff retreat are naturally-occurring processes with an estimated retreat rate of 0.2 to 0.5 feet (6 to 15 cm) per year.
- Since 1970, much of the bluff retreat northwest of FIL has been obstructed by the placement of numerous bulkheads and revetments.
- In-water facilities at FIL do not cause significant blockage of sediment transport from the southeast to northwest. Analyses indicate that the in-water facilities may capture from 7 to 15 percent of the net sediment transport. "...the trapping rate by the salient is not significant to the overall transport processes." (Shepsis, 2002).
- Modeling of shoreline processes indicates that the differences in the nature and magnitude of impacts resulting from the 240-Foot Pontoon, 360-Foot Pontoon, and Fixed Pier Alternatives are very small when compared to the No Action Alternative.

These findings indicate that existing in-water facilities are a minor contributor to cumulative shoreline processes operating in the immediate vicinity of FIL. Action alternatives, including the Preferred Alternative, are not expected to result in significant changes from the existing condition (No Action Alternative), nor are they likely to contribute in a significant fashion to cumulative impacts when combined with possible future shoreline projects in the vicinity of FIL.

4.2 Irreversible and Irretrievable Commitment of Resources

General

NEPA guidelines require that the EIS identify "...the extent to which the action irreversibly curtails the range of potential uses of the environment." (OPNAVINST 5090.1B CH-2, 9 September 1999). In this context, "resources" refers to the natural or cultural resources that would be irretrievably committed or lost if the action is implemented.
Fox Island Laboratory has been operating at its present location since 1953. The purpose of the Proposed Action is to stabilize in-water facilities at FIL in order to provide a safer working environment for scientists, engineers and staff. Over the course of planning, the Navy considered the possibility of moving the FIL facilities and functions to other locations. As described in Chapter 2 of this document, the determination was made that alternative locations were not as desirable for the type of work conducted at FIL and that stabilization of existing facilities at FIL was the most practical course of action. The action alternatives, specifically the 240-Foot Pontoon, 360-Foot Pontoon, and Fixed Pier Alternatives, then, avoid the considerable expenditures of energy, materials, and other natural resources that might be irretrievably lost if the FIL activities were shifted to another location or a new similar facility were developed.

Two elements of the action alternatives involve reuse of existing structures, thereby conserving energy and goods that might be required for new construction. Two of the three action alternatives (240-Foot Pontoon and 360-Foot Pontoon Alternatives) involve use of a pontoon previously used as support for a floating bridge. Reuse of this pontoon avoids probable demolition of this structure and saves the energy and materials that would be necessary to construct a similar floating structure for use at FIL.

4.2.1.1 Socioeconomics

The Socioeconomics Section in Chapter 3 of this document assesses potential impacts of alternatives on transportation, land and shoreline use, demographics and employment, cultural resources, recreation, aesthetics, environmental justice, and children's health and safety. While minor short-term, construction-related impacts have been described, no significant long-term socioeconomic impacts are identified. None of the action alternatives (240-Foot Pontoon, 360-Foot Pontoon, and Fixed Pier) involve any irreversible or irretrievable commitment of socioeconomic resources.

4.2.1.2 Cultural Resources

No cultural or historic resources of significance have been identified, or are thought likely to exist on the uplands or submerged lands at the FIL site, and no impacts on cultural resources are anticipated. None of the action alternatives (240-Foot Pontoon, 360-Foot Pontoon, and Fixed Pier) involve any irreversible or irretrievable commitment of cultural resources.

4.2.1.3 Biological Resources

The Biological Resources Section of Chapter 3 describes the vegetation, fish and shellfish, wildlife and endangered species present in the uplands, shoreline areas, and subtidal waters in the vicinity of FIL. Potential short-term and long-term impacts from alternatives on these resources are described. Minor construction-related impacts are expected to occur with the action alternatives, however, no significant long-term impacts are anticipated. Further, differences in impacts between action alternatives are minor.

Under provisions of the Endangered Species Act, listed species addressed include: Chinook salmon, bull trout, bald eagle, humpback whale, leatherback sea turtle, marbled murrelet, and Steller sea lion. The results of the evaluation of listed species can be found in the Biological Resources Section of Chapter 3 and the accompanying Biological Assessment (Appendix C) prepared for submittal to the U.S. Fish and Wildlife Service and the NOAA Fisheries. Preliminary results indicate that the Preferred Alternative would have "no effect" on the humpback whale, leatherback sea turtle, marbled murrelet, and Steller sea lion. The Preferred Alternative "may affect" but are "not likely to adversely affect" Chinook salmon, bull trout, and bald eagle.

Based on this analysis, it is unlikely that listed species would be irretrievably committed or lost as a result of implementation of any of the action alternatives (240-Foot Pontoon, 360-Foot Pontoon, Fixed Pier Alternatives). In the absence of significant adverse impacts on biological resources, no irreversible or irretrievable commitment of these resources is expected to result from any of the action alternatives.

4.2.1.4 Air Quality, Noise, and Water Quality

Physical Resources examined in Chapter 3 include air quality, noise, and water quality. Evaluation of potential impacts indicates that differences in impacts between action alternatives are slight. Minor short-term impacts on air quality, the ambient noise environment, and water

quality may be expected. Impacts are expected to be typical of those that occur during marine construction projects of this type. In the future, the types and intensity of activities that take place at FIL are not expected to change over present levels. Over the long-term, the impacts of the FIL activities on air resources, the noise environment, and water quality are expected to be similar to those that occur at present. These impacts are not significant and are not expected to be so in the future. FIL activities under any of the action alternatives (240-Foot Pontoon, 360-Foot Pontoon, and Fixed Pier Alternatives) are not likely to result in irretrievable or irreversible losses of physical resources.

4.2.1.5 Soils

As described in the Soils Section of Chapter 3, the growth of the salient beneath the access pier is attributed to the presence of the FIL barges intercepting incoming wave energy and acting as a de facto breakwater reducing energy input to the shoreline (Miller, et al., 2002). Adjacent property owners believe that the development of the salient has contributed to erosion of beaches northwest of FIL by retaining sand and gravel that would otherwise be transported by littoral currents. As discussed in the Cumulative Impacts section of this chapter, the Navy has made a commitment to working with local property owners to correct the conditions that result in beach erosion (i.e. removal of wood debris, moving RCB to deeper water). Coincident is the Navy's intent not to modify FIL in a way that adversely affects existing shoreline processes. This commitment reflects the Navy's desire to avoid potentially irretrievable or irreversible impacts to adjacent beaches.

The results described in Miller et al. (2002) and Shepsis (2002) indicate that bluff retreat is a naturally-occurring process that is a source of beach material for the shoreline on the southwest side of Fox Island. Further, that man-made structures have restricted bluff retreat processes and contributed to erosion of beaches northwest of FIL. As described previously under Cumulative Impacts, FIL has altered shoreline processes and created a salient in the sheltered zone shoreward of the barges. At the same time, detailed examination of bathymetric changes over the last 30 years indicate that the existing FIL structures are a small contributor to any loss of the beach resource that is taking place. Evaluation of potential impacts indicates that none of the action alternatives (240-Foot Pontoon, 360-Foot Pontoon, and Fixed Pier Alternatives) would have a significant impact on adjacent beaches and further, that the differences in impacts between alternatives are minor. Consequently, no significant irreversible or irretrievable impacts on beach resources are expected with any of the action alternatives.

4.2.2 Compliance with Applicable Laws and Regulations

Based on evaluation of the Proposed Action with respect to consistency with land use guidelines for the FIL site and surrounding area, the Proposed Action does not conflict with the objectives of federal, regional, state, and local land use plans, policies, and controls. Table 4-1 provides a summary of compliance of the Proposed Action with Federal, State, and Local plans, policies, and controls.

Table 4-1. Compliance of the Proposed Action with the Objectives of Federal, State, and Local Plans, Policies, and Controls.

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
National Environmental Policy Act (NEPA)(42 United States Code [U.S.C.] § 4321 et seq.) Department of the Navy Procedures for Implementing NEPA (32 Code of Federal Regulations [C.F.R.] 775)	Navy	This Environmental Impact Statement (EIS) has been prepared in accordance with the Council on Environmental Quality (CEQ) Regulations implementing NEPA and Navy NEPA procedures. The preparation of this EIS and the provision for its public review are being conducted in compliance with NEPA.
Coastal Zone Management Act (CZMA)(16 C.F.R. § 1451 et seq.) Washington Shoreline Management Act (RCW 90.58; WAC 173-27-060) Pierce County Shoreline Master Program (Title 20 Pierce County Code)	Washington Department of Ecology Pierce County, Washington	The Navy believes that the Proposed Action would be consistent to the maximum extent practicable with the enforceable policies of the Washington Coastal Zone Management Program and would complete a Coastal Consistency Determination in accordance with the CZMA, after consideration of comments on the DEIS. The Navy would submit a description of the Preferred Alternative, along with a copy of the Coastal Consistency Determination, to Pierce County. The County would determine if a Substantial Development Permit and/or Expansion of Non-Conforming Use Permit would be required for the Preferred Alternative.
Clean Water Act section 401 (§§ 401, 33 U.S.C. § 1251 et seq.) Section 402 (§§ 402, 33 U.S.C. § 1251 et seq.)	U.S. Environmental Protection Agency (USEPA) / U.S. Army Corps of Engineers (USACE) Washington State Department of Ecology	A section 401 permit would be obtained from the EPA prior to construction activities. Construction of facilities may require a National Pollution Discharge Elimination System (NPDES) permit.
Rivers and Harbors Act (33 U.S.C. § 401 et seq.)	USACE	Placement of new mooring systems would require a Section 10 permit from the USACE.

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
Clean Air Act (CAA), as amended (42 U.S.C. § 7401 et seq.)	USEPA	In accordance with CAA regulations, the Proposed Action would not compromise air quality attainment status in Washington or conflict with attainment and maintenance goals established in its State Implementation Plan (SIP). Estimated emissions are below *de minimis* levels. Therefore, a CAA conformity determination is not required.
EO 11990, Protection of Wetlands (U.S.C. §§ 1221-1226)	Navy	The Proposed Action would not have a significant impact on wetlands.
Endangered Species Act (16 U.S.C. § 1531)	U.S. Fish and Wildlife Service (USFWS), NOAA Fisheries	The Navy is in the informal consultation process with the Services. The Navy has determined that the Proposed Action is not likely to adversely affect listed species.
Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801-1802)	NOAA Fisheries	The Navy has determined that the Proposed Action would not adversely affect Essential Fish Habitat; Therefore, consultation with NOAA Fisheries is not required.
Marine Mammal Protection Act (MMPA)(16 U.S.C. § 1431 et seq.)	NOAA Fisheries	The Navy has concluded based upon the analysis provided in this document and the attached Biological Assessment, that the proposed action would not result in a “take” of marine mammals. Therefore, this action would not be in conflict with the MMPA in any way.
Migratory Bird Treaty Act (MBTA) (16 USC §703-712)	Navy	The Proposed Action would not result in violation of the MBTA.
EO 128998, Federal Actions to Address Environmental Justice in Minority populations and Low-Income Populations (Executive Order 12898, 59 Federal Register 7629 [Section 1-101])	Navy	Minority or low-income populations would not be disproportionately affected by the Proposed Action.

Plans, Policies, and Controls	Responsible Agency	Status of Compliance
EO 13045, Protection of Children from Environmental Health Risks and Safety Risks (Executive Order 13045, 62 Federal Register 1985)	Navy	Children would not be disproportionately exposed to environmental health risks or safety risks by the Proposed Action.
National Historic Preservation Act (NHPA)(§ 106, 16 U.S.C. 470 et seq.)	Navy	The Proposed Action would not involve any effects on National Register of Historic Places or eligible properties.
National Marine Sanctuaries Act (16 U.S.C. 1431 et seq.)	National Oceanic and Atmospheric Administration (NOAA)	None of the activities associated with the Proposed Action would take place within a National Marine Sanctuary.
EO 13112, (Invasive Species)		None of the activities associated with the Proposed Action are likely to result in the introduction of invasive species.
EO 13158, Marine Protected Areas (Executive Order 13158, 65 Federal Register 105)	Navy	"Marine Protected Areas" (MPAs) have not yet been officially designated under EO 13158.
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (Executive Order 13186, 66 Federal Register 11)	Navy	The Proposed Action would not have a measurable negative effect on migratory bird populations.

4.3 Government to Government Consultation

Over the course of preparation of this EIS, the Navy has been in contact with tribal representatives (i.e. Nisqually Tribe, Puyallup Tribe, Squaxin Island Tribe) regarding potential impacts on tribal fisheries and cultural resources. This dialogue is expected to continue as requested over the course of environmental review and permit process.

As part of the environmental review process, this EIS will be distributed to federal and state regulatory agencies, municipalities, Native American tribes, and other interested parties in order to provide the opportunity to comment on potential impacts of the Proposed Action.

Chapter 5.0 List of Preparers and Distribution List

5.1 List of Preparers

This EIS for the Stabilization of In-Water Facilities at Fox Island Laboratory has been prepared by a multi-disciplinary team directed by Engineering Field Activity Northwest, Department of the Navy, in Poulsbo, Washington. Important contributions to the document have also been made by NAVSEA, Naval Surface Warfare Center, Carderock Division, and Fox Island Laboratory staff. Adolfson Associates, Inc., Seattle, Washington, a consulting firm under contract to the Navy, prepared the document with assistance from Historical Research Associates, Inc. (cultural resources) and The Environmental Company (air quality, noise, water quality). Following is a list of contributors to the EIS.

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5.2 Distribution List

Following is a list of parties who have been sent copies of the EIS. In addition to this Distribution List, other interested parties have been sent a Notice of Availability, which indicates when the Draft EIS was issued, where copies may be obtained or reviewed, the duration of the comment period, and where comments may be sent, and the location, date and time of the Public Hearing on the Draft EIS.

PARTIES RECEIVING EIS

Federal Elected Officials

U.S. Senator Maria Cantwell
U.S. Senator Patty Murray
U.S. Representative Norm Dicks

State Elected Officials

Representative Patricia T. Lantz
State Senator Bob Oke
Representative Brock Jackley

Federal Agencies

NOAA Fisheries, Northwest Regional Office
U.S. Army Corps of Engineers, Regulatory Branch, CENWS-OD-RG
U.S. Fish and Wildlife Service, Pacific Region

Washington State Agencies

Washington State Department of Natural Resources, Olympia Headquarters
Washington Department of Ecology, Shorelands & Environmental
Washington Department of Fish & Wildlife, Region 6

Local Agencies and Organizations

Pierce County Planning and Land Services

Native American Tribes

Squaxin Island Tribal Council, The Hon. David Lopeman, Chair
Puyallup Tribal Council, The Hon. Herman Dillion, Sr., Chair
Nisqually Indian Tribe, The Hon. John Simmons, Chair
Steilacoom Tribe

PARTIES RECEIVING NOTICE OF AVAILABILITY

Interested Parties

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Albert J. Jones
Lois A. Miller
David C. & Shirley R. McHugh
Michael Gore
Pederson Family LP
Todd L. & Jennifer S. Clarke
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Matt Beckingham
Piper Cheney
John Kinzel

Adjacent Property Owners

Peter Johnson
John Blaser
Christopher Corsi
Matthew T. & Ruth H. Corsi
Judge Otto
Todd L. & Jennifer S. Clarke
Michael W. Steffen
Michael Ellison
William E. & Lenora C. Ellison
Pederson Family LP (2 lots)
Neilan & Lewise Weinstein
Max & Kalli Ostner
Ven T. & Winifred H. Lee

Winston L. & Amy J. Churchill
John W. Simchuk (3 lots)
Jerry L. & Sara Gamache
Colleen Y. Costello-Koval
William T. & Patricia A. Lynn
David C. & Shirley R. McHugh
Nancy H. & William F. Post

Chapter 6.0 References and Personal Communications

This chapter includes references used in Chapters 1 through 4 of this EIS and personal communications with staff personnel of regulatory agencies, municipalities and tribes instrumental in obtaining information used in the evaluation of alternatives.

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6.2 Personal Communications

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Carlson, Mojgan. Pierce County Planning and Land Services Department. Telephone conversation. August 12, 2002.

Gearin, Patrick. U.S. Fish and Wildlife Service. Seattle, Washington. Telephone conversation of November 27, 2000.

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Tihri, Michelle. Washington Department of Fish and Wildlife. Telephone conversation of September 10, 2002.

West, Jerry. Pierce County Public Works Department, Transportation Services Division. Telephone conversation. June 25, 2002

GLOSSARY

Accretion:	The growth of a beach by the addition of material transported by wind and water.
Backshore:	Upper portion of the beach between the beach face and uplands.
Bathymetry:	The measurement of depths of water in oceans, seas, and lakes.
Benthic:	Pertaining to the bottom substrate or the bottom of the water column.
Beach face:	The part of the beach exposed to the action of wave uprush.
Bulkhead:	A wall usually constructed parallel to the shore with the primary purpose of containing and preventing the loss of soil caused by erosion or wave action. Bulkheads may also be termed "seawalls," however in common usage, the term seawall is generally reserved for massive public works structures along the open coast. By contrast, bulkheads are typically lighter in structure and may be either private or public.
Bypassing:	The transfer of beach material from the updrift side of an inlet, harbor entrance, or structure to the downdrift side.
Cusp:	Rounded deposits of beach material separated by crescent-shaped troughs.
Debitage:	The discarded and unused detached pieces of lithic material resulting from toolmaking.
Diffraction:	Change in directions and intensities of a group of waves after passing by an obstacle or through an aperture.
Dolphin:	A cluster of wood, steel, or concrete piles lashed together.
Downdrift:	The direction of transport of beach material.
Epibethos:	Organisms that live on the surface of the bottom sediment.
Estuary:	Region near river mouth where fresh water mixes with salt water of sea.
Groin:	A rigid structure built at an angle from the shore to protect it from erosion or to trap sand. A groin may be further defined as permeable or impermeable depending on whether or not it is designed to pass sand through it.
Habitat:	Interacting physical and biological factors which provide at least minimal conditions for one organism to live or for a group of organisms to occur together.

Infauna:	Organisms that live within the sediment.
Lithic:	Consisting of, or relating to stone or rock.
Littoral:	Characteristic of the shoreline.
Littoral drift:	The beach material transported in the nearshore area by waves and currents.
Longshore current:	The wave-generated current in the nearshore zone that parallels the shoreline.
Longshore transport rate:	The rate at which beach material moves along the shore by wave and current action; often measured in cubic yards (meters) per year.
Mean High Water:	Average height of high waters over a 19-year period.
Mean Low Water:	Average height of low waters over a 19-year period.
Midden:	An area where refuse has been deposited (e.g. shell midden).
Migration:	The seasonal travel of an animal between habitats.
Outfall:	Structure extending into a body of water for the purpose of discharging an effluent (e.g. sewage, storm runoff, cooling water).
Revetment:	A facing, as of masonry, used to support an embankment.
Salient:	A projection from a line or surface, as from a beach or shoreline.
Thermocline:	A layer in a large body of water that sharply separates regions differing in temperature, so that the temperature gradient across the layer is abrupt.
Tombolo:	A sandbar that connects an island to the mainland or to another island.

INDEX

APPENDIX A

RECORD OF NON-APPLICABILITY (RONA)
FOR
CLEAN AIR ACT CONFORMITY
AND
AIR QUALITY EMISSIONS ESTIMATES

Introduction

The USEPA has published "Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule," in the 30 November 1993, Federal Register (40 CFR Parts 6, 51, and 93). The U.S. Navy has published "Interim Guidance of Compliance with the Clean Air Act General Conformity Rule" in OPNAVINST 5090.1b, dated 1 November 1994. These publications provide guidance to document Clean Air Act Conformity requirements.

Federal regulations state that no departments, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license to permit, or approve any activity which does not conform to an applicable implementation plan. It is the responsibility of the Federal agency to determine whether a Federal action conforms to the applicable implementation plan before the action is taken (40 CFR § 93.150b).

Federal actions may be exempt from conformity determinations if they do not exceed designated *de minimis* levels for criteria pollutants (40 CFR § 93.153c). Table A-1 presents the *de minimis* levels (in tons/year [metric tons/year]) for Pierce County (the area potentially affected by the action alternative).

Table A-1. Applicable Criteria Pollutant *de minimis* Levels within Pierce County (tons/year [metric tons/year])

VOCs[1]	*NO_x*[1]	*CO*	*SO_x*	*PM_{10}*
100 (91)	100 (91)	NA	NA	NA

Notes: [1] Pierce County is in attainment of the NAAQS for all six criteria pollutants but is in a maintenance area for the federal and state O_3 standards; VOCs and NO_x are precursors to the formation of O_3.
VOC = volatile organic compounds; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = oxides of sulfur; PM_{10} = particulate matter less than 10 microns in diameter; NA = not applicable.

Action Alternative

NSWCCD proposes to install a 240-foot concrete pontoon and replace the existing mooring system at Fox Island Laboratory, Pierce County, Washington. Under the action alternative, the installation of the 240-foot pontoon will be placed further offshore, deteriorating fender barges and wooden pilings will be removed, the mooring system will be replaced, and offshore facilities will be consolidated to improve safety concerns at the laboratory.

It has been conservatively estimated that construction of the mooring improvements will last one to three months and removal of woody debris will last one to two weeks. Based on the conformity applicability analysis for the action alternative, the maximum estimated emissions associated with construction and implementation of the action alternative would be below applicable *de minimis* levels (Table A-2); therefore, a formal Conformity Determination is not required.

Table 4-2. Estimated Emissions Under the 240-Foot Pontoon Action Alternative

Category	*Emissions(tons/year [metric tons/year])*				
	VOC[1]	*NO_X*[1]	*CO*	*SO_X*	*PM_{10}*
240-Foot Pontoon Action Alternative	1.0 (0.9)	9.0 (8.2)	3.0 (2.7)	1.8 (1.6)	0.5 (0.5)
de minimis threshold	100 (91)	100 (91)	NA	NA	NA
Exceeds *de minimis* threshold?	No	No	NA	NA	NA

Notes:
[1]Pierce County is in attainment of the NAAQS for all six criteria pollutants but is in a maintenance area for the federal and state O_3 standards; VOCs and NO_x are precursors to the formation of O_3.
VOC = volatile organic compounds; NO_x = oxides of nitrogen; CO = carbon monoxide; SO_x = oxides of sulfur; PM_{10} = particulate matter less than 10 microns in diameter; NA = not applicable.

RONA Approval

To the best of my knowledge, the information presented in this RONA is correct and accurate, and I concur in the finding that the implementation of the action alternative would not be subject to the General Conformity Rule.

_____ Date: _____

(Insert Name and Title Here)

APPENDIX B

AGENCY CORRESPONDENCE

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090/Fox Island
Ser 05EC.3KK/0995
May 14, 2002

Mr. John Grettenberger
U.S. Fish and Wildlife Service
510 Desmond Drive, Suite 102
Lacey, Washington 98503-1273

Dear Mr. Grettenberger:

SUBJECT: SECTION 2 TOWNSHIP 20 NORTH, RANGE 1 EAST FOX ISLAND QUADRANGLES, WASHINGTON

Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA), the Naval Surface Warfare Center Carderock Division is preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences of the stabilization of in-water facilities at the Fox Island Laboratory. The proposed project is located on Fox Island in Carr Inlet, Section 2, Township 20 North, Range 1 East, Pierce County, Washington (see attached figure).

We are requesting a species and critical habitat list for the site described above, per the requirements of Section 7(c) of the Endangered Species Act. Please forward the requested information to me at the above address.

Please phone me at (360) 396-0927 if you have any questions. Thank you for your time spent on this request.

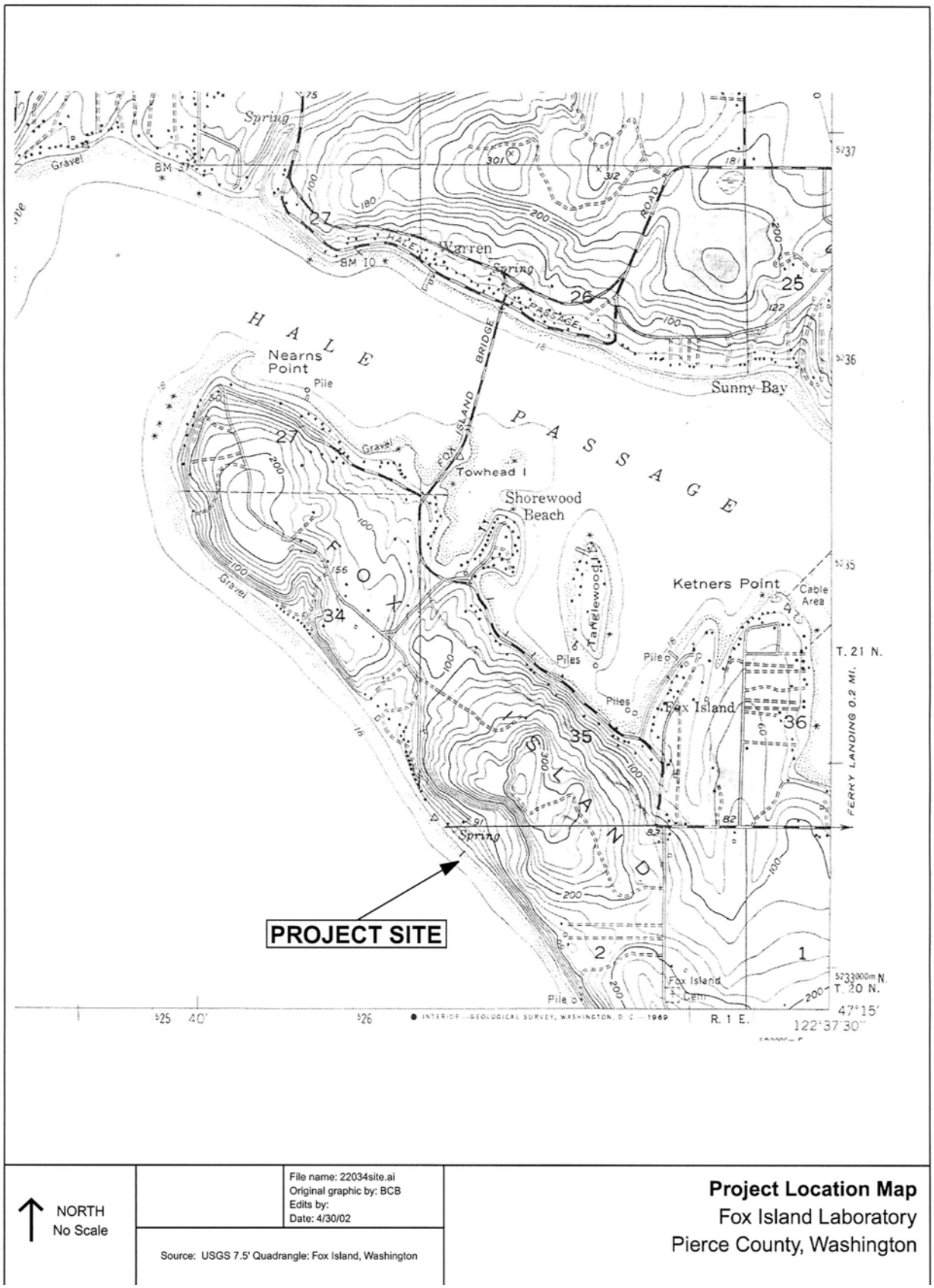
Sincerely,

Kimberly H. Kler

KIMBERLY H. KLER
Environmental Planner
By direction of the
Commanding Officer

Enclosure: Project Site Map

Copy to: Steve Bingham, Adolfson Associates, INC.
Bill Baxley, NSWCCD



NORTH
No Scale

File name: 22034site.ai
Original graphic by: BCB
Edits by:
Date: 4/30/02

Source: USGS 7.5' Quadrangle: Fox Island, Washington

Project Location Map
Fox Island Laboratory
Pierce County, Washington

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090/Fox Island
Ser 05EC.3KK/0994
May 14, 2002

Mr. Steve Landino, Branch Chief
National Marine Fisheries Service
Washington Habitat Branch
510 Desmond Drive SE, Suite 103
Lacey, WA 98503

Dear Mr. Landino:

SUBJECT: SECTION 2 TOWNSHIP 20 NORTH, RANGE 1 EAST FOX ISLAND QUADRANGLES, WASHINGTON

Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA), the Naval Surface Warfare Center Carderock Division is preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences of the stabilization of in-water facilities at the Fox Island Laboratory. The proposed project is located on Fox Island in Carr Inlet, Section 2, Township 20 North, Range 1 East, Pierce County, Washington (see attached figure).

