



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

May 11, 2006

Reply to
Attn Of: ECL-117

Kevin K. Ball, Director
Environmental Restoration Program
Naval Facilities Engineering Command, NW
1101 Tautog Circle
Silverdale, WA 98315

Dear Mr. Ball:

The Environmental Protection Agency (EPA), Region 10 has reviewed the Five Year Review report for Jackson Park Housing Complex and Naval Hospital Bremerton, Washington, signed by the Navy on September 14, 2005 and October 27, 2005. EPA has reviewed the report for technical adequacy, accuracy, and consistency with EPA guidance. EPA has also reviewed: 1) the final Land Use Control Plan, dated August 26, 2005, 2) the Naval Base Kitsap Instructions forwarded to Harry Craig, EPA, by Douglas Thelin on November 30, 2005 and 3) the final Field Report, Installation of Groundwater Monitoring Wells at Benzene Release Area, dated March 2006. EPA's conclusions are based on the information presented in the Five Year Review report and these other documents. EPA is the lead regulatory agency overseeing this cleanup based on the provisions of the Navy/EPA Federal Facilities Agreement (FFA) for Jackson Park.

Based on EPA's review of the Five Year Review report and the above mentioned reports, EPA concurs with the Navy's determinations and recommendations except as noted below.

EPA has determined that the remedy at OU-1, Benzene Release Area (BRA) is not protective. EPA has made this determination because: 1) the original selected remedy for the source, Enhanced Natural Attenuation with Oxygen Releasing Chemicals, as implemented by the Navy in 2001, has not been functioning as intended in the Record of Decision (ROD); 2) the point of compliance seep and outfall samples have not consistently met the remediation goal established in the ROD for Benzene, and 3) the more recent groundwater monitoring data, summarized in the March 2006 Field Report indicates that the contaminant concentrations of Benzene and Total Petroleum Hydrocarbons (TPH) in the discharges into Ostrich Bay are likely to increase if the remedy, as implemented by the Navy, continues without changes. The remedial goals for benzene and TPH in groundwater and surface water seeps established in the OU-1 ROD were based on Model Toxics Control Act (MTCA) standards for protecting beneficial uses of adjacent surface water.

In order for the OU-1, BRA remedy to be protective of human health and the environment in both the short-term and long-term, further actions must be taken to remediate the groundwater plume in the BRA because the original selected remedy for the source, Enhanced Natural Attenuation with Oxygen Releasing Chemicals, as implemented by the Navy in 2001, has been ineffective in sufficiently reducing the contamination in the groundwater. The follow-up actions EPA will be expecting and tracking can be found in the attachment to this letter. Further details will be presented in separate correspondence from Harry Craig, EPA's site manager for the Jackson Park National Priorities List (NPL) site.

EPA also had comments on several other issues in the Five Year Review, other than those related to the BRA. In EPA's comments on the draft Five Year Review, EPA had stated that based on the information available to EPA, the recommendation regarding changes in the shellfish monitoring program (Table 8-1 and Section 8.3) may not provide adequate information for future decision making and trend monitoring. In the Navy's response to comments, the Navy stated that "The Navy will propose changes to the monitoring requirements that will receive appropriate regulatory and stakeholder input and concurrence," but did not change the language in the Five Year Review itself. EPA accepts the Navy statement, and will track a revised recommendation consistent with the Navy's response to comments instead of the recommendation in the Five Year Review report. Again, please see the attachment for the revised recommendation that will be tracked by EPA.

EPA will be adding these issues and these recommendations to our tracking system for follow-up on the Five Year Review recommendations, and will be including our determination and these recommendations in our Annual Report to Congress.

In conclusion, EPA has determined that the remedy at OU 1, BRA is not protective, and that a revised remedy needs to be selected and implemented to ensure protectiveness. We look forward to working with you and your staff to implement the recommendations in the Five Year Review, as modified above. If you have any questions, please contact Harry Craig at e-mail: craig.harry@epa.gov or ph: 503 326-3689.