We are requesting a species and critical habitat list for the site described above, per the requirements of Section 7(c) of the Endangered Species Act. Please forward the requested information to me at the above address.

Please phone me at (360) 396-0927 if you have any questions. Thank you for your time spent on this request.

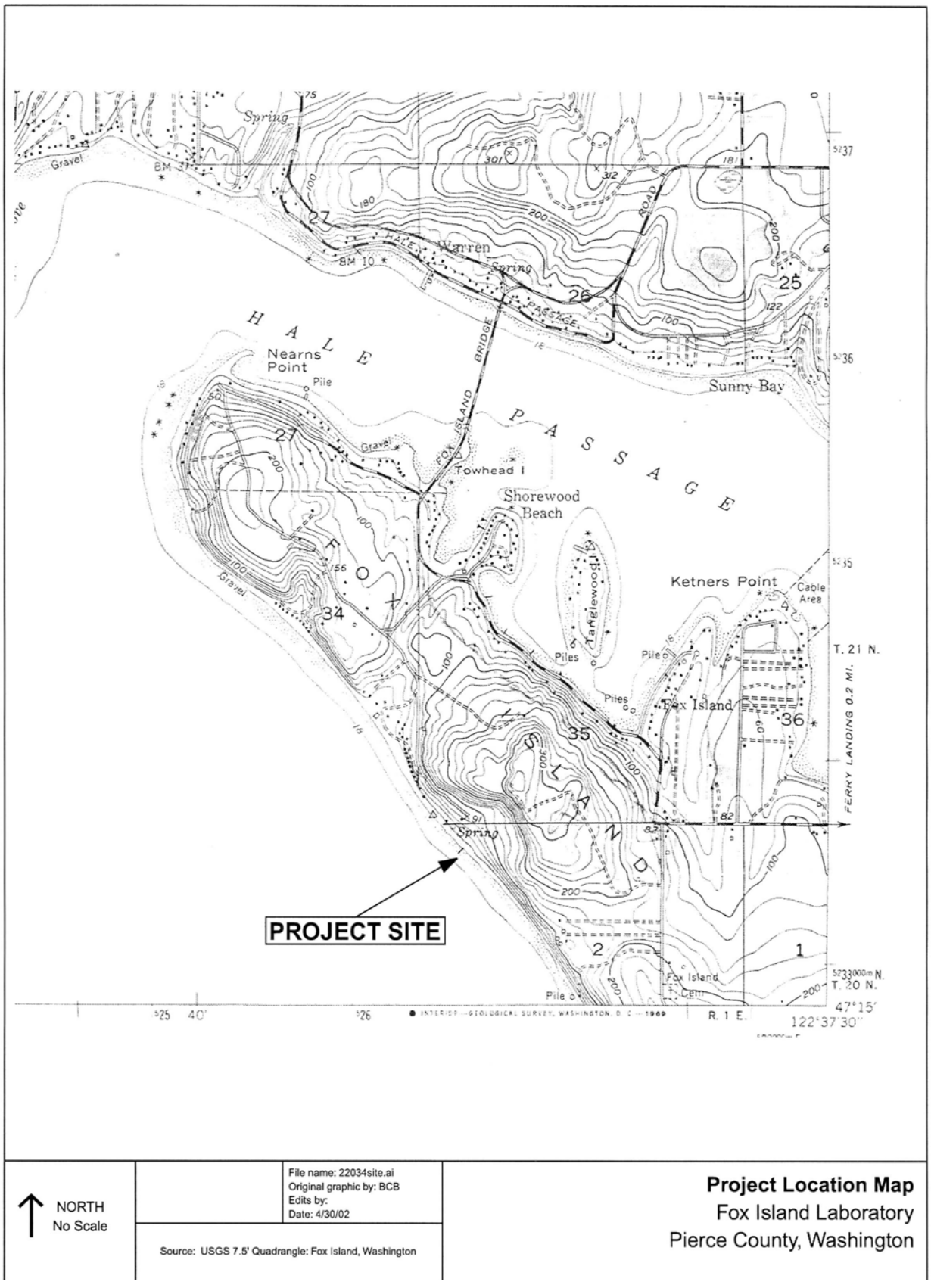
Sincerely,

Kimberly H. Kler

KIMBERLY H. KLER
Environmental Planner
By direction of the
Commanding Officer

Enclosure: Project Site Map

Copy to: Steve Bingham, Adolfson Associates, INC.
Bill Baxley, NSWCCD


Spring
Gravel
BM 21
BM 10
HALE PASSAGE
Warren
Spring
ROAD
Nearns Point
Pile
BRIDGE
FOX ISLAND
Gravel
Towhead I
Shorewood Beach
Sunny Bay
Ketners Point
Cable Area
Tangelwood I
Piles
Fox Island
FERRY LANDING 0.2 MI.
T. 21 N.
T. 20 N.
Spring
PROJECT SITE
Fox Island Cem
R. 1 E.
122°37'30"
47°15'
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1969
NORTH
No Scale
File name: 22034site.ai
Original graphic by: BCB
Edits by:
Date: 4/30/02
Source: USGS 7.5' Quadrangle: Fox Island, Washington
Project Location Map
Fox Island Laboratory
Pierce County, Washington

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Western Washington Fish and Wildlife Office
510 Desmond Drive SE, Suite 102
Lacey, Washington 98503
Phone: (360) 753-9440 Fax: (360) 534-9331

JUL 1 7 2002

Dear Species List Requester:

We are providing the information you requested to assist your determination of possible impacts of a proposed project to species of Federal concern. Attachment A includes the listed threatened and endangered species, species proposed for listing, candidate species, and/or species of concern that may be within the area of your proposed project.

Any Federal agency, currently or in the future, that provides funding, permitting, licensing, or other authorization for this project must assure that its responsibilities section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act), are met. Attachment B outlines the responsibilities of Federal agencies for consulting or conferencing with us (U.S. Fish and Wildlife Service).

If both listed and proposed species occur in the vicinity of a project that meets the requirements of a major Federal action (i.e., "major construction activity"), impacts to both listed and proposed species must be considered in a biological assessment (BA) (section 7(c); see Attachment B). Although the Federal agency is not required, under section 7(c), to address impacts to proposed species if listed species are not known to occur in the project area, it may be in the Federal agency's best interest to address impacts to proposed species. The listing process may be completed within a year, and information gathered on a proposed species could be used to address consultation needs should the species be listed. However, if the proposed action is likely to jeopardize the continued existence of a proposed species, or result in the destruction or adverse modification of proposed critical habitat, a formal conference with us is required by the Act (section 7(a)(4)). The results of the BA will determine if conferencing is required.

The Federal agency is responsible for making a determination of the effects of the project on listed species and/or critical habitat. For a Federal agency determination that a listed species or critical habitat is likely to be affected (adversely or beneficially) by the project, you should request section 7 consultation through this office. For a "not likely to adversely affect" determination, you should request our concurrence through the informal consultation process. For a "no effect" determination, we would appreciate receiving a copy for our information.

Candidate species and species of concern are those species whose conservation status is of concern to us, but for which additional information is needed. Candidate species are included as an advance notice to Federal agencies of species that may be proposed and listed in the future. Conservation measures for candidate species and species of concern are voluntary but recommended. Protection provided to these species now may preclude possible listing in the future.

For other federally listed species that may occur in the vicinity of your project, contact the National Marine Fisheries Service at (360) 753-9530 to request a list of species under their jurisdiction. For wetland permit requirements, contact the Seattle District of the U.S. Army Corps of Engineers for Federal permit requirements and the Washington State Department of Ecology for State permit requirements.

Thank you for your assistance in protecting listed threatened and endangered species and other species of Federal concern. If you have additional questions, please contact Yvonne Dettlaff (360) 753-9582.

Sincerely,

for Ken S. Berg, Manager
Western Washington Fish and Wildlife Office

Enclosure(s)

ATTACHMENT A **July 1, 2002**

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CRITICAL HABITAT, CANDIDATE SPECIES, AND SPECIES OF CONCERN THAT MAY OCCUR IN THE VICINITY OF THE PROPOSED STABILIZATION OF IN-WATER FACILITIES AT THE FOX ISLAND LABORATORY PROJECT IN PIERCE COUNTY, WASHINGTON

(T20N R1E S2)

FWS REF: 1-3-02-SP-1443

LISTED

There are six bald eagle (*Haliaeetus leucocephalus*) nesting territories located in the vicinity of the project at T19N R1E S4; T20N R1E S1-2,15-17. Nesting activities occur from January 1 through August 15.

Wintering bald eagles may occur in the vicinity of the project. Wintering activities occur from October 31 through March 31.

Bull trout (*Salvelinus confluentus*) may occur in ocean waters adjacent to the project.

Foraging marbled murrelets (*Brachyramphus marmoratus*) may occur in the ocean waters adjacent to your project.

Major concerns that should be addressed in your biological assessment of the project impacts to listed species include:

1. Level of use of the project area by listed species,

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project, and

3. Impacts from project construction (i.e., habitat loss, increased noise levels, increased human activity) that may result in disturbance to listed species and/or their avoidance of the project area.

PROPOSED

None

CANDIDATE

None

CRITICAL HABITAT

None

SPECIES OF CONCERN

The following species of concern have been documented in the county where the project is located. These species or their habitat could be located on or near the project site. Species in **bold** were specific occurrences located on the database within a 1 mile radius of the project site.

California wolverine (*Gulo gulo luteus*)
Cascades frog (*Rana cascadae*)
Fender's soliperlan stonefly (*Soliperla fenderi*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Northern goshawk (*Accipiter gentilis*)
Northwestern pond turtle (*Clemmys marmorata marmorata*)
Olive-sided flycatcher (*Contopus cooperi*)
Oregon vesper sparrow (*Pooectetes gramineus affinis*)
Pacific fisher (*Martes pennanti pacifica*)
Pacific lamprey (*Lampetra tridentata*)
Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)
Peregrine falcon (*Falco peregrinus*)
River lamprey (*Lampetra ayresi*)
Slender-billed, white breasted nuthatch (*Sitta carolinensis aculeata*)
Tailed frog (*Ascaphus truei*)
Valley silverspot (*Speyeria zerene bremeri*)
Western gray squirrel (*Scirius griseus griseus*)
Western toad (*Bufo boreas*)
Van Dyke's salamander (*Plethodon vandykei*)
Aster curtus (white-top aster)
Castilleja cryptantha (obscure Indian paintbrush)
Cypripedium fasiculatum (clustered lady's slipper)

ATTACHMENT B

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(c) OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED

SECTION 7(a) - Consultation/Conference

Requires:

1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2. Consultation with the U.S. Fish and Wildlife Service (FWS) when a Federal action may affect a listed endangered or threatened species to ensure that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after it has determined if its action may affect (adversely or beneficially) a listed species; and

3. Conference with the FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or an adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects *

Requires Federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species that is/are likely to be affected by a construction project. The process is initiated by a Federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with the Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should (1) conduct an onsite inspection of the area to be affected by the proposal, which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within the FWS, National Marine Fisheries Service, state conservation department, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion, the report should be forwarded to our Endangered Species Division, 510 Desmond Drive SE, Suite 102, Lacey, WA 98503-1273.

---

* "Construction project" means any major Federal action which significantly affects the quality of the human environment (requiring an EIS), designed primarily to result in the building or erection of human-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes Federal action such as permits, grants, licenses, or other forms of Federal authorization or approval which may result in construction.

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090
Ser 05EC3.KK/674
APR 3 2002

Jim Peters
Fisheries
Squaxin Island Tribe
SE 3100 Old Olympic Hwy
Shelton, Washington 98584

Dear Mr. Peters:

The Navy is about to initiate an Environmental Impact Statement (EIS) for the stabilization of in-water floating facilities at the Fox Island Laboratory located on Fox Island, Washington and adjacent to Carr Inlet. As part of the scoping for this project the Navy has reviewed the usual and accustomed fishing maps designated in the *United States v. Washington* (aka Boldt) decision. Our analysis of these maps indicates that Carr Inlet is not within the U&A for the Squaxin Tribe. I have also reviewed the cultural resources survey for the Fox Island Laboratory conducted in 1997. The survey states that during consultation Ms. LeClair, archivist for the Squaxin Island Tribe, advised that Fox Island was in the aboriginal fishing area of the Squaxin Island Tribe. I will be contacting you to further clarify the U&A status for the Squaxin Island Tribe.

Enclosed with this letter is a scoping announcement with information on the proposed action and invitation to the scoping open house that will be held on 17 April 2002. We welcome the Tribe's participation in preparation of the EIS.

If you have any questions or desire further information, please feel free to contact me at (360) 396-0927.

Sincerely,

Kimberly H. Kler

KIMBERLY H. KLER
Environmental Planner

Copy to:
David Lopeman, Chairman, Squaxin Island Tribal Council

Blind Copy to:
Bill Baxley, NSWCCD
Steve Bingham, Adolfson Associates, INC.

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090
Ser 05EC3.KK/673
APR 3 2002

Joe Anderson
Fisheries
Puyallup Tribe
6824 Pioneer Way E. Street
Tacoma, Washington 98404

Dear Mr. Anderson:

The Navy is about to initiate an Environmental Impact Statement (EIS) for the stabilization of in-water floating facilities at the Fox Island Laboratory located on Fox Island, Washington and adjacent to Carr Inlet. As part of the scoping for this project the Navy has reviewed the usual and accustomed fishing maps designated in the *United States v. Washington* (aka Boldt) decision. Our analysis of these maps indicates that Carr Inlet is not within the U&A for the Puyallup Tribe. If this interpretation is incorrect please contact me at your earliest convenience. If we do not hear from you we will assume that our analysis is correct.

Enclosed with this letter is a scoping announcement with information on the proposed action and invitation to the scoping open house that will be held on 17 April 2002. We welcome the Tribe's participation in preparation of the EIS.

If you have any questions or desire further information, please feel free to contact me at (360) 396-0927.

Sincerely,

Kimberly H. Kler

KIMBERLY H. KLER
Environmental Planner

Copy to:
Herman Dillon, Chairman, Puyallup Tribal Council

Blind Copy to:
Bill Baxley, NSWCCD
Steve Bingham, Adolfson Associates, INC.

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090
Ser 05EC3.KK/672
APR 3 2002

Georgianna Kautz
Fisheries
Nisqually Tribe
4820 She-Nah-Num Drive SE
Olympia, Washington 98513

Dear Ms. Kautz:

The Navy is about to initiate an Environmental Impact Statement (EIS) for the stabilization of in-water floating facilities at the Fox Island Laboratory located on Fox Island, Washington and adjacent to Carr Inlet. As part of the scoping for this project the Navy has reviewed the usual and accustomed fishing maps designated in the *United States v. Washington* (aka Boldt) decision. Our analysis of these maps indicates that Carr Inlet is not within the U&A for the Nisqually Tribe. If this interpretation is incorrect please contact me at your earliest convenience. If we do not hear from you we will assume that our analysis is correct.

Enclosed with this letter is a scoping announcement with information on the proposed action and invitation to the scoping open house that will be held on 17 April 2002. We welcome the Tribe's participation in preparation of the EIS.

If you have any questions or desire further information, please feel free to contact me at (360) 396-0927.

Sincerely,

Kimberly H. Kler

KIMBERLY H. KLER
Environmental Planner

Copy to:
John Simmons, Chairman, Nisqually Tribal Council

Blind Copy to:
Bill Baxley, NSWCCD
Steve Bingham, Adolfson Associates, INC.

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090
Ser 05EC3.KK/675
APR 3 2002

Robert Wahpat
Chairman
Yakama Tribal Council
P.O. Box 151
Toppenish, Washington 98948

Dear Mr. Wahpat:

The Navy is about to initiate an Environmental Impact Statement (EIS) for the stabilization of in-water floating facilities at the Fox Island Laboratory located on Fox Island, Washington and adjacent to Carr Inlet. As part of the scoping for this project the Navy has reviewed the usual and accustomed fishing maps designated in the *United States v. Washington* (aka Boldt) decision. Our analysis of these maps indicates that Carr Inlet is not within the U&A for the Yakama Tribe. If this interpretation is incorrect please contact me at your earliest convenience. If we do not hear from you we will assume that our analysis is correct.

Enclosed with this letter is a scoping announcement with information on the proposed action and invitation to the scoping open house that will be held on 17 April 2002. We welcome the Tribe's participation in preparation of the EIS.

If you have any questions or desire further information, please feel free to contact me at (360) 396-0927.

Sincerely,

Kimberly H. Kler

KIMBERLY H. KLER
Environmental Planner

Blind Copy to:
Bill Baxley, NSWCCD
Steve Bingham, Adolfson Associates, INC.

KHK 4/22/02

Nisqually Indian Tribe
Natural Resources Division
12501 Yelm Hwy. S.E.
Olympia, Washington 98513
Phone: (360) 438-8687
Fax: (360) 438-8742

April 17, 2002

Ms. Kimberly H. Kler, Environmental Planner
Department of the Navy
Engineering Field Activity, Northwest
Naval Facilities Engineering Command
19917 - 7th Avenue NE
Poulsbo, Washington 98370-7570

RE: Ser 05EC3.KK/672
Letter of April 3, 2002

Dear Ms. Kler,

With reference to your recent letter to Georgiana Kautz referenced above, you have stated that your research indicates that the Nisqually Indian Tribe does not have U&A fishing rights in Carr Inlet. This is not correct.

In 1985 the *U.S. v. Washington* court found that the Nisqually Indian Tribe, along with the Puyallup and Squaxin Island tribes, have U&A rights in Carr Inlet. The reference for this decision is 626 F.Supp 1405(1985).

Sincerely,

George F. Walter
Environmental Program Supervisor

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

Ser 5090/Fox Island
Ser 05EC.3RS/1085
June 17, 2002

Mr. Joe Anderson
Fisheries
Puyallup Tribe
6824 Pioneer Way E
Tacoma, WA 98404

Dear Mr. Anderson:

Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA), the Naval Surface Warfare Center Carderock Division is preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences of the stabilization of in-water facilities at the Fox Island Laboratory. The proposed project is on a small facility located on the south side of Fox Island in Carr Inlet, Section 2, Township 20 North, Range 1 East, Pierce County, Washington. We understand that this action may be in the Puyallup Tribal U&A.

We would be happy to brief you and other Puyallup tribal officials on this action. Please let us know if you would desire such a briefing. Richard Stoll can be contacted at (360) 396-0065 or you may contact Kimberly Kler, project lead, at (360) 396-0927.

Sincerely,

Kimberly K. Kler

KIMBERLY KLER
By direction of the
Commanding Officer

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090/Fox Island
Ser 05EC.3RS/1083
June 17, 2002

Ms. Georgianna Kautz
Fisheries
Nisqually Tribe
4820 She-Nah-Num Drive SE
Olympia, WA 98513

Dear Ms. Kautz:

Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA), the Naval Surface Warfare Center Carderock Division is preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences of the stabilization of in-water facilities at the Fox Island Laboratory. The proposed project is on a small facility located on the south side of Fox Island in Carr Inlet, Section 2, Township 20 North, Range 1 East, Pierce County, Washington. We understand that this action may be in the Nisqually Tribal U&A.

We would be happy to brief you and other Nisqually tribal officials on this action. Please let us know if you would desire such a briefing. Richard Stoll can be contacted at (360) 396-0065, or you may contact Kimberly Kler, project lead, at (360) 396-0927.

Sincerely,

Kimberly H. Kler

KIMBERLY KLER
By direction of the
Commanding Officer

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
19917 7TH AVENUE N.E.
POULSBO, WASHINGTON 98370-7570

5090/Fox Island
Ser 05EC.3RS/1086
June 17, 2002

Mr. Jim Peters
Fisheries
Squaxin Island Tribe
SE 3100 Old Olympic Hwy
Shelton, WA 98584

Dear Mr. Peters:

Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA), the Naval Surface Warfare Center Carderock Division is preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences of the stabilization of in-water facilities at the Fox Island Laboratory. The proposed project is on a small facility located on the south side of Fox Island in Carr Inlet, Section 2, Township 20 North, Range 1 East, Pierce County, Washington. We understand that this action may be in the Squaxin Tribal U&A.

We would be happy to brief you and other Squaxin tribal officials on this action. Please let us know if you would desire such a briefing. Richard Stoll can be contacted at (360) 396-0065, or you may contact Kimberly Kler, project lead, at (360) 396-0927.

Sincerely,

Kimberly H. Kler

KIMBERLY KLER
By directioin of the
Commanding Officer

APPENDIX C

BIOLOGICAL ASSESSMENT

BIOLOGICAL ASSESSMENT

STABILIZATION OF IN-WATER FACILITIES

FOX ISLAND LABORATORY

FOX ISLAND, WASHINGTON

December, 2003

Fox Island Laboratory
Naval Surface Warfare Center
Carderock Division
Detachment Bremerton
630 – 3rd Avenue
Fox Island, Washington 98333

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PROPOSED ACTION

ENDANGERED SPECIES ACT

50 CFR § 402.13 requires agencies to consult informally with the services to determine the effect of the Proposed Action upon listed species and their designated critical habitat. This assessment has been prepared to facilitate consultation between the United States Navy, the action agency, and the National Oceanic and Atmospheric Administration (NOAA) Fisheries and the United States Fish and Wildlife Service (USFWS). The Fox Island Laboratory Stabilization of In-Water Facilities project may occur within the general range of the following Endangered Species Act (ESA)-regulated species (NOAA Fisheries, 2002a; NOAA Fisheries, 2002b; and USFWS, 2002):

- Puget Sound ESU chinook salmon (*Oncorhynchus tshawytscha*). Threatened.
- Coastal/Puget Sound bull trout (*Salvelinus confluentus*). Threatened.
- Bald eagle (*Haliaeetus leucocephalus*). Threatened.
- Marbled murrelet (*Brachyramphus marmoratus*). Threatened.
- Steller sea lion (*Eumetopias jubatus*). Threatened.
- Humpback whale (*Megaptera novaeangliae*). Endangered.
- Leatherback sea turtle (*Dermochelys coriacea*). Endangered.

Project Description. The Naval Surface Warfare Center, Carderock Division Detachment Bremerton, is proposing to stabilize in-water facilities at the Fox Island Laboratory (FIL) on Carr Inlet in southern Puget Sound, Pierce County, Washington (Figure 1). The proposed action will facilitate the mission of FIL by providing a more stable working environment for researchers using the laboratory.

FIL site is composed of two elements: upland facilities and in-water facilities (Figure 2). The property is approximately 1.26 acres (0.5 hectares) and has 150 feet (45.7 m) of shoreline frontage on Carr Inlet. The upland portion of FIL is completely developed and includes one laboratory building, parking, storage, and associated structures. In-water facilities include a fixed access pier, catwalk, moored barges, and mooring facilities. The access pier is approximately 15 feet (4.6 m) wide and is supported by 14 concrete piles. From the pier a 30-foot (9.1 m) catwalk leads to the 912 Barge (YFN-912), which is 112 feet (34m) long by 35 feet 6 inches (10.8 m) wide. Outboard of the 912 Barge are two 60-foot (18.3 m) by 30-foot (9.1 m) fender barges which separate the 912 Barge and the M241 barge. The M241 barge is approximately 195 feet (59 m) long by 54 feet (16.5 m) wide.

There are six dolphins used to position the barges. These consist of clusters of between 7 and 21 wood piles and occur in water depths between 0 and –22 feet (–6.7 m) MLLW.

The Navy proposes four action alternatives in order to correct structural deficiencies of the in-water facilities: 1) replace moorings, 2) install a 240-foot (73 m) pontoon barge, 3) install a 360-foot (110 m) pontoon barge, or 4) install a new fixed pier. The Navy has determined that the 240-foot (73 m) pontoon alternative is the Preferred Alternative, and this Biological Assessment will only evaluate this alternative.

The Action. The Action is described below:

240-Foot Pontoon. The Action will involve installation of a 240-foot (73 m) long pontoon barge at a location approximately 110 feet (34 m) further offshore than existing facilities. The two small fender barges now in use under the current configuration will be removed for repair or decommissioning at an offsite location. A new 100-foot (30 m) pontoon section and new steel girder bridge will be installed connecting the existing pier with the 240-foot (73 m) pontoon. Replacement of the existing mooring system and repair of the pier will consist of the replacement of existing mooring lines with 10 mooring lines (Figure 6b). Clump weights will be suspended at intermediate points along the mooring lines to minimize dragging of the chain and cable on the bottom as the barge rises and falls with the tide.

Construction Activities. This information on construction of the Action is provided based upon a draft description of construction methods provided by Reid Middleton.

Moorings and Pilings. The Action will include the repair and replacement of mooring structures as described below.

Two new anchor cables will extend from the corners of the M241 barge into over 300 feet (91 m) of water. Each anchor system will consist of a 5,000-lb (2,268 kg) Danforth anchor, 6 feet (1.8 m) of steel chain, and over 600 feet (183 m) of 1.5-inch (3.8 cm) steel cable (Figure 6b).

The timber fender piles located along the south side of the fixed pier may be replaced. The two sets of dolphins closest to the beach will be removed (Figure 3). The remaining four timber dolphins will be replaced with either steel or concrete piles.

Construction is expected to last approximately one to three months. Construction activities will consist of:

- Spud down or anchor the construction or material barges;
- Remove the timber dolphins (either removed completely or cut off two feet [0.6 m] below the surface; holes will be back-filled with clean sand);
- Drive new replacement dolphin piles;
- Maneuver the construction and material barges to new locations;
- Replace existing synthetic mooring line;
- Remove the fender piles on the fixed pier; and
- Drive replacement fender piles.

Over-Water Footprint and Shading. The existing condition of FIL site has a combined over-water footprint of 18,200 ft^2 (1,690 m^2). Under the Action, the overall footprint increases by 92.9 percent; however, the amount of shaded area under 20 feet (6 m) in depth decreases by 27.3 percent from the present condition.

Upland Construction. Activities on the upland portion of FIL site are limited to material stockpiling and removal of exposed wood debris from the beach. Stockpiling of construction material will be limited to portions of the site that are currently paved parking lot.

Action Area. The aquatic Action Area as defined for this project includes the area of Carr Inlet from Green Point on the northeast shore just northwest of Fox Island to the southeast point of Fox Island. The Action Area for avian species includes the entire FIL site and all upland area within a one-mile (1.6 km) radius of the laboratory.

Marine. The bathymetry of Carr Inlet adjacent to Fox Island is characterized as steeply sloping. Water depths exceed 50 feet (15.2 m) within 300 to 600 feet (91.4 to 183 m) from shore. FIL is located where depths of the nearshore area reach 50 feet (15.2 m) approximately 325 feet (99 m) from the shore. The shallow nearshore area adjacent to FIL is narrow.

Upland. Upland vegetation adjacent to the facility is mixed forest dominated by Douglas fir and red alder, with an understory of salal and sword fern. Upland vegetation within the fenced perimeter of FIL property is predominantly maintained lawn. The backshore on FIL property is predominantly unvegetated and is covered with wood debris deposited by wave action (driftwood).

Intertidal and Subtidal. Beach substrate consists of sand, gravel, and cobble throughout the higher intertidal zone. Substrates decrease in size in subtidal zones with the amount of fine sand and silt increasing with depth toward the drop off at between 6 and 18 feet (1.8 to 5.5 m).

Eelgrass beds in the immediate vicinity (within 120 feet [36.6 m]) of the Access Pier are characterized as being small and sparse (less than 10 shoots per patch).

Salmonids

Salmonids. Juvenile chinook salmon are anticipated to occur within nearshore areas of the project area during the late spring and early summer period coinciding with their peak outmigration. Juvenile salmon are known to utilize eelgrass beds and other areas of nearshore aquatic vegetation for cover and to find forage during this period.

Bull Trout. There is little known about bull trout use of Carr Inlet and it is not known to what extent bull trout use marine nearshore areas in the vicinity of Fox Island. While bull trout may use nearshore areas within the action area, it is anticipated to be rare but cannot be precluded. Streams within the Action Area have temperatures which exceed spawning requirements of bull trout (WDFW, 1998).

Habitat Parameters for Salmon and Trout. In the absence of population-specific information, an assessment must define the biological requirements of a listed fish species in terms of properly functioning conditions (PFC). PFC are described as the sustained presence of natural habitat-forming processes necessary for the long-term survival of the species through the full range of environmental variation.

Existing environmental conditions within the Carr Inlet Action Area are evaluated according to the criteria established in the matrix of pathways and indicators described in the body of this report (see Table 2).

Analysis of Effects

Turbidity. The Action will require in-water construction associated with the removal of existing wood piles, replacement of the existing mooring system, and the reconfiguration of overwater structures. Given the relatively small areas and limited scope of in-water work, natural substrate conditions, and timing restrictions on construction, the potential for turbidity to affect chinook salmon or bull trout is likely negligible and existing turbidity conditions will be maintained.

Dissolved oxygen. The Action will not result in additional nutrient sources or result in discharges with high oxygen demand. The potential is negligible for construction or operation to alter dissolved oxygen (DO) levels within the project area to the extent that would affect chinook salmon, bull trout, or other fish.

Water Contamination. The Action includes the removal of creosote-treated wood piles that are currently part of the existing mooring system. Replacement mooring system components will be constructed of coated steel pilings or pre-cast and cured concrete piles. There will be no increase in impervious surface area. As a result, the potential for contaminants to affect chinook salmon or bull trout is anticipated to be negligible.

Sediment Contamination. Sediment conditions are expected to maintain the current uncontaminated condition.

Substrate/Armoring. The barges and other in-water facilities act as a floating breakwater. This has resulted in the formation of the salient at FIL.

The Action does not involve additions or improvements to the existing bulkhead. The Action will require no additional shoreline armoring; therefore, the project will maintain substrate and armoring conditions within the Action Area.

Depth/Slope. There will be no alteration of depth or slope in the Action Area as a result of the Action.

Tideland Condition. No work will occur within marshes, flats, or other tideland areas. The Proposed Action will maintain tideland conditions within the Action Area.

Marsh Prevalence and Complexity. The Proposed Action will have no effect on, and will therefore maintain marsh prevalence/complexity within the Action Area.

Refugia. The refugia indicator is a composite of many other physical habitat indicators. As described above, the Action will maintain all other physical habitat indicators; therefore, the refugia indicator will be maintained within the Action Area.

Physical Barriers. The general configuration of in-water facilities at FIL will remain the same under the Action. The Action will involve the removal of over-water and in-water structures from shallow nearshore habitats. The quantity of over-water cover of shallow nearshore areas will be less than existing conditions. As a result, the potential for the Action to act as a physical barrier to fish migrating along the shoreline will be less than the present baseline conditions. Thus, the Action will maintain or improve this indicator within the Action Area.

Salt/Fresh Water Mixing. The Action will not affect any fresh water systems. The Action will not create additional outfalls or sources of freshwater within the Action Area; this will maintain the status of this indicator.

Benthic Prey Availability. The Action will result in no loss of benthic prey dependent on eelgrass communities, maintaining the status of this indicator.

Forage Fish Community. The Action will not alter beach areas that are known to support spawning for Pacific herring or sandlance. The Action will also maintain all other indicators including substrate condition, water quality, sediment quality, aquatic vegetation, depth and slope, and physical barriers. The Action will not affect populations of forage fish within the Action Area and will maintain this indicator.

Aquatic Vegetation. The Action will require the continued use of in-water structures at FIL. The Action will cover the water surface resulting in shading of nearshore areas. Shading in nearshore areas by over-water structures can reduce the density and abundance of aquatic vegetation, including eelgrass and may result in the loss of eelgrass under the structures. However, the Action will move the bulk of over-water structures to deeper waters where aquatic vegetation is absent. As a result, the effect on aquatic vegetation will be reduced under the Action. This will maintain the condition of aquatic vegetation within the Action Area.

Exotic Species. The Action will not increase the potential for exotic species to occur within the Action Area. The Action will maintain physical, chemical, and biological indicators within the Action Area and will not create a disturbance that would provide significant advantage to exotic species.

Conservation Measures

Conservation measures will be employed to reduce cumulative impacts to habitat.

- Avoid work between mid-October and mid-June to reduce potential impacts to juvenile salmon and forage fish such as surf smelt and Pacific herring.
- Comply with applicable permit conditions and other measures to protect water quality during in-water work. Care will be taken to prevent any petroleum products, chemicals, or other toxic or deleterious materials from entering the water.
- Avoid shadowing effects by constructing a new gangway between the Access Pier and in-water facilities made of metal grating or other material that passes light.
- Reduce the potential for on-going water and sediment quality contamination by removing the existing treated wood pilings.

Effects Determination

Chinook Salmon. The Action will result in in-water and over-water construction that may temporarily affect turbidity and water quality in localized areas that provide habitat for chinook salmon. Therefore, the Action **may affect** the Puget Sound chinook salmon. Potential short-term effects will be minimized to discountable levels by the proposed conservation measures identified above. The Action will not degrade physical, chemical, or biological habitat indicators throughout the Action

Area. Therefore, the project is **not likely to adversely affect** Puget Sound chinook salmon and their critical habitat.

Bull Trout. The Action will result in in-water and over-water construction that may temporarily affect turbidity and water quality in localized areas that may provide occasional habitat for bull trout. Therefore, the Action **may affect** the Coastal/Puget Sound bull trout. Potential short-term effects to bull trout will be minimized to discountable levels by the proposed conservation measures identified above. The Action will not degrade physical, chemical, or biological habitat indicators throughout the Action Area. Therefore, the project is **not likely to adversely affect** Coastal/Puget Sound bull trout.

Humpback Whale. Humpback whales are not expected to occur within the Action Area during proposed project activities. Leatherback sea turtles are not expected to occur in the Action Area during proposed project activities. Due to the nature of the project coupled with the absence of these species within the Action Area, it is determined that the Preferred Alternative will have **no effect** on humpback whale and will have **no effect** on leatherback sea turtle.

Steller Sea Lion. Steller sea lion may occasionally occur within the Action Area. The Action will result in-water work that may affect sea lion forage fish. Therefore, the Action **may affect** Steller sea lion. Potential short-term effects will be minimized to discountable levels through the use of the proposed conservation measures. The Action will not result in the degradation of existing habitat conditions in the Action Area; therefore, the project is **not likely to adversely affect** Steller sea lion.

Leatherback sea turtle. Leatherback sea turtles are not expected to occur in the Action Area during proposed project activities. Due to the nature of the project coupled with the absence of the species within the Action Area, it is determined that the Action will have **no effect** on leatherback sea turtle.

Bald Eagle. Bald eagles are known to occur within the Action Area, as well as throughout Puget Sound. The nearest nest to FIL is approximately 700 feet (210 m) from the shoreline at FIL. The Action will result in noise and activity that may disturb bald eagles, and in-water work which may affect forage fish and waterfowl species, the food sources of the bald eagle. Therefore, the Action **may affect** bald eagles. Potential short-term effects will be minimized to discountable levels through the use of the proposed conservation measures. The Action will not result in the degradation of existing habitat conditions in the Action Area; therefore, the project is **not likely to adversely affect** bald eagle.

Marbled Murrelet. Marbled murrelets are known to occur within the Action Area. There are no known nests in the vicinity of FIL, and no typical nesting habitat is present. The Action will result in noise and activity which may disturb foraging marbled murrelets, and in-water work which may affect forage fish. Therefore, the Action **may affect** marbled murrelet. Potential short-term effects upon murrelet foraging will be minimized to discountable levels through the use of the proposed conservation measures. The Action will not result in the degradation of existing habitat conditions in the Action Area; therefore, the project is **not likely to adversely affect** marbled murrelet.

1.0 INTRODUCTION

Seven species listed by National Oceanic and Atmospheric Administration (NOAA) Fisheries and the United States Fish and Wildlife Service (USFWS) (jointly referred to as the Services) are identified as being present within the vicinity of Fox Island Laboratory (FIL):

Common Name	Scientific Name	Regulatory Agency/Status*
Puget Sound chinook salmon	*Oncorhynchus tshawytscha*	NOAA Fisheries/Threatened
Coastal / Puget Sound bull trout	*Salvelinus confluentus*	USFWS/Threatened
Bald eagle	*Haliaeetus leucocephalus*	USFWS/Threatened
Marbled murrelet	*Brachyrhamphus marmoratus*	USFWS/Threatened
Humpback Whale	(*Megaptera novaeangliae*)	NOAA Fisheries/Endangered
Leatherback Sea Turtle	*Dermochelys coriacea*).	NOAA Fisheries/Endangered
Steller Sea Lion	*Eumetopias jubatus*	NOAA Fisheries/Threatened

Endangered: defined by regulation as being in danger of extinction; Threatened: species likely to become endangered within the foreseeable future.

The Navy has prepared this biological assessment in accordance with 50 CFR § 402.12 to facilitate the consultation process. This biological assessment has been prepared for the Naval Surface Warfare Center, Carderock Division, Fox Island Laboratory, located on Fox Island, Pierce County, Washington.

Puget Sound chinook salmon and coastal/Puget Sound bull trout may occur in the waters of Carr Inlet adjacent to FIL. Chinook salmon spawn in Minter and Burley Creeks, both of which flow into Carr Inlet. Bull trout are not known to spawn in any of the streams that flow into Carr Inlet; however, it is likely that some bull trout forage in these waters. Bald eagles are known to nest within the vicinity of FIL, and marbled murrelet forage in the waters of Carr Inlet. Steller sea lion occasionally occur in Carr Inlet. Humpback whale and leatherback sea turtle are known to occur in Washington waters. The presence of these species in the vicinity of the Proposed Action at FIL has triggered this biological assessment. The effects of the Action on listed species are also addressed in this biological assessment.

2.0 DESCRIPTION OF THE ACTION

The Naval Surface Warfare Center, Carderock Division, is proposing to stabilize in-water facilities at Fox Island Laboratory (FIL) on Carr Inlet in southern Puget Sound, Pierce County, Washington (Figure 1). FIL was established in the 1950s as the Carr Inlet Acoustic Range (CIAR), serving both diesel and nuclear submarines. In 1992, acoustic range activities were moved to the Southeast Alaska Acoustic Facility (SEAFAC). CIAR was then renamed FIL and continues research and developmental testing of small underwater equipment and vehicles for the Navy. As part of Carderock Division, FIL's current mission is:

> "To provide a unique, shallow water (<400 feet) (122 m), protected ocean environment facility which operates and maintains operational barges, shore facilities, personnel and resources required to support research, development, testing and evaluation… for the Navy Deep Submergence Program and other research efforts (commercial, academic, and private research laboratories)."

2.1 Existing Facilities

FIL site is composed of two elements: upland facilities and in-water facilities. The upland portion of FIL property measures approximately 150 feet (45.7 m) wide by 350 feet (107 m) deep (Figure 2). The property is approximately 1.26 acres (0.5 hectares) and has 150 feet (45.7 m) of shoreline frontage on Carr Inlet. The site slopes from an elevation of approximately 100 feet (30.5 m) means lower low water (MLLW) southwest to the shoreline. The upland portion of FIL is completely developed and includes one laboratory building, a separate laboratory trailer, parking, storage, and associated structures. A riprap bulkhead (Figure 2) separates the upland facilities and in-water facilities. In-water facilities include a fixed Access Pier, catwalk, moored barges, and mooring facilities (Figures 3 and 4). The Access Pier is approximately 15 feet (4.6 m) wide and is supported by 14 concrete piles. From the pier a 30-foot (9.1 m) catwalk leads to the 912 Barge (YFN-912). The 912 Barge is 112 feet (34 m) long by 35 feet 6 inches (10.8 m) wide (Figure 3). This barge serves as a support facility and includes a machine shop and work areas for assembling in-water systems, storage of mooring and rigging gear, and conducting maintenance on small boats. Outboard of the 912 Barge are two 60-foot (18.3 m) by 30-foot (9.1 m) fender barges moored end-to-end (Figure 3). These barges are referred to as "camels" and separate the 912 Barge and the M241 barge. The M241 barge is approximately 195 feet (59 m) long by 54 feet (16.5 m) wide. The M241 barge is the active work area for research and testing conducted at FIL and includes a moon pool, overhead hoists, enclosed work areas, and other support systems used by scientists and engineers. In addition to these four barges, in-water facilities include a small Remote Crane Barge (RCB) and several small, motorized vessels and skiffs.

There are six dolphins used to position the barges. These consist of clusters of between 7 and 21 wood piles and occur in water depths between 0 and –22 feet (–6.7 m) MLLW (Figures 3 and 5). Three dolphins are located on each side of the pier.

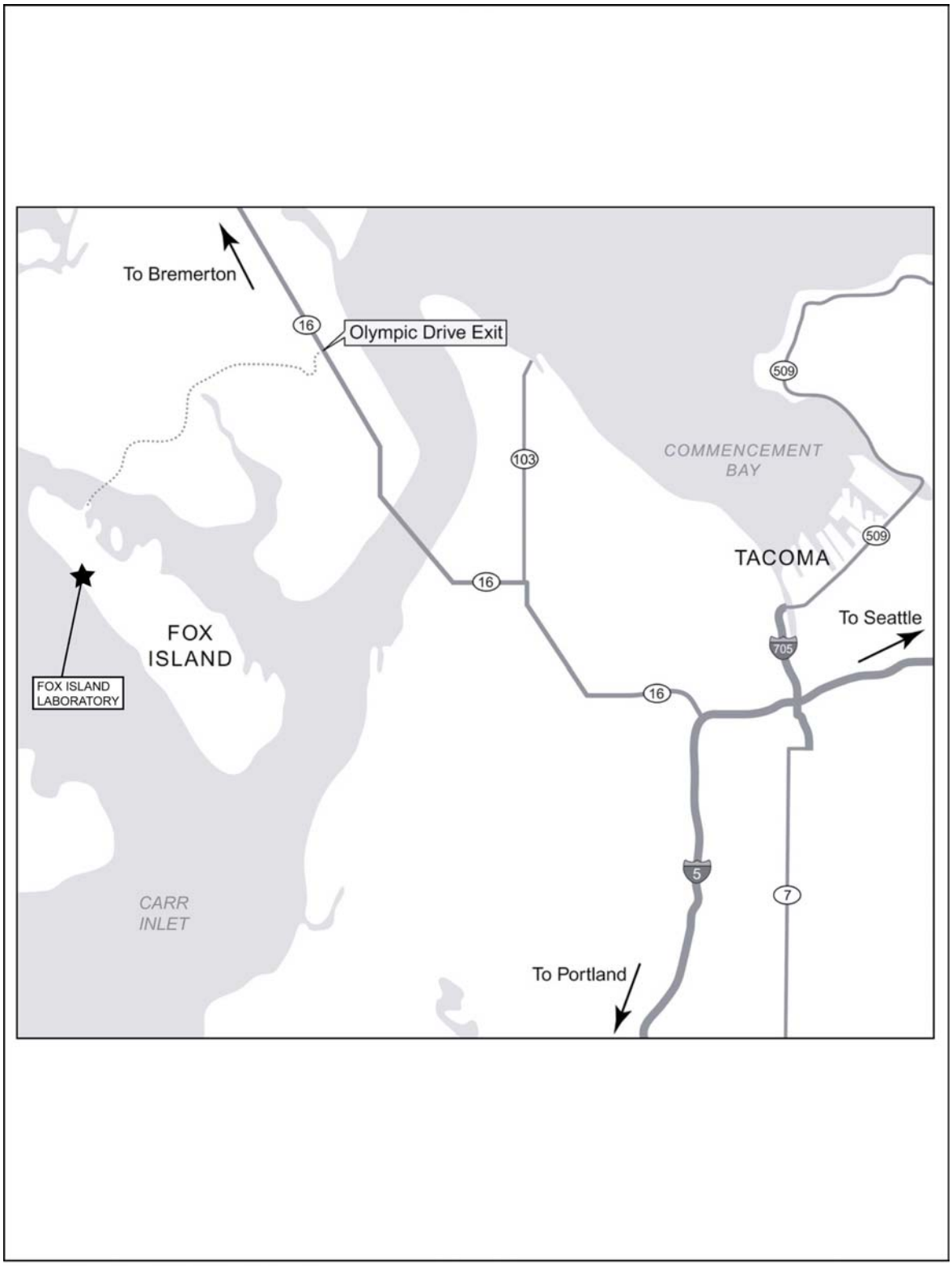

Figure 1. Location of Fox Island Laboratory.

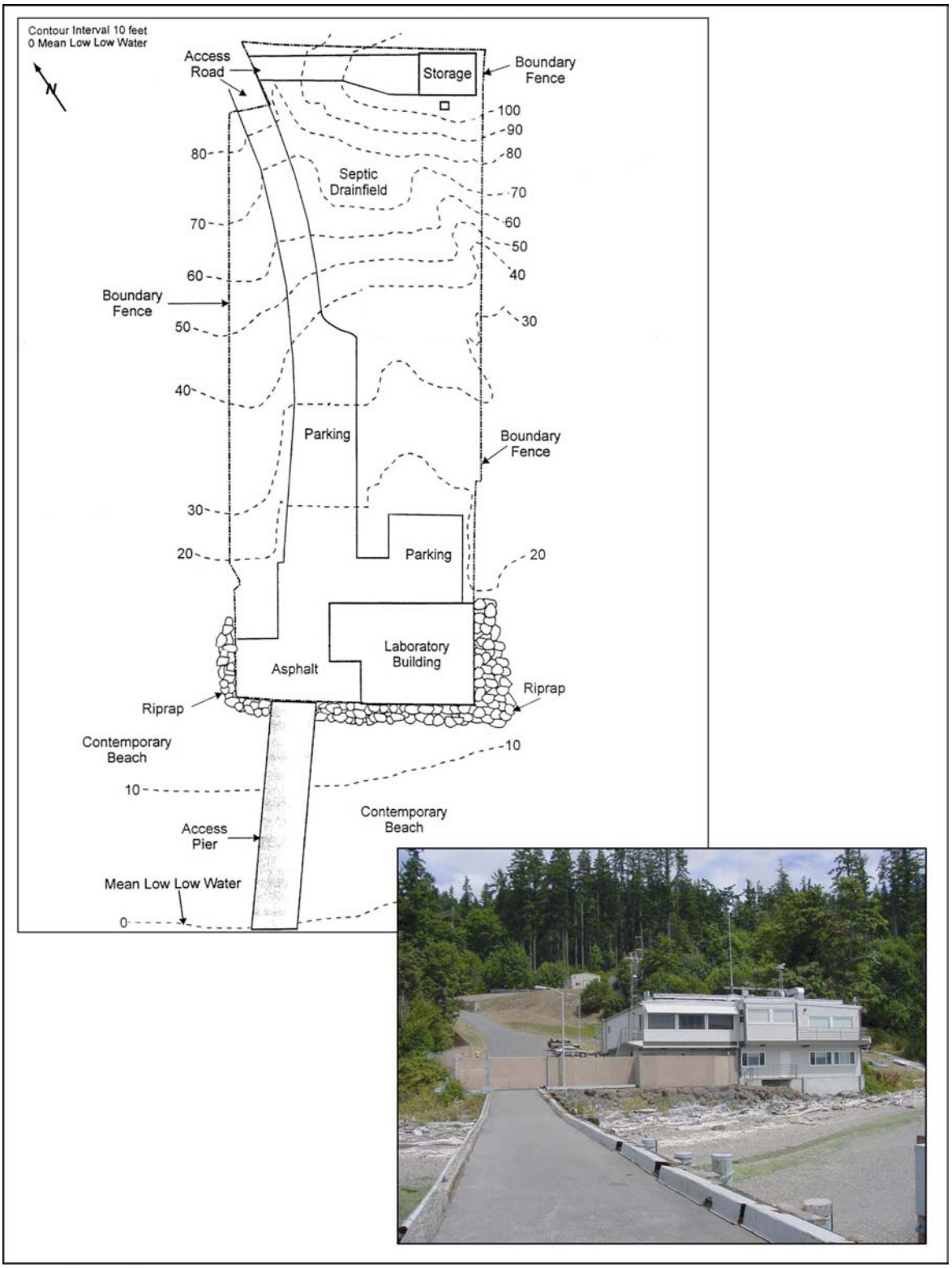

Figure 2. Upland area.

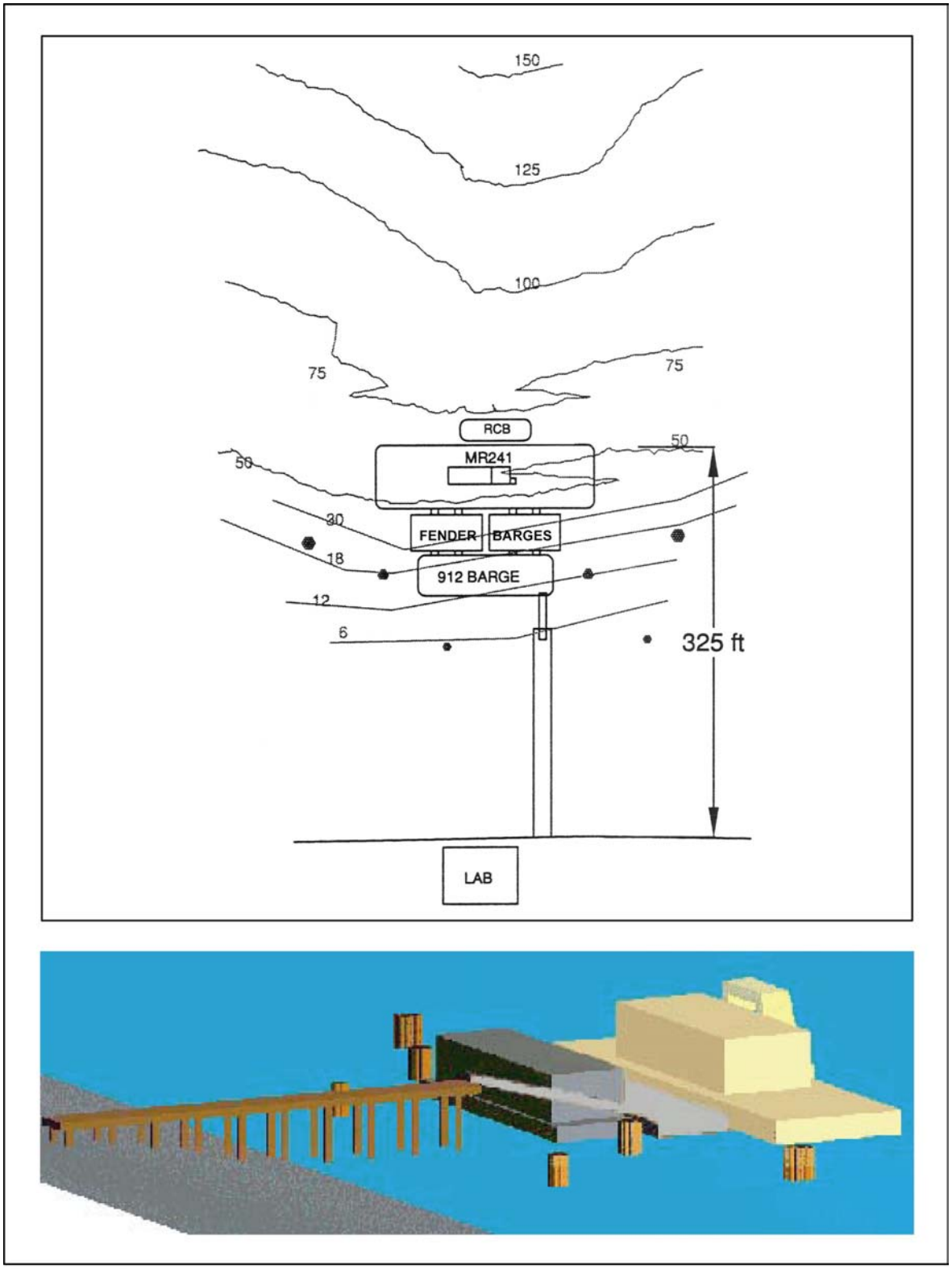

Figure 3. Existing barge configuration.