Sincerely,



Daniel D. Opalski, Director
Office of Environmental Cleanup

Attachment

cc: Douglas Thelin, NAVFAC NW
Barry Rogowski, Ecology

Jackson Park Housing Complex and Naval Hospital Bremerton
 Final First Five-Year Review of Record of Decision

Addendum to Table 8-1
 Recommendations and Follow-Up Actions

These recommendations are to be tracked instead of the first recommendation in the Navy's final report.

Recommendations/ Follow-up Action	Party Responsible	Oversight Agency	Milestone Date	Affects Current Protect- iveness	Affects Future Protect- iveness
Benzene Release Area: Submit proposed schedule for focused feasibility study, ROD amendment, and, if necessary, pilot studies leading to remedy change	U.S. Navy	EPA	June 2006	Yes	Yes
Benzene Release Area: Add FFS, ROD amendment and implementation schedule for the modified remedy to the Jackson Park FFA Site Management Plan [and to EPA's five year review recommendation tracking system??]	U.S. Navy	EPA	June 2006	Yes	Yes
Benzene Release Area: Submit proposed SOW for focused feasibility study	U.S. Navy	EPA	July 2006	Yes	Yes
Benzene Release Area: Implement revised remedy	U.S. Navy	EPA	December 2006, unless modified by EPA through the Site Management Plan		
Benzene Release Area: Initiate free product recovery at all wells that show free product TPH	U. S. Navy	EPA	June 2006	Yes	Yes

These recommendations will be tracked instead of the fifth recommendation in the Navy's final report.

Recommendations/ Follow-up Action	Party Responsible	Oversight Agency	Milestone Date	Affects Current Protect- iveness	Affects Future Protect- iveness-
Shellfish Monitoring Program: Discuss changes to the shellfish monitoring program with EPA and stakeholders. Implement changes after receiving regulatory and stakeholder input and approval	U.S. Navy	EPA	June 2006 or completion of the OU 2 dispute resolution process, whichever occurs first	No	Yes
Shellfish Monitoring Program: Implement EPA approved modified shellfish monitoring program	U.S. Navy	EPA	December 2006, or six months after completion of the OU 2 dispute resolution process, whichever occurs first	No	Yes



Final

26 August 2005

First Five-Year Review of Record of Decision

Jackson Park Housing Complex/ Naval Hospital Bremerton

Bremerton, Washington

Department of the Navy

Naval Facilities Engineering Command Northwest

19917 Seventh Avenue NE

Poulsbo, WA 98370-7570



EXECUTIVE SUMMARY

As lead agency for environmental cleanup of Jackson Park Housing Complex/Naval Hospital Bremerton (Jackson Park), Bremerton, Washington, the U.S. Navy has completed the first 5-year review of the remedial actions at Operable Unit 1 (OU 1) conducted pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300). The purpose of this 5-year review is to ensure that the remedial actions selected in the Record of Decision (ROD) for OU 1 at Jackson Park remain protective of human health and the environment. A 5-year review is required for this site because the remedies allow contaminants to remain in place at concentrations that do not allow unlimited site use and unrestricted exposure. This first 5-year review was prepared in accordance with *Navy/Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Statutory Five-Year Reviews* (U.S. Navy 2004b) and the U.S. Environmental Protection Agency's *Comprehensive Five-Year Review Guidance* (USEPA 2001).

The remedies implemented for OU 1 at Jackson Park are protective both in the short and long terms, with the exception of the Benzene Release Area. The remedy in the Benzene Release Area is considered protective in the short term, because institutional controls are currently in place and there is therefore no exposure to chemicals of concern (COCs) in groundwater. Follow-up actions are necessary to address long-term protectiveness, because COCs in soil remain a source of contamination to groundwater. Further investigation of groundwater impacts and the extent of residual source material in soil is planned for the summer of 2005. Additional actions will be recommended based on this further investigation. These additional actions will be selected to achieve long-term protectiveness in the Benzene Release Area.