Figure 4. Overview of Fox Island Laboratory.

Mooring dolphins surrounding in-water facility.

Close-up view of mooring dolphin.

Figure 5. Mooring dolphins.

2.2 Proposed Action

2.2.1 PURPOSE AND NEED

Fox Island Laboratory must provide stable in-water facilities in order to meet its mission requirements. The purpose of the Proposed Action is to prevent additional damage to existing facilities and to improve the safety of personnel at the laboratory. Replacement of the existing configuration of pier and barges with a more stable platform and replacement of the existing mooring components is intended to correct structural deficiencies and provide safe working conditions. A more stable working platform having secure mooring systems would result in more efficient movement of staff and transfer of equipment between the pier and barges. Proposed improvements would ensure a safe working environment for researchers using the laboratory.

2.2.2 THE NEPA PROCESS

The National Environmental Policy Act (NEPA) requires that an environmental analysis of potential effects of a proposed federal action be conducted and that this information be made available to decision makers and the public. The Endangered Species Act (ESA) and enabling legislation specifies that a biological assessment should also be prepared for actions triggering a NEPA Environmental Impact Statement (EIS). A Notice of Intent to prepare an EIS for FIL project was published in the Federal Register (Volume 67, Number 60) on March 28, 2002.

A Draft Environmental Impact Statement (DEIS) has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council of Environmental Quality and U.S. Navy implementing guidelines for NEPA Environmental and Natural Resources Program Manual (U.S. Navy, 1999). The Draft EIS evaluates three (3) action alternatives and a No Action alternative. The DEIS evaluates each alternative equally and designates a Preferred Alternative, which this Biological Assessment (BA) addresses.

2.2.3 ACTION

The Action is described below:

240-Foot Pontoon. Under the Action, existing mooring components will be replaced. The six existing wood pile dolphins and anchoring systems will be removed. New mooring systems, consisting of spud piles, dragged-in anchors, and clump weights will be installed (Figure 6b). The existing pier will be repaired by replacing deteriorated piles with steel and/or concrete piles. The Action will involve installation of a 240-foot (73 m) long pontoon barge at a location approximately 110 feet (34 m) further offshore than existing facilities (Figure 7). The two small fender barges now in use under the current configuration will be removed for decommissioning at an offsite location. A new 100-foot (30 m) pontoon section and new steel girder bridge will be installed connecting the existing pier with the 240-foot (73 m) pontoon. Replacement of the existing mooring system and repair of the pier will consist of the replacement of existing mooring lines with 10 mooring lines (Figure 6b). Four mooring lines will run from new spud piles installed below grade in the intertidal zone to the pontoons. Clump weights will be suspended at intermediate points along the mooring lines to minimize dragging of the chain and cable on the bottom as the pontoons rise and fall with the tide.

Four dragged-in anchors will be set approximately 600 feet (184 m) seaward of the 240-foot pontoon. Mooring lines will connect these anchors with the pontoon with clump weights suspended at intermediate points. Finally, two spud pile anchors will be installed in the shallow subtidal zone. Mooring lines approximately 160 feet (49 m) long will connect the spud piles with the pontoon.

2.2.3.1 In-Water Construction

The information provided below is based upon a draft description of construction methods provided by Reid Middleton (August 2002). Table 1 has been prepared to compare the shading effects of existing structures and the Action.

2.2.3.2 Moorings

The Action will make repairs to the mooring system to provide additional security for the pontoons. Two anchor cables will extend from the corners of the 240-foot pontoon into over 300 feet of water. Each anchor system will consist of a 5,000 lb (2,268 kg) Danforth anchor, six feet (1.8 m) of steel chain, and over 600 feet (183 m) of 1.5-inch (3.8 cm) steel cable (Figure 6b).

The timber fender piles located along the south side of the fixed pier will be replaced. The two sets of dolphins closest to the beach will be removed under the Action (Figure 3). The remaining four timber dolphins will be replaced with either steel or concrete piles. Due to differences in material properties, fewer steel or concrete piles will be necessary to replace the existing wood dolphins.

Construction is expected to last approximately one to three months. Piles will be disposed of in an approved upland facility. Construction activities are as follows:

- Spud down or anchor the construction or material barges;
- Remove the timber dolphins (either removed completely or cut off two feet [0.6 m] below the surface; holes will be back-filled with clean sand);
- Drive new replacement dolphin piles;
- Maneuver the construction and material barges to new locations;
- Replace the existing synthetic mooring line;
- Remove the fender piles on the fixed pier (disposed in approved site); and
- Drive replacement fender piles.

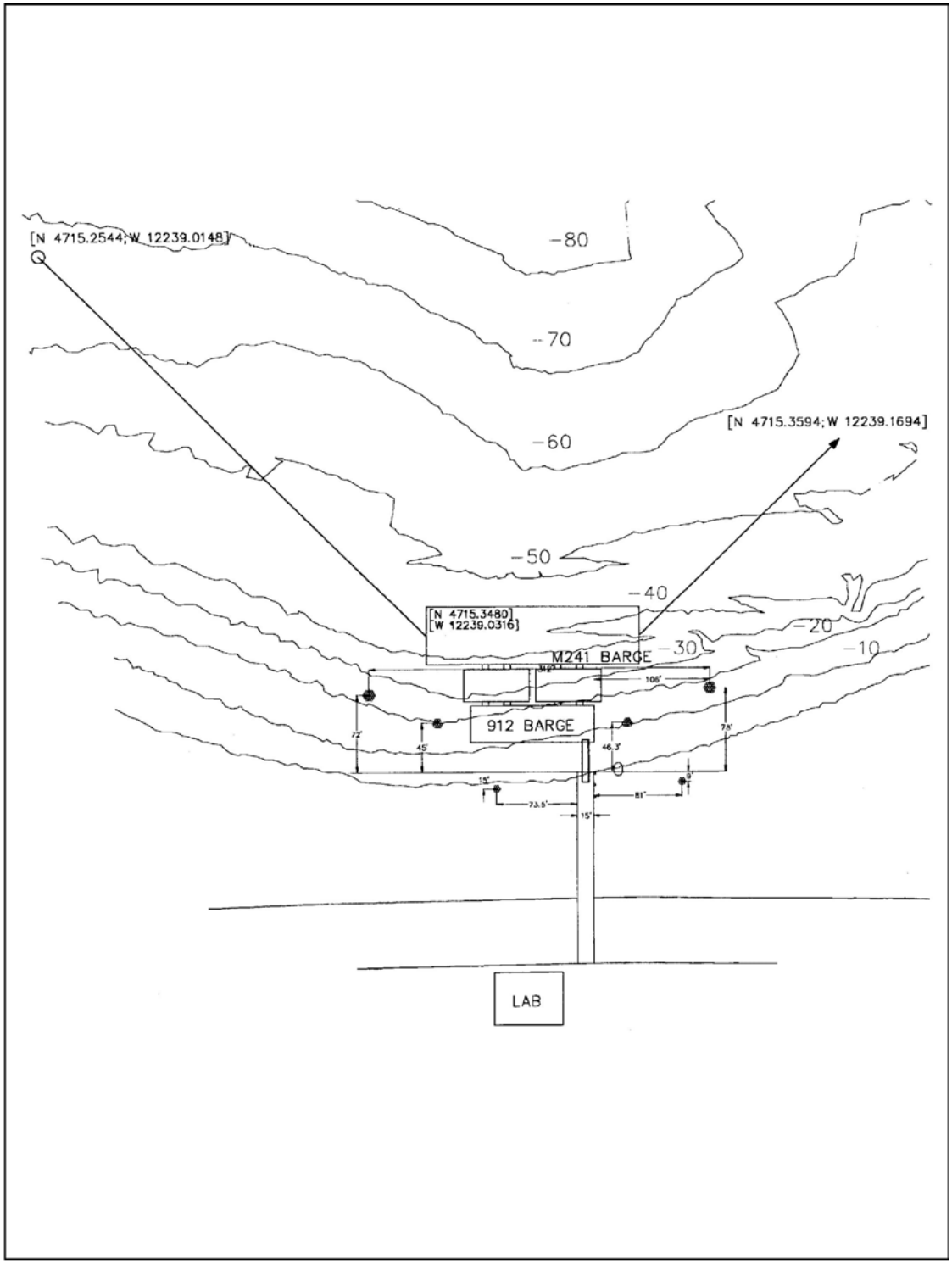

Figure 6a. Existing mooring system.

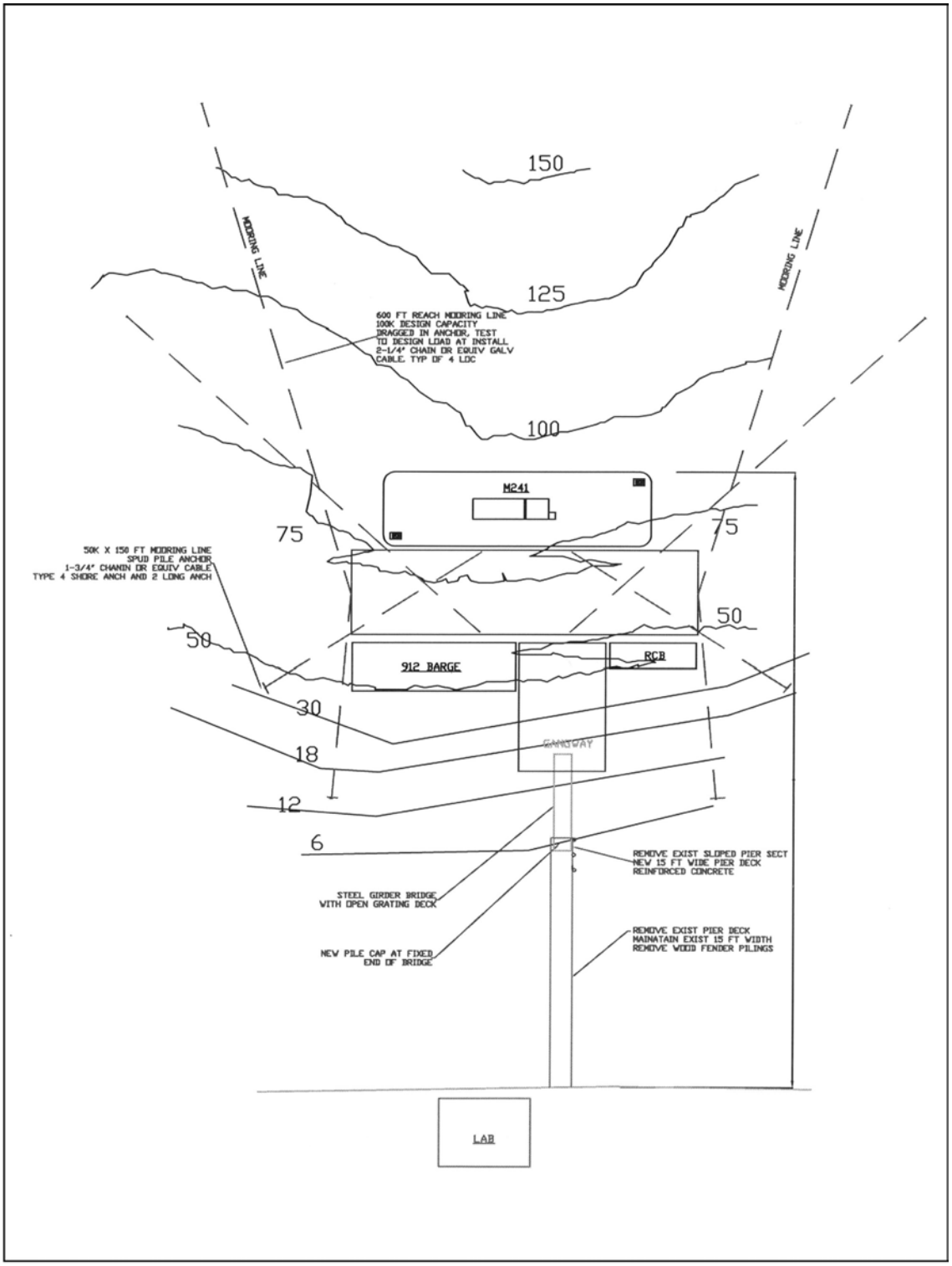

Figure 6b. New mooring system.

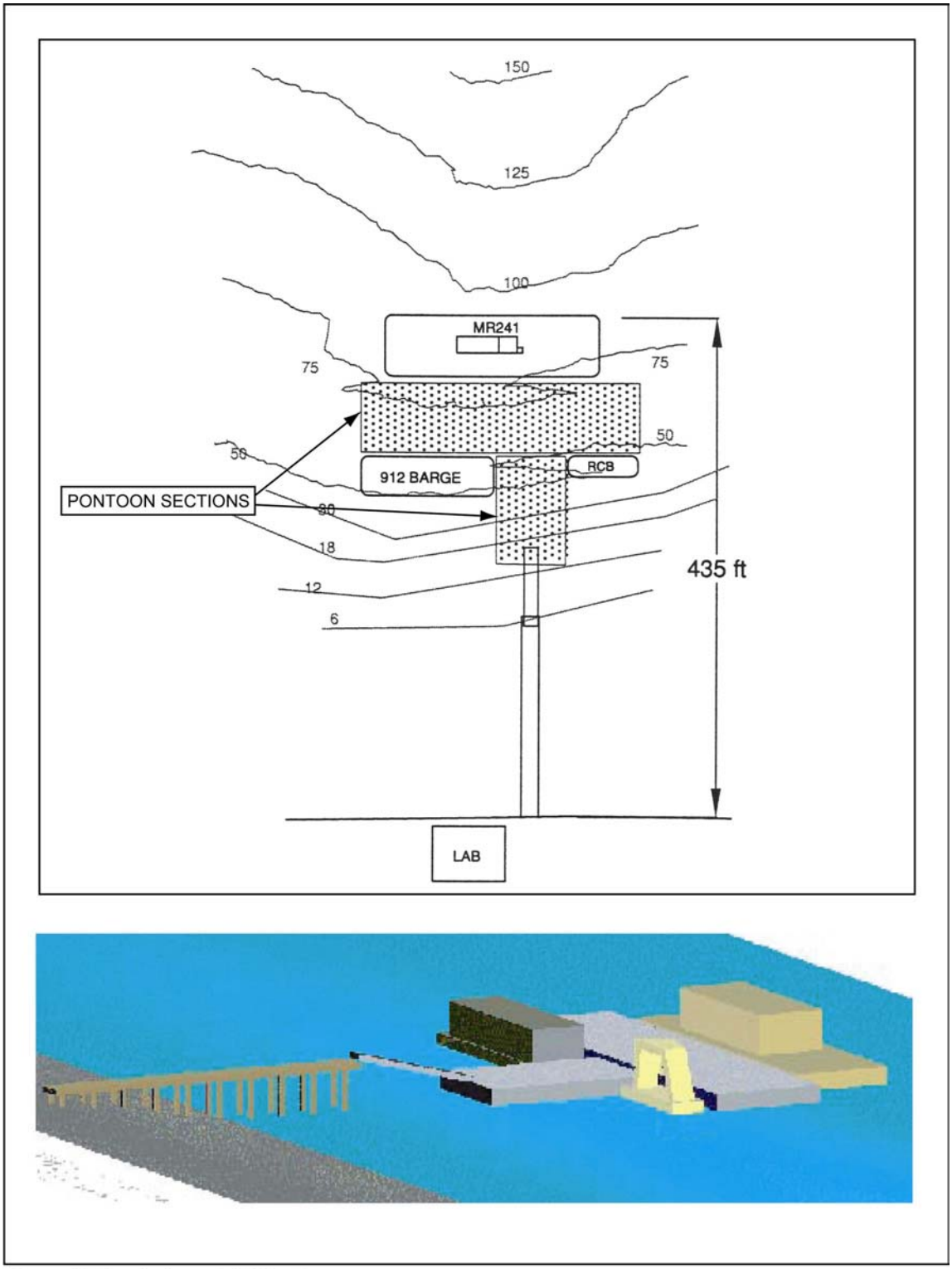

Figure 7. The Action - 240' Pontoon

Equipment for the Action will consist of:

- a pile driving barge with generator, crane, and diesel pile-driving hammer;
- a material barge for holding piles, and
- a motorized work boat.

Construction will be performed from both water and land. Some material or equipment will be transported to the site by land, including concrete and concrete pumper trucks. An upland laydown site will be required for contractor equipment and material storage. Upland equipment will include pick-up trucks, generator, concrete trucks, and pumpers.

2.2.3.3 Over-Water Footprint and Shading

The existing condition of FIL site has a combined over-water footprint of 18,200 ft^2 (1,690 m^2). Under the Action, the overall footprint increases by 92.9 percent; however, the amount of shaded area under 20 feet (6 m) in depth decreases by 27.3 percent from the present condition (Table 1).

Table 1. Shading of Intertidal / Subtidal Areas by The Action

Area (ft^2/m^2)	Action	Existing Condition
Total Overwater Footprint	35,200 ft^2 (3,270 m^2)	18,250 ft^2 (1,695.5 m^2)
Percent Change From Existing	+92.9%	0%
Footprint Under 50' (15 m) in Depth	7,200 ft^2 (670 m^2)	12,000 ft^2 (1,120 m^2)
Percent Change From Existing	–40%	0%
Footprint Under 20' (6 m) in Depth	3,200 ft^2 (300 m^2)	4,400 ft^2 (410 m^2)
Percent Change From Existing	(–27.3%)	0.0%

2.2.3.4 Upland Construction

Activities on the upland portion of FIL site are limited to material stockpiling and equipment storage. Storage and stockpiling of construction material will be limited to portions of the site that are currently paved parking lot.

3.0 GENERAL DESCRIPTION OF THE ACTION AREA

FIL is located on Fox Island in Carr Inlet. Carr Inlet is a large, northwest–southeast trending inlet in southern Puget Sound. The aquatic Action Area as defined for this project includes the area of Carr Inlet from Green Point on the northeast shore just northwest of Fox Island to the southeast point of Fox Island (Figure 1). This area of Carr Inlet has been designated as the aquatic Action Area, because this is a well-defined water body and is at the appropriate scale with which to evaluate potential effects of the Action on threatened and endangered marine species. The Action Area for avian species includes the entire FIL site and all upland area within a one-mile (1.6 km) radius of the laboratory. This area is a conservative estimate based on the disturbance zone recommendations in the Pacific Bald Eagle Recovery Plan (USFWS, 1986) and other literature cited herein.

3.1 Marine Environment

3.1.1 PHYSICAL OCEANOGRAPHY

Carr Inlet is about 13 nautical miles (24 km) in length and ranges from one to two nautical miles (1.8 to 3.7 km) in width over much of its length. It has a maximum depth of approximately 535 feet (163 m) off Gibson Point. The average daily tide range is 9.5 feet (2.9 m). Complex forces comprised of freshwater inputs, tides, and winds drive circulation throughout Puget Sound, including Carr Inlet. The average residence time for water in Central Puget Sound is approximately 120 to 140 days. Residence times in South Puget Sound are much longer as a result in the number of isolated inlets and restricted deep basins such as Carr Inlet (NOAA, 2002).

Tides within the project area fluctuate between two high and two low tides per lunar day. The two tide cycles usually have unequal heights. High and low tides vary 10 ft (3.1 m) per day on average, but the difference can be as much as 15 ft (4.6 m). Littoral currents at the site are generated by tides, direct wind effects, and by momentum transport from waves. Facing southwest, Fox Island Laboratory is fully exposed to winds and associated waves generated by events originating between the south-southeast and west-northwest, but it is protected from waves generated from all other directions.

3.1.2 CHEMICAL OCEANOGRAPHY

Carr Inlet is stratified with a layer of less saline warmer water overlying colder, more saline water. The salinity of the upper layer is sensitive to the amount of freshwater input and may decrease during extended periods of precipitation. There exists a strong relationship between the physical and biological processes in Carr Inlet—throughout the summer and early fall, variability in wind, rainfall, and sunlight result in fluctuations in temperature and salinity, resulting in intermittent periods of strong stratification and deep mixing (USEPA, 2002).

3.1.3 BATHYMETRY

The bathymetry of Carr Inlet adjacent to Fox Island is characterized as steeply sloping. Water depths exceed 50 feet (15.2 m) within 300 to 600 feet (91.4 to 183 m) from shore (Figure 3). FIL is located where depths of the nearshore area reach 50 feet (15.2 m) approximately 325 feet (99 m) from the shore

(Figure 3). The shallow nearshore area adjacent to FIL is narrow. At a water depth between 6 and 18 feet (1.8 to 5.5 m), bottom contours descend rapidly creating a steep drop-off (Figure 3) (Shepsis, 2002).

3.2 Environmental Quality

3.2.1 Land Use and Development

FIL is located on property owned by the United States Navy. The property extends to "the extreme low tide line" per the site legal description. The portions of the in-water facilities that extend beyond the extreme low tide line are located on submerged aquatic lands owned by the State of Washington and managed by the Washington Department of Natural Resources (DNR). Properties northwest and southeast of FIL are privately owned and developed as single-family residential homes. These properties front 3rd Avenue and extend to the mean high tide line per the site legal descriptions. Some residential properties include private boat ramps and bulkheads. Current shoreline use includes boating and recreation by both residents and the public. Fox Island has three shoreline environment designations, as established by Pierce County Code (PCC, § 20.18.180). Generally, the northeast side of the island is designated Rural-Residential. The northwest tip and the southwest side of Fox Island is designated Shoreline Conservancy, with the exception of the Nearns Point spit which is designated Natural. FIL is located within the Conservancy designated areas. The Conservancy Environment is designed to protect, conserve, and manage existing natural resources and valuable historic and cultural areas in order to ensure recreational benefits to the public to achieve sustained resource utilization. FIL and surrounding parcels are zoned "Rural Residential, Rural 10" (PCC § 18A.25.150). The Rural 10 designation allows a density of one unit per 10 acres with minimum lot size of one acre for new lots. This zoning designation is intended to provide for rural uses incorporating existing as well as historic patterns of settlement and character.

Pierce County Comprehensive Planning also incorporates several community plans. Fox Island is included in the Gig Harbor Peninsula Community Plan, adopted on March 12, 2002 (Pierce County, 2002b).

3.2.2 Water Quality

The Washington Department of Ecology (Ecology) operates a surface water quality monitoring station located approximately 3 miles (4.8 km) northwest of FIL (ID# CRR001). The site monitors tidal, diurnal, seasonal, and inter-annual cycles and trends in stratification, oxygen, nutrients, water clarity, and phytoplankton abundance and community distribution. Ecology identifies Carr Inlet as a "moderate" level of concern for marine water quality as a result of seasonally low dissolved oxygen concentrations, low concentrations of nitrogen-dissolved nutrients, moderate concentrations of ammonium, and seasonal stratification. Carr Inlet is sensitive to eutrophication (Ecology, 2002e) and Carr Inlet is listed as an impaired water body for fecal coliform and low dissolved oxygen concentrations on the 1998 Clean Water Act (CWA) Section 303[d] list of impaired waters (USEPA, 2002d).

3.2.3 HABITAT QUALITY

3.2.3.1 Upland

Upland vegetation adjacent to the facility is mixed forest dominated by Douglas fir (*Pseudotsuga menzeisii*) and red alder (*Alnus rubra*), with an understory of salal (*Gaultheria shallon*) and sword fern (*Polystichum munitum*) (Figure 4). Associate tree species include Pacific madrone (*Arbutus menzeisii*), and big-leaf maple (*Acer macrophyllum*). Breaks in the canopy are vegetated with Pacific blackberry (*Rubus ursinus*), ocean spray (*Holodiscus discolor*), snowberry (*Symphoricarpos albus*), and bracken fern (*Pteridium aquilinum*) (Adams and Hamilton, 1999). Upland vegetation within the fenced perimeter of FIL property is predominantly maintained lawn (Figure 8). A few shrub species occur along the boundary fence. The riprap bulkhead separates the upland areas from the backshore. The backshore on FIL property is predominantly unvegetated and is covered with wood debris deposited by wave action (driftwood). Plant species occurring in the backshore include Puget Sound gumweed (*Grindelia integrifolia*), plantain (*Plantago maritime juncoides*), beach pea (*Lathrus japonicus*), saltbush (*Atriplex patula*), and Canada thistle (*Cirsium arvense*).

3.2.3.2 Intertidal and Subtidal

Beach substrate consists of sand, gravel, and cobble throughout the higher intertidal zone (Miller et al., 2002). Substrates decreased in size in subtidal zones with the amount of fine sand and silt increasing with depth toward the drop off at between 6 and 18 feet (Figure 3). Beyond the drop off at approximately 10 feet in depth, the bottom is characterized as typical of other soft bottom habitats in Puget Sound (Miller et al., 2002). The predominant direction of sediment movement along the southwest shoreline of Fox Island is to the north as a result of the tides and prevailing winds, current, and wave action, but sediment is known to move in both directions along the beach (Miller et al., 2002).

Macroalgae including fucus (*Fucus distichus*) and sea lettuce (*Ulva lactuca*) were observed during a July 9, 2002 field visit at low tide (Figure 9). Eelgrass beds are present within nearshore areas adjoining FIL at depths ranging from 2.8 to 14.5 feet (0.85 to 4.4 m) (Miller et al., 2002). No eelgrass was observed at depths in excess of 15 feet (4.6 m). This is due mainly to the rapid decent of the bottom beyond this point (Miller et al., 2002). Eelgrass beds in the immediate vicinity (within 120 feet [36.6 m]) of the Access Pier are characterized as being small and sparse (less than 10 shoots per patch). The size and density of the eelgrass beds generally increase toward the north and south (Figure 10), but eelgrass is still located in small to medium sized patches. This is the patchy condition common for the South Puget Sound Region (Miller et al., 2002). Eelgrass generally is present over about 2 to 5 percent of shoreline areas in South Puget Sound (Bailey et al., 1998). The relatively lower abundance and density of eelgrass adjacent to the Access Pier is attributed to boating activity, barge shading, and vessel grounding at low tides (Figure 11) (Miller et al., 2002).

View of in-water facility.

View of parking lot at Fox Island Laboratory.

Figure 8. Photos of Fox Island Laboratory.

Shoreline south of facility.

Macro algae and sea star.

Figure 9. Intertidal habitat.

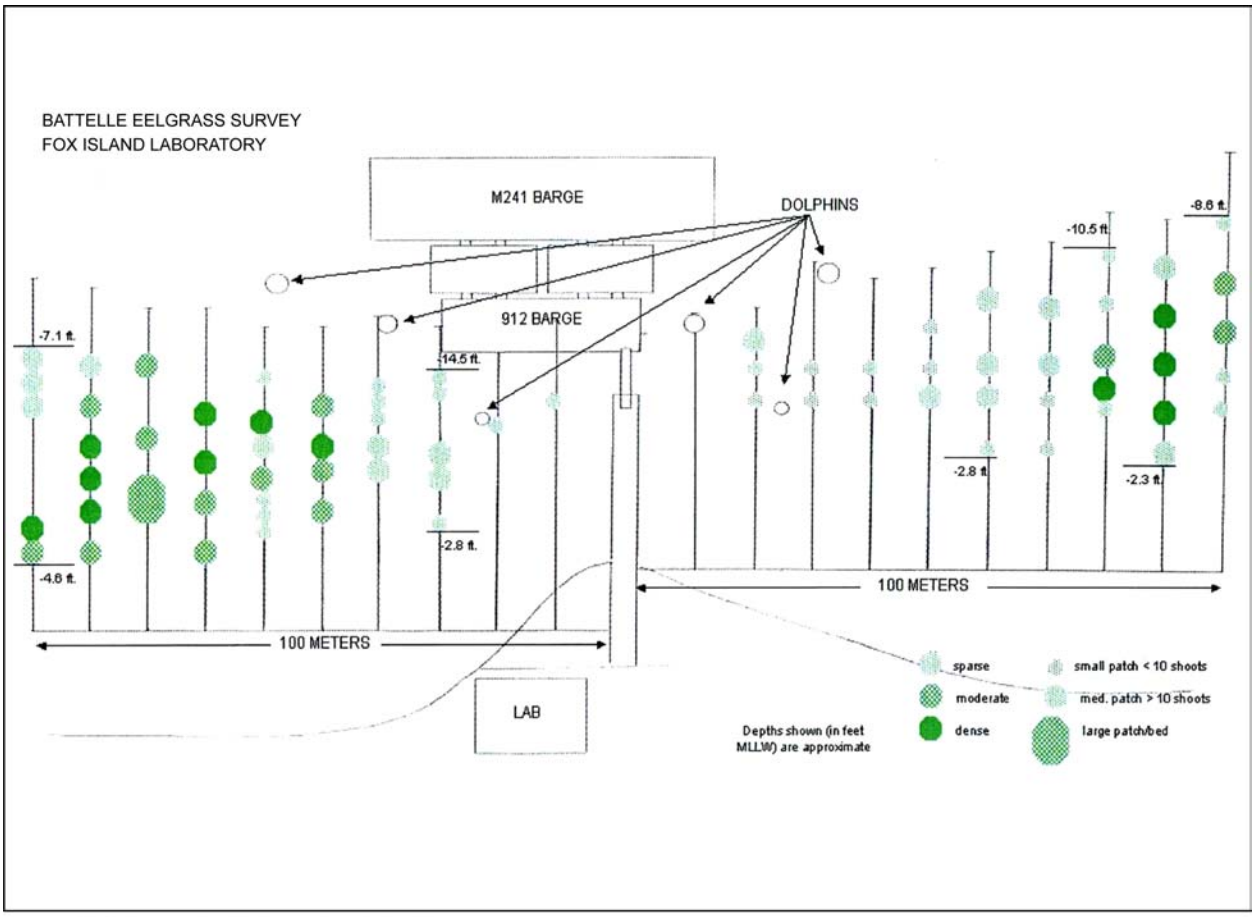

Figure 10. Eelgrass distribution at Fox Island Laboratory.

Boats grounding at low tide.

Boats moored inboard the 912 Barge at low tide.

Figure 11. Boats moored inboard of the 912 Barge.

4.0 ESA LISTED SPECIES IDENTIFICATION

This assessment has been prepared to facilitate coordination between the United States Navy—the action agency—and NOAA Fisheries and USFWS, jointly referred to as the Services. NOAA Fisheries regulates federally-listed threatened and endangered marine wildlife and anadromous fish stocks. USFWS regulates threatened and endangered terrestrial wildlife, plants, and inland fish stocks.

4.1 Species Identified by the Services

Information provided by NOAA Fisheries (2002) identified that the FIL project may occur within the general range of the following ESA-regulated species under their jurisdiction:

- Humpback Whale (*Megaptera novaeangliae*). Endangered.
- Leatherback Sea Turtle (*Dermochelys coriacea*). Endangered.
- Puget Sound ESU Chinook Salmon (*Oncorhynchus tshawytscha*). Threatened.
- Steller Sea Lion (*Eumetopias jubatus*). Threatened.

Information provided by USFWS (2002) identified that the FIL project may occur within the general range of the following ESA-regulated species under their jurisdiction:

- Bald Eagle (*Haliaeetus leucocephalus*). Threatened.
- Marbled Murrelet (*Brachyramphus marmoratus*). Threatened.
- Coastal/Puget Sound Bull Trout (*Salvelinus confluentus*). Threatened.

4.2 Species Not Affected

The Action will not affect Humpback Whale or Leatherback sea turtle, two listed species under NOAA Fisheries jurisdiction. Humpback whales are common off the Washington coast; however, they are infrequently observed in the inland waters of Puget Sound (Norberg, personal communication, 2000). One to two individuals are typically sighted in Puget Sound in an average year (Calambokidis, personal communication, 1995); one was sighted in northern Puget Sound in early 2002 (Calambokidis, personal communication, 2003). The nearest area where migrating whales are commonly seen is within the Strait of Juan de Fuca, more than 70 miles (112 km) to the northwest of Carr Inlet Bay (Gearin, personal communication, 2000). Humpback whales are not expected to occur within the Action Area during proposed project activities. Leatherback sea turtles are pelagic, most often sighted from 5 to 100 nautical miles (9.2 to 185 km) off shore, predominantly over the deep outer continental shelf (Brueggeman, 1990). Leatherback sea turtles are more common in warm temperate waters. The interior waters of Puget Sound do not provide forage or other habitat for leatherback sea turtles. The furthest inland Puget Sound sighting of leatherback sea turtle was a single sighting in 1981 in the Port Angeles area, approximately 90 miles (144 km) from the project Action Area (McAllister, personal communication, 2000; Eckert, personal communication, 2003). Leatherback sea turtles are not expected to occur in the Action Area during proposed project activities. Due to the nature of the project coupled with the absence of these

species within the Action Area, it is determined that the Action will have **no effect** on humpback whale and will have **no effect** on leatherback sea turtle.

4.3 Species Potentially Affected

The remaining listed species identified by the services are known to occur, or have historically utilized habitats, within the Action Area. These species are discussed in detail below and include:

- Puget Sound ESU Chinook Salmon
- Steller Sea Lion
- Bald Eagle
- Marbled Murrelet
- Coastal/Puget Sound Bull Trout

5.0 SPECIES EVALUATIONS

5.1 Salmonids

5.1.1 LIFE HISTORY OF SPECIES AND GENERAL DESCRIPTION OF HABITAT

5.1.1.1 Puget Sound Chinook Salmon

Chinook salmon in Carr Inlet are included in the Puget Sound Chinook ESU; a population currently listed as threatened under the ESA in Washington State. The life history and habitat requirements of Puget Sound Chinook salmon are described by Myers et al., (1998) and are included by reference and briefly summarized herein. Chinook salmon have a historic range from the Ventura River in California to Point Hope, Alaska in North America; and from Hokkaido, Japan to Anadyr River in Russia. Chinook salmon require varied habitats during different phases of their life. Peak spawning occurs within the streams between mid-October and mid-November (Haring, 2000).

Spawning habitat typically consists of lower mainstem areas with large quantities of gravel and greater flows (Haring, 2000). Upstream migration of adult fall chinook salmon in south Puget Sound's lowland streams typically extends from mid-September to mid-November. After spending 3 to 4 months rearing in the lowland streams fry enter the estuaries around May or early-June, depending on the spring flows (Haring, 2000). Chinook salmon generally migrate to salt water in the spring and summer. Most chinook salmon spend from two to four years feeding in the North Pacific before returning to spawn. Chinook salmon die after spawning.

5.1.1.2 Bull Trout

The U.S. Fish and Wildlife Service (USFWS) listed Bull trout in the Coastal/Puget Sound Distinct Population Segment (DPS) as a threatened species on November 1, 1999 (F.R. 64 [210]: 58909-58933). The life history and habitat requirements for Coastal/Puget Sound DPS bull trout are described by Rieman and McIntyre (1993) and included by reference and briefly summarized herein. Bull trout exhibit multiple life-history strategies, and complex age structures, behavior, and maturation schedules. Bull trout populations are known to exhibit four distinct life-history forms: resident, fluvial, adfluvial, and anadromous (Rieman and McIntyre, 1993; KCDNR, 2000; Sims, 2000; and WDFW, 2000a). Resident bull trout spend their entire life cycle within their natal or nearby streams. Fluvial populations spawn in tributary streams where the young rear from two to three years before migrating to a river where they grow to maturity (Knowles and Gumtow, 1999). Adfluvial forms spawn and rear in headwater streams like fluvial fish, but migrate to lakes and reservoirs to mature (KCDNR, 2000). Anadromous bull trout spawn in tributary streams, with major growth and maturation occurring in the marine or estuarine environment (Sims, 2000).

Like many other salmonids, bull trout migrate to fresh water streams to spawn. Spawning begins in late August, peaking in September and October, and ending in November (WDFW, 2000a). Spawning for bull trout appears to be triggered when water temperatures decline below 9°C (KCDNR, 2000 and Rieman and McIntyre, 1993). Fecundity for bull trout can reach up to 5,000 eggs. Emergence from the streambed typically occurs in late winter and early spring (KCDNR, 2000). Among migratory forms

(fluvial, adfluvial and anadromous), outmigration to larger rivers, lakes and the ocean most commonly occurs at age two, but has been observed for ages of one to three years (Pratt, 1992).

5.1.1.3 Other Carr Inlet Salmonids

Salmonid species typically observed within Carr Inlet include chinook, chum (*Oncorhynchus keta*), and coho salmon (*Oncorhynchus kisutch*) as well as steelhead (*Oncorhynchus mykiss*) and cutthroat trout (*Oncorhynchus clarki*). Pink salmon (*Oncorhynchus gorbuscha*) have occasionally been observed in Minter Creek at the north end of Carr Inlet; however, pink salmon in Minter Creek are not recognized as a separate stock and are most likely strays from other basins (Haring, 2000). Carr Inlet fall chum juvenile migration starts in mid to late February and is completed by mid-May (Williams et al., 1975). Many small independent streams that enter Carr Inlet and Hale Passage contain populations of coastal cutthroat trout and coho salmon. Juvenile coho usually remain in the stream system for a little over a year and do not outmigrate from the fresh water until their second year. Coho outmigration generally occurs through the period of late February to mid-July with the peak usually occurring in mid-April (Williams et al., 1975). Late release coho salmon were raised in rearing pens by the Washington Department of Fish and Wildlife on the northwestern shore of Fox Island in Echo Bay between 1975 and July 2002 (Popochock, personal communication, 2003).

5.1.2 OCCURRENCE IN CARR INLET

5.1.2.1 Chinook Salmon

The South Puget Sound stock of chinook within the Puget Sound ESU is composed of chinook salmon originating in larger South Puget Sound tributaries, including Minter Creek and Burley Creek that flow into Carr Inlet (WDFW, 1994). Chinook salmon also utilize other streams in the basin, but significant use in many of the smaller independent tributaries to Carr Inlet is minimal because these streams exhibit very low flows during the late summer and fall, the normal chinook salmon migration and spawning periods (Williams et al., 1975). Fox Island does not contain any streams that support runs of chinook salmon (Molenaar, personal communications, 2002). The nearest streams with chinook salmon runs are located approximately 10 to 13 water-miles (16 to 21 km) distant, in Minter and Burley Creek respectively, which are further described below.

Although sustained natural production occurs in some streams, the occurrence of chinook in the Action Area has been largely dependant on hatchery production (WDFW, 1994). Williams et al., (1975) notes that Burley Creek historically had the only wild stock of chinook salmon in the sub-basin. Natural spawning chinook historically were observed in Minter Creek; however, this run was thought to be of hatchery origin since WDFW used to pass adult chinook upstream past the diversion at the Minter Creek Hatchery (Williams et al., 1975). Adult chinook salmon are no longer passed above the weir on Minter Creek by WDFW, thus reducing the number of naturally produced chinook within Minter Creek.

Juvenile chinook salmon are anticipated to occur within nearshore areas in the Action Area during the late spring and early summer period coinciding with their peak outmigration from freshwater. Juvenile salmon including chinook are known to utilize eelgrass beds and other areas of nearshore aquatic vegetation for cover and to find forage during this period (Nightingale and Simenstad, 2001a). Large numbers of immature salmon, such as blackmouth (immature resident chinook salmon), use the marine waters around the Kitsap Peninsula year round to feed (Williams et al., 1975).

5.1.2.2 Bull Trout

Native char, including bull trout, are not known to occur in streams tributary to Carr Inlet; temperature would likely preclude bull trout from streams in this portion of Puget Sound and associated watersheds. Streams in this region are mainly low-elevation streams that do not meet the low water temperature requirements necessary for successful spawning (Haring, 2000). There is little known about bull trout use in Carr Inlet, and it is not known to what extent bull trout use marine nearshore areas in the vicinity of Fox Island (Harring, 2000); however, anadromous bull trout are opportunistic feeders and are known to travel widely in search of food (USFWS, 1998). While bull trout use of nearshore areas within the action is anticipated to be rare, it cannot be precluded.

5.1.3 HABITAT PARAMETERS FOR SALMON AND BULL TROUT

Ideally, reliable scientific information would exist for all populations of listed species that would allow the effects of an action to be quantified in terms of population impacts (NOAA Fisheries, 1999). As stated in the *Habitat Approach,* an August 1999 supplement to the NOAA Fisheries guidance document: *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale,* in the absence of population-specific information, an assessment must define the biological requirements of a listed fish species in terms of properly functioning conditions (PFC). PFC are described as the sustained presence of natural habitat-forming processes necessary for the long-term survival of the species through the full range of environmental variation (NOAA Fisheries, 1999). PFC elements are typically identified as being either:

1. "properly functioning" meaning that the element can support healthy populations of fish;

2. "at risk," meaning that functionality is maintained but there is a likelihood that further degradation would result in a negative response by fish populations; or

3. "not properly functioning," meaning that there are known limitations to those parameters necessary to support healthy salmonid populations.

Indicators of PFC vary in different landscapes based on unique physiographic and geologic features (NOAA Fisheries, 1999). Since aquatic habitats are inherently dynamic, PFC are defined by the persistence of natural processes that maintain habitat productivity at a level sufficient to ensure long-term survival, and are not necessarily defined by absolute thresholds and parameters (NOAA Fisheries, 1999).

Both the NOAA Fisheries and the USFWS have prepared guidance on the evaluation of PFC for salmonid fish in montane stream systems. The services have developed a pathway-indicator matrix to assist in making determinations of effect for watershed-scale actions in these areas (NOAA Fisheries, 1996; USFWS, 1998). Although many ecological pathways that support salmonid fish in montane streams are similar to those that support salmonid fish in marine and estuarine environments, the requirements of the fish in these areas are significantly different and are not well represented by existing NOAA Fisheries (1996) and USFWS (1998) guidance. A pathway-indicator matrix has not been published by the Services for marine or estuarine environments; however, marine and estuarine habitat requirements for salmonid stocks have been described by many authors (Fresh et al., 1981; Healy, 1982; Levy and Northcote, 1982; Shepherd, 1981; Weitkamp et al., 2000; and others).

In the absence of a PFC pathway-indicator matrix from the Services for marine and estuarine areas, indicator-pathway relationships must be generalized from the literature. A pathway-indicatory matrix for construction projects in nearshore and marine areas that includes the following primary indicators: physical habitat, sediment inputs, biota, predator/prey relationships, and water quality has been adapted from the available literature and provides the basis for the evaluation of PFC for this assessment.

5.1.3.1 Water Quality Indicators

Turbidity

Turbidity is a natural characteristic of nearshore habitats. Turbidity occurs when particulates, organic and inorganic, become suspended in the water column. Total suspended solids consist of inorganic solids, such as clay, sand, and silt, as well as organic solids such as algae and detritus (Nightingale and Simenstad, 2001a). Turbidity can result in effects to salmonid species including chinook and bull trout, and may include alteration in migration patterns and feeding patterns and, in extreme instances, gill injury and mortality. The severity of the effect of turbidity depends largely on the size, shape, and composition of the suspended solids and the duration of fish exposure. Threshold studies describing potential effects of suspended sediment levels in northwest marine environments are lacking (Nightingale and Simenstad, 2001a). Due to the lack of marine threshold studies, freshwater turbidity thresholds will be described for the purpose of defining properly functioning conditions relative to the Action. Studies show a wide range of responses from salmonid fish to differing levels of turbidity. Some studies have shown acute lethal effects where suspended solid levels were several hundred mg/L while others have shown no acute effects at concentrations above 10,000 mg/L (Nightingale et al., 2001b). Lethal effects related to turbidity in natural environments are relatively rare (Nightingale et al., 2001b). Chronic effects of turbidity are more commonly observed in natural environments. Healy (1991) and Beauchamp et al. (1983) observed salmonid avoidance when levels of suspended solids exceeded 4,000 mg/L. Other authors described habitat avoidance to turbidity at suspended solid levels of 300 mg/L (Sandercock, 1991). The above concentrations between 300 mg/L and 4,000 mg/L are used to define the limits between not properly functioning and properly functioning habitat conditions for this analysis.

Dissolved Oxygen

The State of Washington defines Class AA water bodies, such as Carr Inlet, as waters that that exceed the requirements of water quality for all or substantially all uses including the support of fish and benthic life. The desired target for dissolved oxygen (DO) for Class AA marine waters established by Ecology is a minimum of 7.0 mg/L. Varying studies on salmonids have demonstrated that effects to salmonid species can occur when DO levels fall below this level. The growth of coho salmon has been shown to decline at 4.0 mg/L. Juvenile chinook have demonstrated marked avoidance of areas with DO concentrations less than 4.5 mg/L but no avoidance of areas with a DO concentration of 6.0 mg/L (Beauchamp et al., 1983). Since these studies show that concentrations of 4.0 mg/L may induce adverse effects, this concentration is considered the criteria for not properly functioning habitat for this assessment. A DO concentration between 4.0 mg/L and 7.0 mg/L constituted at risk habitat.

Water Contamination

Contamination is indicative of a degraded habitat. Ecology has developed water quality standards intended to protect beneficial uses, including use as fish and wildlife habitat. Water bodies with known

exceedances of these water quality standards are listed as degraded as specified by Section 303(d) of the Clean Water Act (CWA). CWA Section 303(d) listed water bodies are defined as not properly functioning for the purpose of this assessment.

Sediment Contamination

The State of Washington has developed a two-tiered approach to evaluate levels of sediment contamination relative to levels of specific chemical contaminants and the toxicity of these contaminants in situ. Concentrations of specific chemicals found in sediment that are at, or below the sediment quality standards are expected to have no adverse biological effects. Sediment cleanup decisions are based on the toxicity of various chemical concentrations, which are set at a higher level than sediment quality standards. For the purpose of this assessment, sediment contaminant concentrations above the sediment quality contamination levels are determined at risk. Contaminant levels at or above toxic levels are not properly functioning.

5.1.3.2 Physical Habitat Indicators

Substrate/Armoring

The direct modification or armoring of shoreline habitat can compromise the quality of adjacent estuarine and nearshore marine habitats (Nightingale et al., 2001b). Many species of fish and wildlife, including ESA listed salmonids, utilize these habitats for rearing, forage, and refuge. Following their outmigration from freshwaters, juvenile salmon rear in nearshore habitats before migrating to deeper marine waters. These habitats are highly utilized by juvenile chinook salmon. The majority of use by chinook in these areas occurs soon after outmigration, and consists of feeding on epibenthic prey, which is abundant within mud, gravel, and sand substrate (Fresh et al., 1981).

A number of studies have demonstrated various impacts to estuarine and nearshore areas as a result of shoreline modification and armoring (KCDNR, 2001; Thom et al., 1994; Prinslow et al., 1979; and Nightingale et al., 2001a). Structural modifications may change shoreline geomorphology (Williams and Thom, 2001) that may in turn alter nearshore habitats. Aside from direct modifications, a critical effect of armoring and shoreline development is the loss of sediment sources that provide substrate recruitment for beach, intertidal, and subtidal nearshore areas. The alteration of the sediment character and quality can result in the loss of smelt, sand lance, and other finfish spawning habitat, alter benthic communities, and affect the quality and quantity of marine vegetation including eelgrass beds (Williams and Thom, 2001). Shoreline areas containing site extensive armoring by riprap or bulkheads are considered to be not properly functioning for this indicator.

Tideland Condition

Following outmigration from freshwaters, juvenile salmon are found in close association with intertidal nearshore areas containing gradual slopes and fine substrates (Beechie et al., 1994). These areas provide foraging opportunities and refuge from predators. Juvenile chinook salmon may forage extensively in upper elevations of tidelands during high tide, where they can gain a large percentage of their daily caloric intake (Williams and Thom, 2001). Tidal channels have been shown to be excellent salmon rearing habitat (Shepard, 1981 and Beechie et al., 1994). Thus, for the purpose of this assessment, large

intertidal areas with an abundance of tidal channels are considered properly functioning. Habitat that has experienced loss of tidal areas through tidal filling is considered not properly functioning.

Depth/Slope

Juvenile salmon use transitions from shallow waters to deeper waters as they age depending on species. Deep-water habitats are avoided during early stages of salmonid growth. Gently sloping nearshore areas with natural transition from shallow water to deepwater are defined as properly functioning. Habitat conditions that have been altered to have steep side slopes, drop-offs, and nearshore deep-water habitats are considered not properly functioning for this indicator. This type of condition is most commonly associated with the wharfs, bulkheads, and nearshore dredging (KCDNR, 2001). Areas that have naturally occurring steep slopes with narrow nearshore habitat areas are defined as at risk.

Marsh Prevalence and Complexity

Juvenile chinook also utilize marshes for rearing habitat. Various studies have observed juvenile chinook occurring in salt marshes (Shepherd, 1981; Simenstad et al., 1982; and Healey, 1991). As with tidelands and shallow nearshore areas, these habitats provide both foraging and refuge opportunities. Due to the heavy reliance on marsh habitat, habitat consisting of undisturbed historical marshland is considered properly functioning. Habitat containing historical marshland that has been lost by filling and/or degradation is considered not properly functioning.

Refugia

For this assessment, refuge is defined as habitat area that provides protection from predators or disturbance. Juvenile salmonids use a number of habitat characteristics for refuge. Areas with a high abundance of refugia involve shallow intertidal habitat with numerous subtidal channels, and a prevalence of marshes or marine vegetation such as eelgrass. Refugia are affected by the degradation and loss due to shoreline armoring, physical barriers, tidal and marsh filling, and dredging. The criteria defined within the NOAA Fisheries matrix for salmon in streams (NOAA Fisheries, 1998) was followed to evaluate the refugia indicator within marine waters. At risk habitat consists of the presence of historical refugia, or refugia insufficient in size, number, and connectivity. A not properly functioning habitat condition exists when adequate habitat refugia do not exist.

Physical Barriers

Overwater structures can cause alterations to key controlling factors, such as light, wave energy and substrate regimes, which in turn determine the habitat characteristics that support ecological functions of spawning, rearing, and refugia (Nightingale et al., 2001b). Studies on behavioral responses of migrating juvenile salmon to overwater structures have conflicting results. Various studies have shown that piers, floating structures, and other physical barriers can not only alter the key controlling factors and affect salmon indirectly, but can possibly affect salmonids directly by changing migration responses (Nightingale et al., 2001b). Other studies have shown that overwater structures have little impact on migration patterns or the movement of juvenile salmonids in certain situations (Weitkamp et al., 2000). Although many differences were found within the various studies, it has been demonstrated that over-water structures, with some exceptions, may alter the behavior or movement of juvenile salmon. Thus, a properly functioning habitat was defined as habitat absent of over-water structures, in-water structures,

and other constructed barriers. An at-risk habitat is considered to contain a minimal amount and minimum sized structures, determined to have an effect, but only a slight effect on salmon migration. A not properly functioning habitat is defined as habitat that contained a large number of structures along a shoreline, and is considered likely to represent a significant barrier to juvenile salmon.

Current Patterns

Current patterns determine both the composition of the physical habitat and contribute to the ability of that habitat to provide beneficial uses to salmonids, particularly in relation to forage abundance and feeding opportunity. Habitat that contains current patterns unaltered by shoreline modifications and/or the presence of in-water structures is the preferable condition. Areas that contain minor alterations are determined to be at risk. Areas where shoreline modifications and/or direct habitat modification of current habitat by dredging is determined to be not properly functioning for this habitat indicator.

Salt/Fresh Water Mixing Patterns and Locations

The physiological transition from fresh water to salt water is highly stressful on anadromous salmonids. Salmonids typically require a period of gradual acclimation in intertidal, brackish waters before entering the marine environment. These areas are characterized as transitional zones where salt water and fresh water mix together. Chinook salmon are specifically sensitive to lower salinity estuarine areas and are found in areas with salinity levels at 6.75 to 25.73 parts per thousand (ppt) or more (Beauchamp et al., 1983).