The remedies for the other two OUs at Jackson Park, OU 2 and OU 3, will be selected based on their protectiveness of human health and the environment. The selected remedies are therefore expected to be protective, once selected and implemented. Follow-through is needed on the following recommendations identified during the 5-year review:

- Implement enhancements to the remedy for the Benzene Release Area based on the results of the upcoming additional investigations.
- Implement the Land Use Control Plan being prepared concurrently with this 5-year review.
- Continue long-term monitoring at seeps and outfalls.

- Continue shellfish monitoring with a revised analyte list and a reduced sampling frequency of once prior to each 5-year review.
- Discontinue use restrictions and monitoring for upland groundwater at Site 110 outside the Benzene Release Area.

RODs are in the process of being developed for OU 2 and OU 3. Two time-critical removal actions have occurred at OU 3 during the time period covered under this 5-year review.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name (from WasteLAN): Jackson Park Housing Complex and Naval Hospital Bremerton

EPA ID (from WasteLAN): WA3170090044

Region: 10 **State:** WA **City/County:** Kitsap

SITE STATUS

NPL status: Final Deleted Other (specify) _____

Remediation status (choose all that apply): Under Construction Operating Complete

Multiple OUs?* YES NO **Construction completion date:**

Has site been put into reuse? YES NO

REVIEW STATUS

Lead agency: EPA State Tribe Other Federal Agency: Navy

Author name: Larry Tucker

Author title: Remedial Project Manager **Author affiliation:** Naval Facilities Engineering Command Northwest

Review period:** 08/01/04 to 02/28/05

Date(s) of site inspection: September 9, 2004

Type of review:

Post-SARA <input checked="" type="checkbox"/>	Pre-SARA	NPL-Removal only
Non-NPL Remedial Action Site		NPL State/Tribe-lead
Regional Discretion		

Review number: 1 (first)

Triggering action:

Actual RA Onsite Construction at OU#__1__	Actual RA Start at OU #1
Construction Completion	Previous Five-Year Review Report
Other (specify): _____	

Triggering action date (from WasteLAN): August 2000

Due date (five years after triggering action date): 08/31/2005

*["OU" refers to operable unit.]

**[Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form (Continued)

Issues:

- The remedial action at the Benzene Release Area, injection of oxygen-releasing compounds, appears to have maximized its effectiveness in its ability to reduce benzene concentrations and the remedy does not appear to be functioning as designed. While benzene concentrations have fallen in groundwater, concentrations are still significantly above the remedial goal at some locations.

Recommendations and Follow-up Actions:

- Implement enhancements to the remedy for the Benzene Release Area based on the results of the upcoming additional investigations.
- Implement the Land Use Control Plan being prepared concurrently with this 5-year review.
- Continue long-term monitoring at seeps and outfalls.
- Continue shellfish monitoring with a revised analyte list and a reduced sampling frequency—once prior to each 5-year review.
- Discontinue use restrictions and monitoring for upland groundwater at Site 110.

Protectiveness Statement(s):

The remedies implemented for OU 1 at JPHC/NHB are protective both in the short and long terms, with the exception of the Benzene Release Area. The remedy in the Benzene Release Area is considered protective in the short term, because institutional controls are currently in place, and, therefore, there is no exposure to COCs in groundwater. Follow-up actions are necessary to address long-term protectiveness because COCs in soil remain a source of contamination to groundwater. Further investigation of groundwater impacts and the extent of residual source material in soil is planned for the summer of 2005. Additional actions will be recommended based on this further investigation. These additional actions will be selected to achieve long-term protectiveness in the Benzene Release Area.

The remedies for OU 2 and OU 3 will be selected based on their protectiveness of human health and the environment. The selected remedies are therefore expected to be protective, once selected and implemented.

Other Comments:

FINAL FIRST FIVE-YEAR REVIEW OF RECORD OF DECISION
Jackson Park Housing Complex and Naval Hospital Bremerton
Naval Facilities Engineering Command Northwest
Contract No. N44255-02-D-2008
Delivery Order 0044

Executive Summary
Revision No.: 0
08/26/05
Page v

Signature sheet for the Jackson Park Housing Complex/Naval Hospital Bremerton first five-year review of Record of Decision for Operable Unit 1 report.