The loss of naturally occurring transition zones found at river mouths and in estuaries decreases the size of the transitional habitat. This loss may occur as a result of changes in flow conditions in rivers resulting from an increase of impervious surface within upland drainage basins or as direct habitat modification from dredging, diking, and use of levees to reduce the amount of estuarine habitats. An at-risk habitat is defined as altered conditions that change surface hydrology or estuarine habitat resulting in minor effects on salmon. A not properly functioning habitat is defined as containing significant impervious surface area or a high level of modification of estuarine habitats.

5.1.3.3 Biological Habitat Indicators

Benthic Prey Availability

Salmonids feed on a variety of organisms influenced by differing characteristics of estuaries (Healy, 1991). The major component of organisms found within a smaller fish's diet consists of benthic invertebrates including amphipods (*Eogammarus* and *Corophium* spp.), herpacticoid copepods, mysids, and cumaceans (Kjelson et al., 1982; Healey, 1991; and Fresh et al., 1981). Sediment texture and quality are important elements in determining the composition of the community of benthic invertebrates that provide forage for salmonid fish. This indicator combines the previously described elements of substrate composition and sediment quality related to contamination. Sediments that have an impaired ability to support benthic invertebrates preferable to salmon are not properly functioning. Sediments containing a benthic community that was altered from its natural state is considered at risk.

Forage Fish Community

Both chinook salmon and bull trout are opportunistic feeders that rely on forage fish, particularly as adults (Myers et al., 1998). Adult bull trout feed almost exclusively on other fish (USFWS, 1998). As juvenile salmon grow larger their diet shifts to forage fish such as herring, surf smelt, and sand lance. Therefore, a properly functioning habitat contains abundant forage fish. A not properly functioning habitat consists of limited or depleted forage fish resources that do not provide for adequate prey for salmon.

Aquatic Vegetation

Seagrasses, including eelgrass beds, are widely recognized as one of the most productive and valuable habitats in shallow marine environments (Shafer, 2002). Areas of aquatic vegetation provide refuge to juvenile salmon from predators and support a wide base of invertebrates and fish that provide forage for both juvenile and adult salmonids including chinook salmon and bull trout. The presence and abundance of aquatic vegetation is related to several factors including the width, slope, depth, and substrate of nearshore areas and the level of disturbance of these areas (Nightingale et al., 2001b). Areas containing an abundance of aquatic vegetation are considered high quality habitat and properly functioning. If an area historically contains vegetation, but the vegetation is degraded by disturbance or vegetation is lost, then the habitat is considered at risk or not properly functioning depending on the amount of degradation that has occurred. Habitat without naturally occurring vegetation is considered not properly functioning.

Exotic Species

Exotic (non-native) and invasive species present within the natural environment of Puget Sound have the potential to produce adverse affects on natural habitat and naturally occurring species through competition or predation. If no exotic species are present then the habitat is presumed to be properly functioning. Habitat containing exotics that may complete with, or prey on, salmonids are considered not properly functioning. If exotic species are present, but do not present any adverse effects, at risk habitat is assumed.

5.1.4 ENVIRONMENTAL BASELINE

Existing environmental conditions within the Carr Inlet Action Area are evaluated according to the criteria established in the matrix of pathways and indicators outlined above. A rating of properly functioning, at risk, or not properly functioning is assigned to each estuarine habitat indicator for the Action Area. These ratings are summarized in Table 2 and are described below.

5.1.4.1 Water Quality Indicators

Turbidity

Ecology collected light transmissivity data with a transmissometer for Carr Inlet between 1990 and 2000 (http://www.ecy.wa.gov/programs/eap/mar_wat/images/mwm_ps.gif, August 2002) and found low levels of turbidity within the Action Area. The surface water in nearshore marine areas was generally clear during site visits in the spring and summer of 2002. While transmissivity and clarity are not completely related to levels of total suspended solids in the water, they are often correlated (Wetzel, 1983). Turbidity within the Action Area has been classified as properly functioning.

Table 2. Matrix of Pathways and Indicators

Pathways: Indicators	Environmental Baseline			Effects of the Action(s)		
	Properly functioning	At risk	Not Properly Functioning	Restore	Maintain	Degrade
Water Quality						
Turbidity	X				X	
Dissolved Oxygen		X			X	
Water Contamination	X				X	
Sediment Contamination	X				X	
Physical Habitat						
Substate/Armoring		X			X	
Depth/Slope	X				X	
Tideland Condition	X				X	
Marsh Prevalence and Complexity	X				X	
Refugia	X				X	
Physical Barriers	X				X	
Current Patterns	X				X	
Salt/Fresh Water Mixing Patterns and Locations		X			X	
Biological Habitat						
Benthic Prey Availability	X				X	
Forage Fish Community	X				X	
Aquatic Vegetation	X				X	
Exotic Species	X				X	

Dissolved Oxygen

Data from 1990 to 2000 shows that DO concentrations have been trending lower. Ecology has identified that Carr Inlet is susceptible to eutrophication, which is often indicated by high nutrient levels and depressed DO levels. Currently Carr Inlet is listed on the State CWA 303(d) list for exceedances of dissolved oxygen standards. Ecology found that 22 percent of the DO readings collected in Carr Inlet between 1991 and 1996 were below 7.0 mg/L (WAC 173.201A.030.1.B). Values as low as 4.8 mg/L were recorded at the Ecology monitoring station. Low DO levels are anticipated to be a result of a combination of natural and human-induced factors. These DO levels indicate that the Action Area is at risk for this indicator.

Water Contamination

Ecology found no incidents of exceedances of state water quality standards related to water-born contaminants in Carr Inlet between 1990 and 2000 (Ecology, 2000). Carr Inlet has been listed on the CWA 303(d) list for fecal coliform contamination; however, the decision to place Carr Inlet on the CWA 303(d) list for this water quality parameter was based on testing of commercial shellfish areas at Von Geldern Cove. Many areas classified as "Prohibited" for shellfish harvest by the Washington Department

of Health, listed because of the area's proximity to wastewater discharges or non-point pollution (Ecology, 2000). Contaminant levels are likely to be properly functioning for the Action Area over-all.

Sediment Contamination

Sediment sampling conducted by NOAA and Ecology (2002) found no exceedances of substrate quality standards. All stations within Carr Inlet contained no chemical contamination and supported abundant and diverse infaunal assemblages (Long et al., 2002). Data collected in May 2001 found low levels of polychlorinated biphenyls (PCBs) within Carr Inlet (Roose and Seiders, 2002). The Action Area is designated as properly functioning for sediment contamination.

5.1.4.2 Physical Habitat Indicators

Substrate/Armoring

A salient has formed at the location of the existing Access Pier on the beach at FIL. The salient has formed as a result of a change to sediment transport along the beach resulting from the Access Pier. Movement of sediment and beach formation along the southwestern shore of Fox Island has been found to be strongly influenced by the presence of armored shoreline (Shepsis, 2002). Shoreline armoring occurs intermittently along the southwestern shoreline of Fox Island, including FIL frontage. A riprap bulkhead (Figure 2) separates the upland facilities and in-water facilities. However, the majority of the shoreline in the greater Action Area is undisturbed, and most bulkheads are set back from the water's edge. The Action Area is anticipated to be at risk for this indicator.

Depth/Slope

As described above, the beach and nearshore areas at FIL are naturally steep and narrow. The quick transition between shoreline and deep marine areas at this location were predominant factors in originally siting the facility at this location. The steeply sloping shoreline off FIL is naturally occurring. Shoreline modifications do not appear to have occurred to the extent that the depth or slope of the beach and nearshore areas has been significantly affected. While shoreline changes have been observed at FIL since its construction, these changes have largely resulted in a widening of the beach fronting the facility (Shepsis, 2002). As describe above, much of the shoreline within the larger Action Area is in its natural state. The Action Area is anticipated to be properly functioning for this indicator.

Tideland Condition

Intertidal areas within the Action Area have been affected to some degree by shoreline development as described above. There are no freshwater streams or rivers on Fox Island to form estuaries at their mouths, where the most valuable tidelands occur. Tide flats and estuaries with defined tidal channels are found throughout other parts of the Action Area and are largely unaffected by development. The Action Area is properly functioning for this indicator.

Marsh Prevalence and Complexity

A number of small freshwater and estuarine wetlands occur along the shoreline of Fox Island (Pierce County, 2001). None of these habitats occur in the immediate vicinity of FIL. Development has not

significantly altered shoreline areas within the Action Area. The Marsh Prevalence and Complexity indicator is anticipated to be properly functioning within the Action Area.

Refugia

No marsh and loss of established habitat, eelgrass. As stated above, some armoring is present, but the Action Area as a whole is relatively unaffected. Therefore, the Action Area is properly functioning for all the various habitat elements that combine to determine this indicator. The Action Area is properly functioning for the refugia indicator.

Physical Barriers

FIL currently has in-water facilities including barges and piers with over-water coverage. FIL is the only facility with in-water and overwater structures along the southwestern shoreline of Fox Island. The area of over-water coverage is small compared to the entire length of shoreline within the Action Area. As described above, shoreline areas within the Action Area are relatively undisturbed. While a few overwater structures occur within the Carr Inlet Action Area, they are generally small and separated from each other by long stretches of undeveloped beach. Overwater and in-water structures do not form a continuous barrier along shoreline areas with the Action Area. The Action Area is properly functioning for this indicator.

Current Patterns

Current Patterns within the Action Area are properly functioning based on the rationale described above for other habitat indicators. Large in-water structures and large scale dredging that would effect current patterns throughout the Action Area are absent. Some small scale modification of current patterns has occurred where in-water structures have been built. Shepsis (2002) concluded that the existing pier and other in-water facilities have altered the wave and current patterns at FIL facility. Current patterns may be similarly affected in localized areas around other in-water structures within the Action Area. These limited local modifications have not altered current patterns within the Action Area as a whole.

Salt/Fresh Water Mixing Patterns and Locations

The Action Area does not contain any large estuaries, and no large river systems drain to Carr Inlet. Significant saltwater/freshwater mixing zones are largely limited to the mouths of the smaller streams that drain to the inlet. No large freshwater streams occur on Fox Island. The estuaries at the mouths of the tributaries to Carr Inlet have not been modified to the same extent as more urbanized basins to the east of the Action Area; however, urbanization has resulted in added runoff from impervious areas to local streams to the extent that hydrology has been notably altered in some drainages (Pierce County, 2001). Due to ongoing urbanization throughout the basins draining to the greater Action Area, the Action Area is at risk for this indicator.

5.1.4.3 Biological Habitat Indicators

Benthic Prey Availability

The abundance of benthic prey is directly related to habitat conditions. At FIL site, the narrow beach and steep, rapidly descending bottom limit the quality and quantity of nearshore areas that support benthic

communities relative to other nearby areas. However, although naturally limited at FIL site, shoreline and nearshore habitat indictors are generally properly functioning throughout the Action Area. Similarly, Benthic Prey Availability is properly functioning within the Action Area.

Forage Fish Community

Nearshore areas within the vicinity of FIL support spawning habitat for sandlance (*Ammodytes hexapterus*) and herring (*Clupea pallasi*). However, no sandlance or herring spawning areas are mapped on the southwestern side of Fox Island in proximity to FIL (WDFW, 2002). Sandlance and herring spawning areas occur along Hale Passage on the northeastern shoreline of Fox Island. Habitat quality necessary to support functional populations of forage fish is directly related to the quality and condition of nearshore and shoreline areas as described above. The Forage Fish Community indicator is anticipated to be properly functioning within the Action Area.

Aquatic Vegetation

Macroalgae and eelgrass beds are present within nearshore areas adjoining FIL at depths ranging from 2.8 feet (0.85 m) to 14.5 feet (4.4 m) (Figure 10) (Shepsis, 2002). Eelgrass beds in the immediate vicinity of Access Pier are characterized as being small and sparse. The size and density of the eelgrass beds generally increase toward the north and south of FIL. Eelgrass generally is present over about 2 to 5 percent of shoreline areas in South Puget Sound (Bailey et al., 1998). The relatively lower abundance and density of eelgrass adjacent to the Access Pier is attributed to boating activity, barge shading, and vessel grounding at low tides. These types of disturbances are relatively rare within the Action Area. Although the condition of aquatic vegetation has been altered in the immediate vicinity of FIL, the Aquatic Vegetation Indicator for the greater Action Area is anticipated to be properly functioning due to the condition of nearshore habitats and lack of large-scale in-water development or overwater development.

Exotic Species

There are no known occurrences of exotic species within the Action Area that compete with, or prey on salmonids. The Action Area is properly functioning for this indicator.

5.1.5 Analysis of Effects

5.1.5.1 Water Quality Indicators

Turbidity

The Action will require in-water construction associated with the removal of existing wood piles, replacement of the existing mooring system, and the reconfiguration of over-water structures. Proposed in-water work will result in disturbances to the bottom substrates and turbidity in the immediate vicinity of the existing mooring system components during removal and the new mooring system components during installation. Fish-life may temporarily avoid the work areas during in-water construction as a result of localized increases in turbidity immediately adjacent to the areas of in-water work. Substrates in the immediate vicinity of FIL are generally sand, gravel, and cobble. There is limited silt or other fine material that will become suspended in the water column and drift beyond the immediate work area. It is expected that currents in the immediate vicinity of the project will quickly dissipate any residual

suspended solids. The Action will not result in long-term increases in turbidity in the Action Area. Given the relatively small areas and limited scope of in-water work, natural substrate conditions, and timing restrictions on construction, the potential for turbidity to affect chinook salmon or bull trout is likely negligible and existing turbidity conditions will be maintained.

Dissolved oxygen

The Action will not result in additional nutrient sources or result in discharges with high oxygen demand. Although dissolved oxygen (DO) concentrations could be temporarily depressed in areas directly adjacent to in-water work areas if anoxic bottom sediments are disturbed (Ecology, 1998c), it is unlikely that anoxic bottom sediments are present. Currents and tidal action will dissipate suspended sediments and quickly dilute waters with low DO. The potential is negligible for construction to alter DO levels within the project area to the extent that would affect chinook salmon, bull trout, or other fish. There will be no long term modifications in DO levels within the Action Area, and DO levels would be maintained by the Action.

Water Contamination

Creosote-treated wood piles are known sources of polycyclic aromatic hydrocarbons (PAH) (Poston, 2001). The Action includes the removal of creosote-treated wood piles currently part of the existing mooring system. Replacement mooring system components will be constructed of coated steel pilings or pre-cast and cured concrete piles. Neither of these types of piles contains PAH and they are not known to leach contaminants into the water column. All of the barges and pontoons that could be used as part of the Action have been in sea water for several years, including the concrete pontoon which has been in-water for over a decade. The leaching of toxic material, if any, from the barges or pontoons is anticipated to have already occurred.

There will be no increase in potential pollution-generating impervious area. The Action will not increase the size or level of use of the parking area at FIL that could result in potential pollutants from runoff from during storms.

Construction will require the use of heavy machinery located on barges or operated from the existing Access Pier or upland areas on-site. Work to construct or repair in-water facilities could involve welding, pouring concrete, concrete drilling and sawing, and painting. Although not likely, accidents such as spills of hazardous materials (typically green cement, paint, fuel, and hydraulic fluid) or unanticipated additional construction impacts could occur which could be toxic to fish. The potential for spills to occur will be avoided or minimized through adherence to an Oil and Hazardous Substance Spill Contingency Plan and an Oil and Hazardous Substance Spill Prevention Control and Countermeasures Plan required for construction. As a result, the potential for contaminants to affect chinook or bull trout is anticipated to be negligible. Long-term contaminant levels will be maintained by the Action.

Sediment Contamination

The proposed project is not expected to affect existing sediment quality which is likely uncontaminated. The Action includes the removal of creosote-treated wood piles. New pilings will be constructed of coated steel or cured concrete that are not known to leach toxic materials. The project will not increase stormwater runoff from parking areas that may contain metals and other known sediment contaminants.

Sediment contamination conditions are, therefore, expected to maintain current conditions in the Action Area..

5.1.5.2 Physical Habitat Indicators

Substrate/Armoring

The barges and other in-water facilities act as a floating breakwater, and have reduced the forces of wind and waves on the beach. This has resulted in the formation of the salient at FIL. Although the in-water facilities have created the salient at FIL, the quantity of material contained in the salient represents a small fraction of the sediment transported along the southwestern shoreline of Fox Island (Shepsis, 2002) and the facility does not have a significant effect on beach substrates except for approximately 1,000 feet (330 m) of beach in the immediate vicinity north and south of FIL. In these areas, FIL has contributed to a wider beach and a higher concentration of small-diameter substrates (Shepsis, 2002). Armoring along the shoreline has been found to have a significantly larger impact on beach substrate conditions than the in-water facilities.

The Action does not involve additions or improvements to the existing bulkhead. The Action will require no additional shoreline armoring. Therefore, the project is expected to maintain substrate and armoring conditions within the Action Area.

Depth/Slope

There will be no alteration of depth or slope in the Action Area as a result of the proposed project. No dredging or other excavations of intertidal or subtidal areas are part of the Action. The proposed project will therefore maintain depth/slope conditions within the Action Area.

Tideland Condition

No work will occur within marshes, flats, or other tideland areas. The Action will maintain tideland conditions within the Action Area.

Marsh Prevalence and Complexity

The proposed project will have no effect on, and will therefore maintain, marsh prevalence/ complexity within the Action Area.

Refugia

The refugia indicator is a composite of many other physical habitat indicators. As described above, the Action is anticipated to maintain all other physical habitat indicators; therefore, the refugia indicator will be maintained within the Action Area.

Physical Barriers

The Action will involve the removal of over-water and in-water structures from shallow nearshore habitats, and mooring system components will be changed as described above. The quantity of over-water cover of shallow nearshore areas will be less than existing conditions (see Table 3). As a result, the

potential for the Action to act as a physical barrier to fish migrating along the shoreline will be less than the present baseline conditions. The Action will maintain this indicator within the Action Area.

Table 3. Shading of Intertidal/Subtidal Areas

Area (ft^2/m^2)	Action	Existing Condition
Total Overwater Footprint	35,200 ft^2 (3,270 m^2)	18,250 ft^2 (1,695.5 m^2)
Percent Change From Existing	+92.9%	0%
Footprint Under 20' (6 m) in Depth	3,200 ft^2 (300 m^2)	4,400 ft^2 (410 m^2)
Percent Change From Existing	(–27.3%)	0.0%

Current Patterns

The existing in-water facilities act as a breakwater reducing the force of wave and wind action at FIL beach. This has contributed to the formation of the salient at FIL and has affected beach conditions immediately adjacent to the facility. The in-water structures that will be installed and/or reconfigured as part of the Action will also act as a floating breakwater. Although this will continue to effect the force of waves and winds at FIL, this is unlikely to have a measurable effect on current speed or flow patterns beyond the footprint of the facility that do not currently occur under baseline conditions. The Action will maintain current patterns within the Action Area.

Salt/Fresh Water Mixing

The Action will not affect any fresh water systems. The Action will not increase the volume or period of freshwater runoff from upland areas. The Action will not create additional outfalls or sources of freshwater within the Action Area; this will maintain the status of this indicator.

5.1.5.3 Biological Habitat Indicators

Benthic Prey Availability

The potential for the Action to affect benthic prey availability is closely linked to potential affects to aquatic vegetation (described below). The Action is anticipated to have a lessened impact on aquatic vegetation compared to baseline conditions. The result is that there would be no loss of benthic prey dependent on eelgrass communities.

The Action will require a mooring system that will involve the installation of spud piles in the nearshore areas and anchors in deeper marine areas. Densities of shellfish and other benthos could be temporarily reduced by the construction necessary to install the piles, anchors, and other mooring system components. It is likely that benthic prey species would re-colonize temporarily disturbed areas following construction.

Dragging of mooring lines in response to the tides and currents could disturb the bottom directly adjacent to the lines. The dragging of mooring lines occurs under existing conditions and will likely be reduced over current conditions by the use of clump weights. Bottom sediments will be disturbed by the clump weights when they contact the bottom; however, the clump weights will result in the vertical movement of the lines, and will reduce horizontal dragging that would disturb a greater bottom area. The Action will have less effect on benthos than the existing condition since the majority of lines and other mooring system components will be located in deeper water. Therefore, the proposed project will maintain benthic prey availability.

Forage Fish Community

The Action will not alter beach areas that are known to support spawning for Pacific herring or sandlance. The Action will also maintain all other indicators including substrate condition, water quality, sediment quality, aquatic vegetation, depth and slope, and physical barriers. Although described specifically in relation to their use by chinook salmon and/or bull trout, these physical, chemical, and biological indicators are also critical in that they support populations of herring, sandlance, and other fish that both these salmonids utilize as a forage base. The Action will not affect populations of forage fish within the Action Area and will maintain this indicator relative to affects on chinook salmon and bull trout.

Aquatic Vegetation

The Action will require the continued use of in-water structures at FIL. These will cover the water surface resulting in shading of nearshore areas. Shading will result from either the fixed structures, moored barges, and/or the pontoons. These over-water structures will create a shade footprint over the bottom. The area and intensity of shading depends on the size of the over-water structure, the height of the structure over the water, the ability of the structure to move with the wind, current, and tides, and the depth of the water (Nightingale and Simenstad, 2001). Shading in nearshore areas by over-water structures can reduce the density and abundance of aquatic vegetation, including eelgrass, and may result in the loss of eelgrass under the structure (Shafer, 2002; Thom et al., 2001; Dennison, 1987; and Visconty, 1997). The specific area of over-water structure is identified in Section 2.2.3.3. (The existing Access Pier, will be retained under the Action.) The Actions will move the bulk of over-water structures in to deeper waters where aquatic vegetation is absent. As a result, the affect on aquatic vegetation would be reduced under the Action. This will maintain the condition of aquatic vegetation within the Action Area.

Exotic Species

The Action will not increase the potential for exotic species to occur within the Action Area. The Action will not involve the installation of in-water facilities that have been used in marine or freshwater systems beyond the Puget Sound. The pontoons were originally constructed in Lake Washington and have been in service at Everett Naval Station for the past decade. Exotic species may also colonize new areas as a result of disturbance that provides them with a competitive advantage over indigenous species. The Action will maintain physical, chemical, and biological indicators within the Action Area and will not create a disturbance that would provide significant advantage to exotic species.

5.1.6 CONSERVATION MEASURES

The potential for the Action to alter physical, chemical, or biological factors throughout the Action Area is largely discountable; however, the discussion of effects identified several actions that could potentially affect chinook salmon or bull trout in the absence of adequate conservation measures. These potential effects include localized increases in turbidity during in-water construction, bottom disturbance by mooring system components, and spills of toxic materials during construction. In addition, this analysis also identified potential effects to aquatic vegetation, shallow nearshore habitats, water quality, and sediment quality as a result of existing in-water uses at FIL. Although the Action is anticipated to create additional levels of impact compared to existing conditions, certain additional conservation measures will be employed to reduce cumulative impacts to these habitat elements.

The contractor will be required to implement measures during construction to avoid or minimize the potential to adversely impact upland vegetation, aquatic vegetation, or other marine life.

Avoid construction in shallow nearshore areas during periods of peak use of these areas. Peak use for chinook is anticipated to occur following their outmigration from fresh water that peaks in the late spring and summer. Bull trout use in the Action Area is anticipated to be rare, but would likely be highest during this same period, when populations of forage fish in nearshore areas peak.

Avoid construction during periods of peak habitat use to minimize the short-term impacts resulting from turbidity or noise disturbance. Avoiding work between mid-October and mid-June will reduce potential impacts to juvenile salmon and forage fish such as surf smelt and Pacific herring.

Comply with applicable permit conditions and other measures to protect water quality. Care will be taken to prevent any petroleum products, chemicals, or other toxic or deleterious materials from entering the water. All construction activities will be conducted in conformance with the Naval hazardous waste management plan, oil and hazardous substance spill contingency plan, and oil and hazardous substance spill prevention, control, and countermeasures plan.

Avoid shadowing effects. Any new gangway constructed between the Access Pier and in-water facilities will be constructed of metal grating or other material that passes light. New gangways will be constructed under the Action.

Reduce the potential for on-going water and sediment quality contamination. The Action will remove the existing treated wood pilings. All new pilings and in-water mooring system components will be constructed of metal or pre-cast cured concrete.

5.1.7 EFFECT DETERMINATION

In this section, the "Dichotomous Key for Making ESA Determination of Effects" NOAA Fisheries (1996) and USFWS (1998), as well as the contents of Tables 2 and 3, are utilized to make determinations of effect on Puget Sound chinook salmon and Coastal/Puget Sound bull trout.

Chinook Salmon

Puget Sound chinook salmon have been listed by NOAA Fisheries as a threatened species. Chinook salmon are known to occur in the Action Area during estuarine and marine life history stages. Portions of

the Action Area are also designated critical habitat for this species. The Action will result in in-water and over-water construction that may temporarily affect turbidity and water quality in localized areas that provide habitat for chinook salmon. Therefore, the Action **may affect** the Puget Sound chinook salmon. Potential short-term effects will be minimized to discountable levels by the proposed conservation measures identified above. The Action will not degrade physical, chemical, or biological habitat indicators throughout the Action Area. Therefore, the project is **not likely to adversely affect** Puget Sound chinook salmon and their critical habitat.

Bull Trout

Coastal/Puget Sound bull trout have been listed by USFWS as a threatened species. No critical habitat has been designated by USFWS for this species. Bull trout are known to occur within many of the drainages within the greater Puget Sound area, but are not known to occur in any tributary systems draining to the Action Area. Bull trout occurrence within the Action Area is anticipated to be occasional and rare, limited to foraging adults from other Puget Sound drainages. The Action will result in in-water and over-water construction that may temporarily affect turbidity and water quality in localized areas that may provide occasional habitat for bull trout. Therefore, the Action **may affect** the Coastal/Puget Sound bull trout. Potential short-term effects to bull trout will be minimized to discountable levels by the proposed conservation measures identified above. The Action will not degrade physical, chemical, or biological habitat indicators throughout the Action Area. Therefore, the project is **not likely to adversely affect** Coastal/Puget Sound bull trout.