R.S. Tanaka
Captain, U.S. Navy
Commanding Officer, Naval Base Kitsap

Date

FINAL FIRST FIVE-YEAR REVIEW OF RECORD OF DECISION
Jackson Park Housing Complex and Naval Hospital Bremerton
Naval Facilities Engineering Command Northwest
Contract No. N44255-02-D-2008
Delivery Order 0044

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Signature sheet for the Jackson Park Housing Complex/Naval Hospital Bremerton first five-year review of Record of Decision for Operable Unit 1 report.

W.M. Roberts
Captain, U.S. Navy
Commanding Officer, Naval Hospital Bremerton

Date

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ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
BTEX	benzene, ethylbenzene, toluene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
COC	chemical of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ETPH	equivalent total petroleum hydrocarbons
FS	feasibility study
g/day	gram per day
g/kg/day	gram per kilogram per day
HI	hazard index
IC	institutional control
IRIS	Integrated Risk Information System
JPHC	Jackson Park Housing Complex
kg	kilogram
LUC	land use control
MEC	munitions and explosives of concern
M	marine
mg/kg	milligram per kilogram
mg/kg-d	milligram per kilogram per day
MLLW	mean lower low water
MTBE	methyl-tert-butyl-ether
MTCA	Model Toxics Control Act
MW	monitoring well
NAD	U.S. Naval Ammunition Depot
Naval Magazine	Naval Magazine Puget Sound
NAVFAC NW	Naval Facilities Engineering Command Northwest
Navy	U.S. Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEX	Navy Exchange
NHB	Naval Hospital Bremerton
NPL	National Priorities List

ABBREVIATIONS AND ACRONYMS (Continued)

NWTPH-Gx	Northwest Total Petroleum Hydrocarbon—Gas
O&M	operation and maintenance
ORC	oxygen-releasing compound
OU 1	Operable Unit 1
PA	preliminary assessment
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
RAB	Restoration Advisory Board
RAO	remedial action objective
RDX	research demolition explosive (cyclotrimethylenetrinitramine)
RG	remediation goal
RI	remedial investigation
ROD	Record of Decision
SI	site inspection
SVOC	semivolatile organic compound
T	terrestrial
TCE	trichloroethene
TPH	total petroleum hydrocarbons
URS	URS Group, Inc.
UST	underground storage tank
VOC	volatile organic compound

1.0 INTRODUCTION

This report presents the results of the first 5-year review performed for the Jackson Park Housing Complex/Naval Hospital Bremerton (JPHC/NHB) National Priorities List (NPL) site, more commonly known as Jackson Park. The purpose of a 5-year review is to evaluate whether the implementation and performance of the remedies selected in the Record of Decision (ROD) for a site are or will be protective of human health and the environment. The methods, findings, and conclusions of 5-year reviews are documented in 5-year review reports, which identify any issues found during the review and provide recommendations to address them.

The U.S. Navy (Navy), the lead agency for Jackson Park, is preparing this 5-year review report pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 Code of Federal Regulations [CFR] Part 300). CERCLA Section 121 states the following:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The Naval Facilities Engineering Command Northwest (NAVFAC NW) has conducted this 5-year review of the remedial actions implemented at Jackson Park. This review was conducted from August 2004 through February 2005, and this report documents the results of the review. URS Group, Inc. (URS) provided support to NAVFAC NW during this review, which included site inspection, conducting interviews, administrative record review, data analysis, and report production, under contract number N44255-02-D-2008, Delivery Order 0044.