5.2 Marine Mammals

5.2.1 DESCRIPTION OF SPECIES AND HABITAT

5.2.1.1 Steller Sea Lion

The Steller sea lion ranges from the Channel Islands off the southern California coast north to the Bering Sea. These large mammals, weighing up to 2,205 pounds (1,000 kilograms), forage on squid, herring, and other fish at depths up to 600 feet (183 m) (Ingles, 1965; Carl, 1971; and NOAA Fisheries, 2002). Although they occur regularly in Puget Sound, populations of this species are largest in waters off of British Columbia and Alaska.

Large breeding colonies (rookeries) are present on islands off of the Oregon coast, the Scott Islands (north of Vancouver Island), and on British Columbia and Alaska coastal islands. Pupping and breeding occur from late May to July. Terrestrial habitat also includes haulouts that may include sand beaches, rocky shores, and marine buoys.

5.2.2 OCCURRENCE

There are no known rookeries of Steller sea lions in the state of Washington (Gearin, personal communication, 2002 and Jeffries, personal communication, 1995). Sightings of Steller sea lions in Puget Sound number 50 or fewer per year (Jeffries, personal communication, 1995) and are most abundant from late fall to early spring (NOAA and EPA, 1980).

Steller sea lions have not been observed at FIL; however, it is likely that they occur occasionally in Carr Inlet and near FIL shoreline. Steller sea lions have been observed hauled-out on Gertrude Island (approximately 5 miles [11 km] from FIL) and marker buoys off of Toliva shoals, and marker buoys off of McNeil Island within Carr Inlet south of Fox Island (approximately 2 to 5 miles [4.5 to 11 km] from FIL) (Gearin, personal communication, 2000; WDFW 2002; and Bass, personal communication, 2002). These areas are frequently used as haulout sites for California sea lions; however, only small numbers of Steller sea lions have been seen within these areas (Gearin, personal communication, 2002).

5.2.3 ENVIRONMENTAL BASELINE

Prior to the enactment of the Marine Mammal Protection Act (as amended 1994), Steller sea lions were hunted extensively, along with the smaller California sea lion, as fishermen believed that they robbed fishing lines and fouled nets and other gear (Ingles, 1965). The total population of Steller sea lions is thought to have been 240,000 to 300,000 individuals in 1962. The most recent estimate of the Eastern Pacific stock of Steller sea lion was conducted in 1996 (Ferrero et al., 2000). Current populations identified 2,042 Steller sea lions in California, 3,990 sea lions in Oregon, and 523 sea lions in Washington. Trend counts in Oregon appear relatively stable, whereas counts in California appear to be declining. A trend count has not been conducted for Washington State. Steller sea lions are more common on the outer coast of Washington than in inland waters such as Puget Sound (Gearin, personal communication, 2000).

5.2.4 ANALYSIS OF EFFECTS

There will be no direct effect to Steller sea lion, as they are not known to use habitat within the project area. Forage fish species may be temporarily affected by the activities of construction as discussed in Section 5.1.3.3 above. Pile driving underwater sound pressure levels may be in the range of 195 dB//µPa, but they are typically low in frequency (less than 150 Hertz (Hz)). This is below the hearing threshold of pinnipeds, including Steller sea lions, whose optimal hearing is above 1,000 Hz (Richardson, 1995). During construction activities, construction noise and other activities may cause marine mammals to avoid the vicinity of FIL. Due to the small proportion of marine habitat in Carr Inlet potentially affected by construction at FIL, and the availability of extensive additional foraging habitats for marine mammals, the effects upon the normal behavior patterns of these species is likely negligible. This avoidance is anticipated to be a minor and temporary change in behavior, with no adverse affect to behavior patterns. However, the construction activities will cause only temporary displacement of fish in a small portion of the potential foraging habitat for Steller Sea Lion in Puget Sound. Because the Steller sea lion is an infrequent visitor to Carr Inlet and no Critical Habitat for Steller sea lion is located in Washington State, there will be no adverse effects to the species.

5.2.5 CONSERVATION MEASURES

No specific conservation measures are proposed for Steller sea lion at FIL. However, conservation measures described in Section 5.1.6 above will minimize effects upon forage fish species.

5.2.6 EFFECT DETERMINATION

Steller sea lion has been listed by the USFWS as threatened. Critical habitat has been designated for Steller sea lion, but no critical habitat is mapped in the State of Washington. Steller sea lion may

occasionally occur within the Action Area, as well as throughout Puget Sound. The Action will result in noise and activity which may disturb Steller sea lion, and in-water work which may affect forage fish species. Therefore, the Action **may affect** Steller sea lion. Potential short-term effects will be minimized to discountable levels through the use of the proposed conservation measures. The Action will not result in the degradation of existing habitat conditions in the Action Area; therefore, the project is **not likely to adversely affect** Steller sea lion.

5.3 Avian Species

5.3.1 DESCRIPTION OF SPECIES AND HABITAT

5.3.1.1 Bald Eagle

The range for bald eagles extends from Alaska and Canada across North America to Florida (USFWS, 1986). The bald eagle was federally listed as threatened on February 14, 1978. A proposal to de-list the species from the threatened and endangered list occurred on July 6, 1999. This proposal is currently under review. No bald eagle Critical Habitat has been designated.

Bald eagles generally perch, roost, and build nests in mature trees near water bodies and available prey, usually away from intense human activity. They prey on a variety of foods including fish, birds, mammals, carrion, and invertebrates. Stalmaster (1987) reports that typically over 50 percent of an eagle's diet comes from fish, 25 percent from other birds, and 15 percent from mammals, although they will also feed on carrion (Stokes and Stokes, 1989 and Matthews, 1988). Bald eagles usually spot prey from perches or while soaring (Ehrlich et al., 1988).

Bald eagles typically return to one of several nests located within an established nesting territory (Stalmaster, 1987). Eggs laid in March and April hatch within one and a half months. As bald eagles are primarily fish eaters, they usually nest within 1 mile (1.6 km) of open water. Their seasonal home range for foraging and nesting averages 2.4 square miles (5.3 sq km) in this region (Stinson et al., 2001).

Bald eagles are both residents in, and migrants through Washington, including Pierce County. Bald eagles generally perch, roost, and build nests in mature trees near water bodies and available prey. Nests are located in trees which dominate the surrounding canopy and provide a clear vantage point. Eagle populations are usually highest in the region in the winter months when both resident birds and winter migrants are present due to the mild winter climate and abundant fall salmon runs (Stinson et al., 2001). In the Puget Sound region birds and fish are generally the most common food for eagles (Stinson et al., 2001). In western Washington, bald eagles breed during mid- to late winter. Young eagles usually fledge in early to mid-July in Washington.

5.3.1.2 Marbled Murrelet

The Marbled murrelet was listed by the USFWS in 1992 as a federally threatened species in Washington, Oregon, and California. Marbled murrelet critical habitat was designated in May 1996 in 50 CFR § 17.11.

Marbled murrelets are found from the Aleutian Islands of Alaska south to central California, and individual birds may winter as far south as southern California. In Washington, marbled murrelets are

year-round residents on coastal waters. Their preferred prey includes small fish and crustaceans (WDW, 1991 and Ehrlich et al., 1988). However, nestlings are usually fed larger second year fish (USFWS, 1997). Murrelets feed between 500 feet (152 m) of the shore (Ehrlich et al., 1988) and 1.2 miles (1.9 km) from the shore (WDW, 1991), at depths of less than 330 feet (100 m).

Marbled murrelets nest and roost in mature and old growth forest areas of western Washington (WDW, 1991). The nesting period extends from April 1 to September 15. Although they do not nest in colonies like many other seabirds, they may nest in clusters, and they tend to nest in the same forest stand in successive years (USFWS, 1997). Nest trees are typically greater than 32 inches (81 cm) in diameter at breast height (dbh). Murrelets prefer large flat conifer branches, often covered with moss (WDW, 1991). These branches can range from four to 25 inches (10 to 63 cm) in diameter. Nesting branches are usually located in the upper third of the tree canopy layer (USFWS, 1997).

The main cause of the decline of marbled murrelets in the Pacific Northwest is most likely the loss of nesting habitat and poor reproductive success in the habitat that remains. Oil spills and fishing nets contribute to adult mortality (USFWS, 1997).

5.3.2 OCCURRENCE

5.3.2.1 Bald Eagle

There are six bald eagle nesting territories located in the vicinity of FIL (WDFW, 2002). One territory includes the location of FIL, with two nest sites in close proximity to one another, located approximately 700 feet (210 m) east of FIL. The nests are located in large conifers located on the top of the ridge above the laboratory. This territory was active from 1996 to 1999; it has not been active since 1999 (Brookshire, personal communication, 2002 and Tihri, personal communications, 2002). A second nest territory is located approximately 1.5 miles (2.4 km) southeast of FIL. This nest was active in 2001; it is unknown if it was active in 2002 (Brookshire, personal communication, 2002; Tihri, personal communications, 2002). However, the WDFW considers a nest "active" for five years from the last known use (Tihri, personal communications, 2002). A third bald eagle territory is located on Gertrude Island, approximately 5 miles (8 km) from FIL; the last recorded use of this nest was in 1990 (WDFW, 2002). Three other nests are located in excess of one mile from FIL.

Eagles have been observed soaring and foraging over the marine habitat off of FIL.

5.3.2.2 Marbled Murrelet

In Washington, marbled murrelets are year-round residents on coastal waters. They feed on saltwater within 1.2 miles (2 km) of the shore, at depths of less than 100 feet (30 m) (WDW, 1991). The estimated breeding population of marbled murrelets is 5,000 on Washington coastal waters (Speich et al., 1991). An estimated 1,800 marbled murrelets were observed along Washington's outer coast during aerial surveys (Varoujean et al., 1994 in USFWS, 1997).

Although they do not nest in colonies like many other seabirds, they may nest in clusters. They nest and roost in mature and old growth forest areas of western Washington (WDW, 1991). The nest trees are often emergent canopy trees (Bush, personal communication, 1994). The branches used for nesting are

five to seven inches (12 to 18 cm) in diameter, and located at the high point of the canopy (Bush, personal communication, 1994). The nesting period extends from April 1 to September 15.

The USFWS has indicated that marbled murrelets may forage in marine waters off of the project site. The Action Area does not contain any known marbled murrelet nest sites or potential nesting sites due to the lack of suitable mature or old growth tree stands within the Action Area (Brookshire and Tirhi, personal communications, 2002). There is no critical habitat within the vicinity of FIL. Marbled murrelets likely forage off of FIL site.

5.3.3 ANALYSIS OF EFFECTS

5.3.3.1 Bald Eagle

Eagles have been found to be sensitive to both noise and human activity within specific distances of their nests (Stalmaster, 1987 and Watson 1993 and 1994). Considerable information is available in the scientific literature regarding the effect of human activity on nesting eagles (Watson, 1993 and 2002; Watson and Cunningham, 1994; Stalmaster 1987; and Watson, 2002). Recommended buffer zones around nest sites range from 600 to 800 feet (182 to 244 m) (WDW, 1993 and Watson and Cunningham, 1993). Less is known, however, about eagle tolerance of human activity near feeding or perching sites. Stalmaster and Newman (1978) found that 50 percent of bald eagles observed flushed from perches at 500 feet (152 m), but that 98 percent of eagles would tolerate human presence at 1,000 feet (305 m) (WDW, 1991). The WDFW recommends a buffer of 1,500 feet (457 m) between feeding areas and human activity and permanent structures. In perching areas, where little screening is present, buffers of 800 to 1,000 feet (244 to 305 m) are recommended (Stalmaster, 1987).

Proposed construction at FIL is located within the range of the recommended construction buffer zone (600 to 800 feet [182 to 244 m]) from a bald eagle nest. However, construction will not take place within the breeding, or nesting period. As noted in Section 5.1.6, the in-water work will be limited to the period of mid-June through mid-October; this includes a portion of the rearing period for bald eagle. The lack of line-of-sight between the eagle nest and the construction area will lessen the effects upon nesting bald eagles.

Foraging activity by bald eagle in the vicinity of FIL would potentially be affected. Potential avoidance is expected to be limited only to the period of construction. Alternative nearshore foraging habitat exists both northwest and southeast of FIL. Operation of the new facility is not expected to substantially exceed the cumulative level of disturbance caused by activities at the existing FIL, and as a result, is not anticipated to impact bald eagles foraging or perching within the vicinity.

5.3.3.2 Marbled Murrelet

The USFWS has indicated that marbled murrelets may forage in marine waters off of the project site. The Action Area does not contain any known marbled murrelet nest sites or potential nesting sites due to the lack of suitable mature or old growth tree stands within the Action Area (Brookshire and Tirhi, personal communications, 2002). Marbled murrelets may forage off of FIL site. Murrelets will likely avoid the immediate vicinity of FIL during construction activity; this area is an insignificant portion of their potential foraging habitat in Puget Sound. Therefore, this project is not likely to significantly impact marbled murrelet.

5.3.4 CONSERVATION MEASURES

5.3.4.1 Bald Eagle

Construction activities will be timed to avoid most bald eagle nesting activity. Prior to scheduling construction, Navy biologists will determine from USFWS and WDFW if the nest territory adjoining FIL site is in active use. If the nest is active, the nest will be monitored and noise intensive activities such as piling removal or pile driving will not occur until the young eagles have fledged, which usually occurs in mid- to late-July. Construction timing to avoid impacts to fish and bald eagles, if present during construction, would also minimize the potential to affect other waterfowl species that bald eagle may forage upon.

5.3.4.2 Marbled Murrelet

No specific conservation measures are proposed for marbled murrelet at FIL. However, conservation measures described in Section 5.1.6 above will minimize effects upon forage fish species.

5.3.5 EFFECT DETERMINATIONS

5.3.5.1 Bald Eagle

Bald eagle has been listed by the USFWS as threatened. No critical habitat was been designated or proposed for bald eagle. Bald eagles are known to occur within the Action Area, as well as throughout Puget Sound. The nearest nest to FIL is approximately 700 feet (210 m) from the shoreline at FIL. The Action will result in noise and activity that may disturb bald eagles, and in-water work which may affect forage fish and waterfowl species of the bald eagle. Therefore, the Action **may affect** bald eagle. Potential short-term effects will be minimized to discountable levels through the use of the proposed conservation measures. The Action will not result in the degradation of existing habitat conditions in the Action Area; therefore, the project is **not likely to adversely affect** bald eagle.

5.3.5.2 Marbled Murrelet

Marbled murrelet has been listed by the USFWS as threatened. Marbled murrelet critical habitat was designated in May 1996. Marbled murrelet are known to occur within the Action Area, as well as throughout Puget Sound. There are no known nests in the vicinity of FIL, and no typical nesting habitat is present. The Action will result in noise and activity which may affect foraging marbled murrelets, and in-water work which may affect forage fish. Therefore, the Action **may affect** marbled murrelet. Potential short-term effects upon murrelet foraging will be minimized to discountable levels through the use of the proposed conservation measures. The Action will not result in the degradation of existing habitat conditions in the Action Area; therefore, the project is **not likely to adversely affect** marbled murrelet.

5.4 Interrelated and Interdependent Actions

The Action involves an in-kind replacement of existing facilities at FIL. FIL must provide stable in-water facilities in order to meet its mission requirements. The purpose of the Action is to stabilize in-water facilities to ensure the safety of staff and visitors working at the laboratory and to prevent further damage.

The Action includes the stabilization of in-water facilities. No alteration is proposed to upland facilities that would increase the capacity of FIL. The Action will not affect or change the mission of FIL. No other actions are interrelated with, or interdependent on, the Action.

5.5 Cumulative Effects

Cumulative effects are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area, not subject to consultation (50 CFR § 402.02). As described above, the Action Area has experienced various levels of development. Most development has been associated with residential shoreline development. No other Navy facilities occur within the Action Area. Limited commercial and institutional development occurs within the Action Area. The Washington State Department of Corrections operates a facility on McNeil Island across Carr Inlet from FIL. This facility includes docks and piers used to support the facility. The Access Pier and other in-water facilities associated with FIL are the only significant in-water facilities located on the southwestern shoreline of Fox Island. Residential shoreline development, particularly related to shoreline armoring, has had a significant effect on beach and nearshore habitat along the southwestern shoreline of Fox Island (Shepsis, 2002). The Navy is not aware of any proposed non-federal projects in the vicinity of FIL that could contribute to cumulative effects on listed species. The replacement of these facilities or the construction of new facilities will be regulated by the U.S. Army Corps of Engineers under the CWA and, therefore, subject to individual section 7 review. Any in-water project within the Action Area will require a similar federal permit or action. The contribution of the Action to cumulative effects on listed species is discountable.

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APPENDIX D

CENSUS PROFILES
FOR
FOX ISLAND AND PIERCE COUNTY

Table DP-1. Profile of General Demographic Characteristics: 2000
Geographic area: Fox Island CDP, Washington
[For information on confidentiality protection, nonsampling error, and definitions, see text]

Subject	Number	Percent
Total population	2,803	100.0
SEX AND AGE		
Male	1,406	50.2
Female	1,397	49.8
Under 5 years	153	5.5
5 to 9 years	225	8.0
10 to 14 years	262	9.3
15 to 19 years	178	6.4
20 to 24 years	70	2.5
25 to 34 years	189	6.7
35 to 44 years	513	18.3
45 to 54 years	523	18.7
55 to 59 years	232	8.3
60 to 64 years	137	4.9
65 to 74 years	207	7.4
75 to 84 years	82	2.9
85 years and over	32	1.1
Median age (years)	41.5	(X)
18 years and over	2,038	72.7
Male	998	35.6
Female	1,040	37.1
21 years and over	1,963	70.0
62 years and over	395	14.1
65 years and over	321	11.5
Male	162	5.8
Female	159	5.7
RACE		
One race	2,737	97.6
White	2,637	94.1
Black or African American	18	0.6
American Indian and Alaska Native	21	0.7
Asian	46	1.6
Asian Indian	2	0.1
Chinese	11	0.4
Filipino	11	0.4
Japanese	11	0.4
Korean	6	0.2
Vietnamese	2	0.1
Other Asian [1]	3	0.1
Native Hawaiian and Other Pacific Islander	4	0.1
Native Hawaiian	-	-
Guamanian or Chamorro	-	-
Samoan	-	-
Other Pacific Islander [2]	4	0.1
Some other race	11	0.4
Two or more races	66	2.4
Race alone or in combination with one or more other races: [3]		
White	2,694	96.1
Black or African American	27	1.0
American Indian and Alaska Native	46	1.6
Asian	65	2.3
Native Hawaiian and Other Pacific Islander	8	0.3
Some other race	29	1.0

Subject	Number	Percent
HISPANIC OR LATINO AND RACE		
Total population	2,803	100.0
Hispanic or Latino (of any race)	52	1.9
Mexican	28	1.0
Puerto Rican	6	0.2
Cuban	3	0.1
Other Hispanic or Latino	15	0.5
Not Hispanic or Latino	2,751	98.1
White alone	2,604	92.9
RELATIONSHIP		
Total population	2,803	100.0
In households	2,803	100.0
Householder	1,048	37.4
Spouse	759	27.1
Child	865	30.9
Own child under 18 years	744	26.5
Other relatives	48	1.7
Under 18 years	14	0.5
Nonrelatives	83	3.0
Unmarried partner	31	1.1
In group quarters	-	-
Institutionalized population	-	-
Noninstitutionalized population	-	-
HOUSEHOLD BY TYPE		
Total households	1,048	100.0
Family households (families)	848	80.9
With own children under 18 years	386	36.8
Married-couple family	759	72.4
With own children under 18 years	326	31.1
Female householder, no husband present	64	6.1
With own children under 18 years	43	4.1
Nonfamily households	200	19.1
Householder living alone	158	15.1
Householder 65 years and over	50	4.8
Households with individuals under 18 years	398	38.0
Households with individuals 65 years and over	218	20.8
Average household size	2.67	(X)
Average family size	2.97	(X)
HOUSING OCCUPANCY		
Total housing units	1,150	100.0
Occupied housing units	1,048	91.1
Vacant housing units	102	8.9
For seasonal, recreational, or occasional use	64	5.6
Homeowner vacancy rate (percent)	0.7	(X)
Rental vacancy rate (percent)	9.4	(X)
HOUSING TENURE		
Occupied housing units	1,048	100.0
Owner-occupied housing units	961	91.7
Renter-occupied housing units	87	8.3
Average household size of owner-occupied units	2.71	(X)
Average household size of renter-occupied units	2.33	(X)

- Represents zero or rounds to zero. (X) Not applicable.
[1] Other Asian alone, or two or more Asian categories.
[2] Other Pacific Islander alone, or two or more Native Hawaiian and Other Pacific Islander categories.
[3] In combination with one or more of the other races listed. The six numbers may add to more than the total population and the six percentages may add to more than 100 percent because individuals may report more than one race.

Source: U.S. Census Bureau, Census 2000.

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U.S. Census Bureau

Table DP-2. Profile of Selected Social Characteristics: 2000

Geographic area: Fox Island CDP, Washington

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
SCHOOL ENROLLMENT		
Population 3 years and over enrolled in school	**813**	**100.0**
Nursery school, preschool	43	5.3
Kindergarten	18	2.2
Elementary school (grades 1-8)	482	59.3
High school (grades 9-12)	172	21.2
College or graduate school	98	12.1
EDUCATIONAL ATTAINMENT		
Population 25 years and over	**1,899**	**100.0**
Less than 9th grade	-	-
9th to 12th grade, no diploma	73	3.8
High school graduate (includes equivalency)	371	19.5
Some college, no degree	542	28.5
Associate degree	149	7.8
Bachelor's degree	481	25.3
Graduate or professional degree	283	14.9
Percent high school graduate or higher	96.2	(X)
Percent bachelor's degree or higher	40.2	(X)
MARITAL STATUS		
Population 15 years and over	**2,154**	**100.0**
Never married	351	16.3
Now married, except separated	1,523	70.7
Separated	22	1.0
Widowed	56	2.6
Female	56	2.6
Divorced	202	9.4
Female	136	6.3
GRANDPARENTS AS CAREGIVERS		
Grandparent living in household with one or more own grandchildren under 18 years	**9**	**100.0**
Grandparent responsible for grandchildren	9	100.0
VETERAN STATUS		
Civilian population 18 years and over	**2,026**	**100.0**
Civilian veterans	419	20.7
DISABILITY STATUS OF THE CIVILIAN NONINSTITUTIONALIZED POPULATION		
Population 5 to 20 years	**722**	**100.0**
With a disability	29	4.0
Population 21 to 64 years	**1,631**	**100.0**
With a disability	225	13.8
Percent employed	56.4	(X)
No disability	1,406	86.2
Percent employed	78.6	(X)
Population 65 years and over	**314**	**100.0**
With a disability	98	31.2
RESIDENCE IN 1995		
Population 5 years and over	**2,667**	**100.0**
Same house in 1995	1,467	55.0
Different house in the U.S. in 1995	1,168	43.8
Same county	798	29.9
Different county	370	13.9
Same state	206	7.7
Different state	164	6.1
Elsewhere in 1995	32	1.2

Subject	Number	Percent
NATIVITY AND PLACE OF BIRTH		
Total population	**2,803**	**100.0**
Native	2,777	99.1
Born in United States	2,732	97.5
State of residence	1,498	53.4
Different state	1,234	44.0
Born outside United States	45	1.6
Foreign born	26	0.9
Entered 1990 to March 2000	-	-
Naturalized citizen	26	0.9
Not a citizen	-	-
REGION OF BIRTH OF FOREIGN BORN		
Total (excluding born at sea)	**26**	**100.0**
Europe	26	100.0
Asia	-	-
Africa	-	-
Oceania	-	-
Latin America	-	-
Northern America	-	-
LANGUAGE SPOKEN AT HOME		
Population 5 years and over	**2,667**	**100.0**
English only	2,592	97.2
Language other than English	75	2.8
Speak English less than "very well"	27	1.0
Spanish	49	1.8
Speak English less than "very well"	27	1.0
Other Indo-European languages	26	1.0
Speak English less than "very well"	-	-
Asian and Pacific Island languages	-	-
Speak English less than "very well"	-	-
ANCESTRY (single or multiple)		
Total population	**2,803**	**100.0**
Total ancestries reported	*3,399*	*121.3*
Arab	24	0.9
Czech[1]	24	0.9
Danish	52	1.9
Dutch	54	1.9
English	420	15.0
French (except Basque)[1]	116	4.1
French Canadian[1]	53	1.9
German	701	25.0
Greek	32	1.1
Hungarian	-	-
Irish[1]	371	13.2
Italian	133	4.7
Lithuanian	10	0.4
Norwegian	312	11.1
Polish	21	0.7
Portuguese	4	0.1
Russian	34	1.2
Scotch-Irish	91	3.2
Scottish	78	2.8
Slovak	6	0.2
Subsaharan African	9	0.3
Swedish	170	6.1
Swiss	4	0.1
Ukrainian	6	0.2
United States or American	110	3.9
Welsh	78	2.8
West Indian (excluding Hispanic groups)	-	-
Other ancestries	486	17.3

-Represents zero or rounds to zero. (X) Not applicable.

[1]The data represent a combination of two ancestries shown separately in Summary File 3. Czech includes Czechoslovakian. French includes Alsatian. French Canadian includes Acadian/Cajun. Irish includes Celtic.

Source: U.S. Bureau of the Census, Census 2000.

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U.S. Census Bureau

Table DP-3. Profile of Selected Economic Characteristics: 2000

Geographic area: Fox Island CDP, Washington

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
EMPLOYMENT STATUS		
Population 16 years and over	**2,085**	**100.0**
In labor force	1,404	67.3
Civilian labor force	1,404	67.3
Employed	1,335	64.0
Unemployed	69	3.3
Percent of civilian labor force	4.9	(X)
Armed Forces	-	-
Not in labor force	681	32.7
Females 16 years and over	**1,077**	**100.0**
In labor force	662	61.5
Civilian labor force	662	61.5
Employed	638	59.2
Own children under 6 years	**154**	**100.0**
All parents in family in labor force	77	50.0
COMMUTING TO WORK		
Workers 16 years and over	**1,309**	**100.0**
Car, truck, or van - - drove alone	963	73.6
Car, truck, or van - - carpooled	161	12.3
Public transportation (including taxicab)	10	0.8
Walked	26	2.0
Other means	19	1.5
Worked at home	130	9.9
Mean travel time to work (minutes)[1]	41.9	(X)
Employed civilian population 16 years and over	**1,335**	**100.0**
OCCUPATION		
Management, professional, and related occupations	648	48.5
Service occupations	132	9.9
Sales and office occupations	361	27.0
Farming, fishing, and forestry occupations	-	-
Construction, extraction, and maintenance occupations	102	7.6
Production, transportation, and material moving occupations	92	6.9
INDUSTRY		
Agriculture, forestry, fishing and hunting, and mining	12	0.9
Construction	95	7.1
Manufacturing	107	8.0
Wholesale trade	58	4.3
Retail trade	101	7.6
Transportation and warehousing, and utilities	93	7.0
Information	47	3.5
Finance, insurance, real estate, and rental and leasing	130	9.7
Professional, scientific, management, administrative, and waste management services	189	14.2
Educational, health and social services	325	24.3
Arts, entertainment, recreation, accommodation and food services	38	2.8
Other services (except public administration)	58	4.3
Public administration	82	6.1
CLASS OF WORKER		
Private wage and salary workers	974	73.0
Government workers	244	18.3
Self-employed workers in own not incorporated business	105	7.9
Unpaid family workers	12	0.9

Subject	Number	Percent
INCOME IN 1999		
Households	**1,041**	**100.0**
Less than $10,000	15	1.4
$10,000 to $14,999	-	-
$15,000 to $24,999	51	4.9
$25,000 to $34,999	53	5.1
$35,000 to $49,999	150	14.4
$50,000 to $74,999	329	31.6
$75,000 to $99,999	128	12.3
$100,000 to $149,999	200	19.2
$150,000 to $199,999	59	5.7
$200,000 or more	56	5.4
Median household income (dollars)	69,135	(X)
With earnings	867	83.3
Mean earnings (dollars)[1]	81,425	(X)
With Social Security income	210	20.2
Mean Social Security income (dollars)[1]	14,281	(X)
With Supplemental Security Income	39	3.7
Mean Supplemental Security Income (dollars)[1]	5,962	(X)
With public assistance income	12	1.2
Mean public assistance income (dollars)[1]	5,783	(X)
With retirement income	267	25.6
Mean retirement income (dollars)[1]	31,128	(X)
Families	**859**	**100.0**
Less than $10,000	15	1.7
$10,000 to $14,999	-	-
$15,000 to $24,999	34	4.0
$25,000 to $34,999	54	6.3
$35,000 to $49,999	107	12.5
$50,000 to $74,999	234	27.2
$75,000 to $99,999	119	13.9
$100,000 to $149,999	197	22.9
$150,000 to $199,999	59	6.9
$200,000 or more	40	4.7
Median family income (dollars)	72,284	(X)
Per capita income (dollars)[1]	32,533	(X)
Median earnings (dollars):		
Male full-time, year-round workers	61,208	(X)
Female full-time, year-round workers	39,821	(X)

Subject	Number below poverty level	Percent below poverty level
POVERTY STATUS IN 1999		
Families	**15**	**1.7**
With related children under 18 years	15	3.7
With related children under 5 years	-	-
Families with female householder, no husband present	**9**	**10.2**
With related children under 18 years	9	11.4
With related children under 5 years	-	-
Individuals	**88**	**3.2**
18 years and over	45	2.2
65 years and over	-	-
Related children under 18 years	38	5.0
Related children 5 to 17 years	38	6.2
Unrelated individuals 15 years and over	12	4.8

-Represents zero or rounds to zero. (X) Not applicable.

[1]If the denominator of a mean value or per capita value is less than 30, then that value is calculated using a rounded aggregate in the numerator. See text.

Source: U.S. Bureau of the Census, Census 2000.

Table DP-4. Profile of Selected Housing Characteristics: 2000

Geographic area: Fox Island CDP, Washington

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent	Subject	Number	Percent
Total housing units	**1,150**	**100.0**	**OCCUPANTS PER ROOM**		
UNITS IN STRUCTURE			**Occupied housing units**	**1,048**	**100.0**
1-unit, detached	1,044	90.8	1.00 or less	1,022	97.5
1-unit, attached	43	3.7	1.01 to 1.50	19	1.8
2 units	5	0.4	1.51 or more	7	0.7
3 or 4 units	9	0.8			
5 to 9 units	-	-	**Specified owner-occupied units**	**842**	**100.0**
10 to 19 units	-	-	**VALUE**		
20 or more units	-	-	Less than $50,000	6	0.7
Mobile home	49	4.3	$50,000 to $99,999	6	0.7
Boat, RV, van, etc	-	-	$100,000 to $149,999	94	11.2
			$150,000 to $199,999	155	18.4
YEAR STRUCTURE BUILT			$200,000 to $299,999	249	29.6
1999 to March 2000	51	4.4	$300,000 to $499,999	254	30.2
1995 to 1998	174	15.1	$500,000 to $999,999	66	7.8
1990 to 1994	194	16.9	$1,000,000 or more	12	1.4
1980 to 1989	243	21.1	Median (dollars)	260,300	(X)
1970 to 1979	237	20.6			
1960 to 1969	77	6.7	**MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS**		
1940 to 1959	77	6.7			
1939 or earlier	97	8.4	With a mortgage	647	76.8
			Less than $300	-	-
ROOMS			$300 to $499	13	1.5
1 room	15	1.3	$500 to $699	6	0.7
2 rooms	15	1.3	$700 to $999	85	10.1
3 rooms	38	3.3	$1,000 to $1,499	217	25.8
4 rooms	59	5.1	$1,500 to $1,999	125	14.8
5 rooms	159	13.8	$2,000 or more	201	23.9
6 rooms	179	15.6	Median (dollars)	1,505	(X)
7 rooms	216	18.8	Not mortgaged	195	23.2
8 rooms	239	20.8	Median (dollars)	483	(X)
9 or more rooms	230	20.0			
Median (rooms)	7.0	(X)	**SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999**		
Occupied housing units	**1,048**	**100.0**			
YEAR HOUSEHOLDER MOVED INTO UNIT			Less than 15.0 percent	258	30.6
1999 to March 2000	169	16.1	15.0 to 19.9 percent	126	15.0
1995 to 1998	275	26.2	20.0 to 24.9 percent	121	14.4
1990 to 1994	247	23.6	25.0 to 29.9 percent	96	11.4
1980 to 1989	243	23.2	30.0 to 34.9 percent	62	7.4
1970 to 1979	74	7.1	35.0 percent or more	179	21.3
1969 or earlier	40	3.8	Not computed	-	-
VEHICLES AVAILABLE			**Specified renter-occupied units**	**88**	**100.0**
None	48	4.6	**GROSS RENT**		
1	126	12.2	Less than $200	-	-
2	577	55.1	$200 to $299	-	-
3 or more	295	28.1	$300 to $499	-	-
			$500 to $749	29	33.0
HOUSE HEATING FUEL			$750 to $999	-	-
Utility gas	13	1.2	$1,000 to $1,499	28	31.8
Bottled, tank, or LP gas	116	11.1	$1,500 or more	24	27.3
Electricity	748	71.4	No cash rent	7	8.0
Fuel oil, kerosene, etc	113	10.8	Median (dollars)	1,283	(X)
Coal or coke	-	-			
Wood	42	4.0	**GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999**		
Solar energy	-	-			
Other fuel	10	1.0	Less than 15.0 percent	18	20.5
No fuel used	6	0.6	15.0 to 19.9 percent	-	-
			20.0 to 24.9 percent	9	10.2
SELECTED CHARACTERISTICS			25.0 to 29.9 percent	23	26.1
Lacking complete plumbing facilities	-	-	30.0 to 34.9 percent	22	25.0
Lacking complete kitchen facilities	-	-	35.0 percent or more	9	10.2
No telephone service	7	0.7	Not computed	7	8.0

-Represents zero or rounds to zero. (X) Not applicable.

Source: U.S. Bureau of the Census, Census 2000.

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U.S. Census Bureau

Table DP-1. Profile of General Demographic Characteristics: 2000
Geographic area: Pierce County, Washington
[For information on confidentiality protection, nonsampling error, and definitions, see text]

Subject	Number	Percent	Subject	Number	Percent
Total population	700,820	100.0	**HISPANIC OR LATINO AND RACE**		
			Total population	700,820	100.0
SEX AND AGE			Hispanic or Latino (of any race)	38,621	5.5
Male	348,557	49.7	Mexican	23,773	3.4
Female	352,263	50.3	Puerto Rican	4,837	0.7
			Cuban	597	0.1
Under 5 years	49,861	7.1	Other Hispanic or Latino	9,414	1.3
5 to 9 years	53,862	7.7	Not Hispanic or Latino	662,199	94.5
10 to 14 years	55,016	7.9	White alone	532,934	76.0
15 to 19 years	52,775	7.5			
20 to 24 years	47,645	6.8	**RELATIONSHIP**		
25 to 34 years	101,146	14.4	**Total population**	700,820	100.0
35 to 44 years	118,408	16.9	In households	679,310	96.9
45 to 54 years	94,574	13.5	Householder	260,800	37.2
55 to 59 years	32,142	4.6	Spouse	137,673	19.6
60 to 64 years	23,771	3.4	Child	212,083	30.3
65 to 74 years	38,154	5.4	Own child under 18 years	173,526	24.8
75 to 84 years	25,197	3.6	Other relatives	28,318	4.0
85 years and over	8,269	1.2	Under 18 years	11,582	1.7
			Nonrelatives	40,436	5.8
Median age (years)	34.1	(X)	Unmarried partner	16,183	2.3
			In group quarters	21,510	3.1
18 years and over	510,251	72.8	Institutionalized population	8,013	1.1
Male	250,875	35.8	Noninstitutionalized population	13,497	1.9
Female	259,376	37.0			
21 years and over	478,956	68.3			
62 years and over	85,337	12.2	**HOUSEHOLD BY TYPE**		
65 years and over	71,620	10.2	**Total households**	260,800	100.0
Male	30,174	4.3	Family households (families)	180,199	69.1
Female	41,446	5.9	With own children under 18 years	93,671	35.9
			Married-couple family	137,673	52.8
RACE			With own children under 18 years	65,774	25.2
One race	664,977	94.9	Female householder, no husband present	30,679	11.8
White	549,369	78.4	With own children under 18 years	20,534	7.9
Black or African American	48,730	7.0	Nonfamily households	80,601	30.9
American Indian and Alaska Native	9,963	1.4	Householder living alone	63,496	24.3
Asian	35,583	5.1	Householder 65 years and over	19,927	7.6
Asian Indian	1,132	0.2			
Chinese	1,936	0.3	Households with individuals under 18 years	101,421	38.9
Filipino	7,324	1.0	Households with individuals 65 years and over	50,400	19.3
Japanese	3,571	0.5			
Korean	10,562	1.5	Average household size	2.60	(X)
Vietnamese	4,830	0.7	Average family size	3.10	(X)
Other Asian [1]	6,228	0.9			
Native Hawaiian and Other Pacific Islander	5,922	0.8	**HOUSING OCCUPANCY**		
Native Hawaiian	998	0.1	**Total housing units**	277,060	100.0
Guamanian or Chamorro	1,835	0.3	Occupied housing units	260,800	94.1
Samoan	2,386	0.3	Vacant housing units	16,260	5.9
Other Pacific Islander [2]	703	0.1	For seasonal, recreational, or occasional use	2,584	0.9
Some other race	15,410	2.2			
Two or more races	35,843	5.1	Homeowner vacancy rate (percent)	1.8	(X)
			Rental vacancy rate (percent)	6.1	(X)
Race alone or in combination with one or more other races: [3]					
White	579,234	82.7	**HOUSING TENURE**		
Black or African American	59,948	8.6	**Occupied housing units**	260,800	100.0
American Indian and Alaska Native	19,919	2.8	Owner-occupied housing units	165,598	63.5
Asian	48,803	7.0	Renter-occupied housing units	95,202	36.5
Native Hawaiian and Other Pacific Islander	9,581	1.4	Average household size of owner-occupied units	2.71	(X)
Some other race	23,000	3.3	Average household size of renter-occupied units	2.42	(X)

- Represents zero or rounds to zero. (X) Not applicable.
[1] Other Asian alone, or two or more Asian categories.
[2] Other Pacific Islander alone, or two or more Native Hawaiian and Other Pacific Islander categories.
[3] In combination with one or more of the other races listed. The six numbers may add to more than the total population and the six percentages may add to more than 100 percent because individuals may report more than one race.

Source: U.S. Census Bureau, Census 2000.

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U.S. Census Bureau

Table DP-2. Profile of Selected Social Characteristics: 2000

Geographic area: Pierce County, Washington

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
SCHOOL ENROLLMENT		
Population 3 years and over enrolled in school	**191,320**	**100.0**
Nursery school, preschool	11,150	5.8
Kindergarten	10,414	5.4
Elementary school (grades 1-8)	89,011	46.5
High school (grades 9-12)	42,746	22.3
College or graduate school	37,999	19.9
EDUCATIONAL ATTAINMENT		
Population 25 years and over	**442,665**	**100.0**
Less than 9th grade	14,874	3.4
9th to 12th grade, no diploma	43,251	9.8
High school graduate (includes equivalency)	131,810	29.8
Some college, no degree	125,820	28.4
Associate degree	35,749	8.1
Bachelor's degree	60,536	13.7
Graduate or professional degree	30,625	6.9
Percent high school graduate or higher	86.9	(X)
Percent bachelor's degree or higher	20.6	(X)
MARITAL STATUS		
Population 15 years and over	**541,944**	**100.0**
Never married	136,584	25.2
Now married, except separated	299,137	55.2
Separated	10,299	1.9
Widowed	28,650	5.3
Female	22,983	4.2
Divorced	67,274	12.4
Female	38,238	7.1
GRANDPARENTS AS CAREGIVERS		
Grandparent living in household with one or more own grandchildren under 18 years	**11,338**	**100.0**
Grandparent responsible for grandchildren	5,364	47.3
VETERAN STATUS		
Civilian population 18 years and over	**493,720**	**100.0**
Civilian veterans	96,713	19.6
DISABILITY STATUS OF THE CIVILIAN NONINSTITUTIONALIZED POPULATION		
Population 5 to 20 years	**168,136**	**100.0**
With a disability	13,972	8.3
Population 21 to 64 years	**389,033**	**100.0**
With a disability	79,383	20.4
Percent employed	58.3	(X)
No disability	309,650	79.6
Percent employed	77.0	(X)
Population 65 years and over	**68,865**	**100.0**
With a disability	30,269	44.0
RESIDENCE IN 1995		
Population 5 years and over	**651,081**	**100.0**
Same house in 1995	305,276	46.9
Different house in the U.S. in 1995	325,494	50.0
Same county	184,191	28.3
Different county	141,303	21.7
Same state	67,966	10.4
Different state	73,337	11.3
Elsewhere in 1995	20,311	3.1

Subject	Number	Percent
NATIVITY AND PLACE OF BIRTH		
Total population	**700,820**	**100.0**
Native	644,295	91.9
Born in United States	626,734	89.4
State of residence	341,574	48.7
Different state	285,160	40.7
Born outside United States	17,561	2.5
Foreign born	56,525	8.1
Entered 1990 to March 2000	21,641	3.1
Naturalized citizen	28,370	4.0
Not a citizen	28,155	4.0
REGION OF BIRTH OF FOREIGN BORN		
Total (excluding born at sea)	**56,514**	**100.0**
Europe	14,971	26.5
Asia	26,092	46.2
Africa	722	1.3
Oceania	819	1.4
Latin America	10,454	18.5
Northern America	3,456	6.1
LANGUAGE SPOKEN AT HOME		
Population 5 years and over	**651,081**	**100.0**
English only	574,433	88.2
Language other than English	76,648	11.8
Speak English less than "very well"	31,523	4.8
Spanish	24,602	3.8
Speak English less than "very well"	9,664	1.5
Other Indo-European languages	19,065	2.9
Speak English less than "very well"	5,468	0.8
Asian and Pacific Island languages	31,447	4.8
Speak English less than "very well"	16,012	2.5
ANCESTRY (single or multiple)		
Total population	**700,820**	**100.0**
Total ancestries reported	*766,399*	*109.4*
Arab	1,331	0.2
Czech[1]	4,000	0.6
Danish	7,492	1.1
Dutch	13,905	2.0
English	73,614	10.5
French (except Basque)[1]	26,162	3.7
French Canadian[1]	7,131	1.0
German	131,414	18.8
Greek	2,346	0.3
Hungarian	1,653	0.2
Irish[1]	80,111	11.4
Italian	25,756	3.7
Lithuanian	932	0.1
Norwegian	45,459	6.5
Polish	13,414	1.9
Portuguese	2,753	0.4
Russian	5,207	0.7
Scotch-Irish	13,266	1.9
Scottish	17,542	2.5
Slovak	736	0.1
Subsaharan African	3,720	0.5
Swedish	22,831	3.3
Swiss	4,111	0.6
Ukrainian	2,561	0.4
United States or American	35,637	5.1
Welsh	6,588	0.9
West Indian (excluding Hispanic groups)	1,420	0.2
Other ancestries	215,307	30.7

-Represents zero or rounds to zero. (X) Not applicable.

[1]The data represent a combination of two ancestries shown separately in Summary File 3. Czech includes Czechoslovakian. French includes Alsatian. French Canadian includes Acadian/Cajun. Irish includes Celtic.

Source: U.S. Bureau of the Census, Census 2000.

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U.S. Census Bureau

Table DP-3. Profile of Selected Economic Characteristics: 2000

Geographic area: Pierce County, Washington

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
EMPLOYMENT STATUS		
Population 16 years and over	531,215	100.0
In labor force	352,677	66.4
Civilian labor force	335,830	63.2
Employed	314,158	59.1
Unemployed	21,672	4.1
Percent of civilian labor force	6.5	(X)
Armed Forces	16,847	3.2
Not in labor force	178,538	33.6
Females 16 years and over	270,468	100.0
In labor force	160,119	59.2
Civilian labor force	157,806	58.3
Employed	147,240	54.4
Own children under 6 years	57,236	100.0
All parents in family in labor force	33,819	59.1
COMMUTING TO WORK		
Workers 16 years and over	324,285	100.0
Car, truck, or van - - drove alone	247,597	76.4
Car, truck, or van - - carpooled	43,166	13.3
Public transportation (including taxicab)	8,784	2.7
Walked	9,412	2.9
Other means	3,763	1.2
Worked at home	11,563	3.6
Mean travel time to work (minutes)[1]	28.4	(X)
Employed civilian population 16 years and over	314,158	100.0
OCCUPATION		
Management, professional, and related occupations	94,546	30.1
Service occupations	51,126	16.3
Sales and office occupations	84,105	26.8
Farming, fishing, and forestry occupations	1,683	0.5
Construction, extraction, and maintenance occupations	35,334	11.2
Production, transportation, and material moving occupations	47,364	15.1
INDUSTRY		
Agriculture, forestry, fishing and hunting, and mining	3,126	1.0
Construction	24,340	7.7
Manufacturing	39,511	12.6
Wholesale trade	13,919	4.4
Retail trade	39,408	12.5
Transportation and warehousing, and utilities	21,555	6.9
Information	7,138	2.3
Finance, insurance, real estate, and rental and leasing	18,212	5.8
Professional, scientific, management, administrative, and waste management services	23,095	7.4
Educational, health and social services	65,256	20.8
Arts, entertainment, recreation, accommodation and food services	24,275	7.7
Other services (except public administration)	15,960	5.1
Public administration	18,363	5.8
CLASS OF WORKER		
Private wage and salary workers	237,903	75.7
Government workers	55,577	17.7
Self-employed workers in own not incorporated business	19,736	6.3
Unpaid family workers	942	0.3

Subject	Number	Percent
INCOME IN 1999		
Households	260,897	100.0
Less than $10,000	18,639	7.1
$10,000 to $14,999	13,841	5.3
$15,000 to $24,999	30,639	11.7
$25,000 to $34,999	34,324	13.2
$35,000 to $49,999	46,521	17.8
$50,000 to $74,999	58,734	22.5
$75,000 to $99,999	30,989	11.9
$100,000 to $149,999	19,130	7.3
$150,000 to $199,999	4,081	1.6
$200,000 or more	3,999	1.5
Median household income (dollars)	45,204	(X)
With earnings	214,998	82.4
Mean earnings (dollars)[1]	53,458	(X)
With Social Security income	57,023	21.9
Mean Social Security income (dollars)[1]	11,558	(X)
With Supplemental Security Income	11,436	4.4
Mean Supplemental Security Income (dollars)[1]	6,598	(X)
With public assistance income	12,364	4.7
Mean public assistance income (dollars)[1]	3,804	(X)
With retirement income	49,140	18.8
Mean retirement income (dollars)[1]	18,143	(X)
Families	181,466	100.0
Less than $10,000	8,338	4.6
$10,000 to $14,999	6,343	3.5
$15,000 to $24,999	16,992	9.4
$25,000 to $34,999	21,619	11.9
$35,000 to $49,999	32,246	17.8
$50,000 to $74,999	46,270	25.5
$75,000 to $99,999	26,260	14.5
$100,000 to $149,999	16,547	9.1
$150,000 to $199,999	3,504	1.9
$200,000 or more	3,347	1.8
Median family income (dollars)	52,098	(X)
Per capita income (dollars)[1]	20,948	(X)
Median earnings (dollars):		
Male full-time, year-round workers	38,510	(X)
Female full-time, year-round workers	28,580	(X)

Subject	Number below poverty level	Percent below poverty level
POVERTY STATUS IN 1999		
Families	13,574	7.5
With related children under 18 years	11,399	11.3
With related children under 5 years	5,796	14.8
Families with female householder, no husband present	7,095	23.9
With related children under 18 years	6,734	29.6
With related children under 5 years	3,329	42.9
Individuals	71,316	10.5
18 years and over	45,846	9.3
65 years and over	4,953	7.2
Related children under 18 years	24,421	13.2
Related children 5 to 17 years	16,734	12.2
Unrelated individuals 15 years and over	24,867	20.9

-Represents zero or rounds to zero. (X) Not applicable.

[1]If the denominator of a mean value or per capita value is less than 30, then that value is calculated using a rounded aggregate in the numerator. See text.

Source: U.S. Bureau of the Census, Census 2000.

Table DP-4. Profile of Selected Housing Characteristics: 2000

Geographic area: Pierce County, Washington

[Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see text]

Subject	Number	Percent
Total housing units	277,060	100.0
UNITS IN STRUCTURE		
1-unit, detached	174,629	63.0
1-unit, attached	11,479	4.1
2 units	8,125	2.9
3 or 4 units	11,425	4.1
5 to 9 units	12,398	4.5
10 to 19 units	15,175	5.5
20 or more units	20,936	7.6
Mobile home	21,988	7.9
Boat, RV, van, etc	905	0.3
YEAR STRUCTURE BUILT		
1999 to March 2000	7,984	2.9
1995 to 1998	24,759	8.9
1990 to 1994	28,315	10.2
1980 to 1989	47,614	17.2
1970 to 1979	55,636	20.1
1960 to 1969	35,000	12.6
1940 to 1959	42,895	15.5
1939 or earlier	34,857	12.6
ROOMS		
1 room	5,894	2.1
2 rooms	13,423	4.8
3 rooms	26,969	9.7
4 rooms	43,252	15.6
5 rooms	51,924	18.7
6 rooms	50,668	18.3
7 rooms	39,211	14.2
8 rooms	23,456	8.5
9 or more rooms	22,263	8.0
Median (rooms)	5.4	(X)
Occupied housing units	260,800	100.0
YEAR HOUSEHOLDER MOVED INTO UNIT		
1999 to March 2000	62,904	24.1
1995 to 1998	81,603	31.3
1990 to 1994	42,924	16.5
1980 to 1989	36,388	14.0
1970 to 1979	20,080	7.7
1969 or earlier	16,901	6.5
VEHICLES AVAILABLE		
None	18,222	7.0
1	81,729	31.3
2	104,603	40.1
3 or more	56,246	21.6
HOUSE HEATING FUEL		
Utility gas	88,163	33.8
Bottled, tank, or LP gas	5,571	2.1
Electricity	145,978	56.0
Fuel oil, kerosene, etc	11,069	4.2
Coal or coke	41	-
Wood	8,241	3.2
Solar energy	25	-
Other fuel	1,345	0.5
No fuel used	367	0.1
SELECTED CHARACTERISTICS		
Lacking complete plumbing facilities	952	0.4
Lacking complete kitchen facilities	1,486	0.6
No telephone service	3,450	1.3

Subject	Number	Percent
OCCUPANTS PER ROOM		
Occupied housing units	260,800	100.0
1.00 or less	247,911	95.1
1.01 to 1.50	7,733	3.0
1.51 or more	5,156	2.0
Specified owner-occupied units	137,268	100.0
VALUE		
Less than $50,000	1,292	0.9
$50,000 to $99,999	18,238	13.3
$100,000 to $149,999	49,571	36.1
$150,000 to $199,999	36,843	26.8
$200,000 to $299,999	20,466	14.9
$300,000 to $499,999	8,727	6.4
$500,000 to $999,999	1,741	1.3
$1,000,000 or more	390	0.3
Median (dollars)	149,600	(X)
MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS		
With a mortgage	107,652	78.4
Less than $300	273	0.2
$300 to $499	1,872	1.4
$500 to $699	5,983	4.4
$700 to $999	21,782	15.9
$1,000 to $1,499	45,985	33.5
$1,500 to $1,999	21,241	15.5
$2,000 or more	10,516	7.7
Median (dollars)	1,244	(X)
Not mortgaged	29,616	21.6
Median (dollars)	352	(X)
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15.0 percent	36,892	26.9
15.0 to 19.9 percent	22,795	16.6
20.0 to 24.9 percent	21,456	15.6
25.0 to 29.9 percent	16,567	12.1
30.0 to 34.9 percent	11,516	8.4
35.0 percent or more	27,140	19.8
Not computed	902	0.7
Specified renter-occupied units	94,734	100.0
GROSS RENT		
Less than $200	2,408	2.5
$200 to $299	2,107	2.2
$300 to $499	19,207	20.3
$500 to $749	39,191	41.4
$750 to $999	17,996	19.0
$1,000 to $1,499	7,394	7.8
$1,500 or more	1,545	1.6
No cash rent	4,886	5.2
Median (dollars)	624	(X)
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15.0 percent	14,294	15.1
15.0 to 19.9 percent	13,729	14.5
20.0 to 24.9 percent	13,112	13.8
25.0 to 29.9 percent	10,612	11.2
30.0 to 34.9 percent	7,402	7.8
35.0 percent or more	29,217	30.8
Not computed	6,368	6.7

-Represents zero or rounds to zero. (X) Not applicable.

Source: U.S. Bureau of the Census, Census 2000.