This report covers the remedies selected in the signed ROD for Operable Unit 1 (OU 1) (U.S. Navy, Ecology, and USEPA 2000). There are two additional OUs at Jackson Park, OU 2 and OU 3. OU 1 (Figures 1-1 and 1-2) addresses the terrestrial portions of the site as well as all human health risks. OU 1 at Jackson Park consists of five sites: 101, 101-A, 103, 110, and the Benzene Release Area. OU 2 consists of marine sediments in Ostrich Bay and any associated

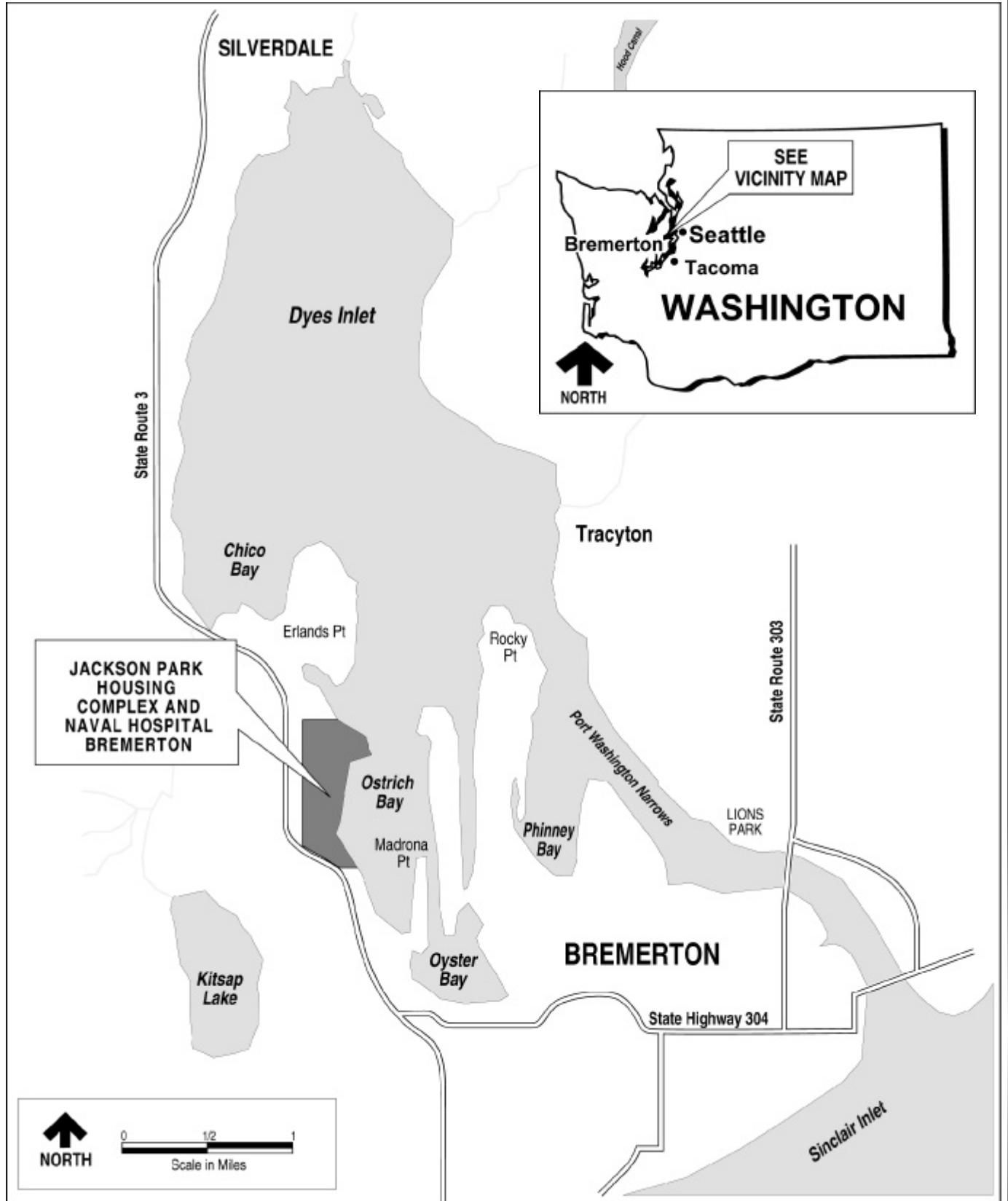
ecological risks to the marine environment. OU 3 addresses unexploded ordnance/ordnance explosive waste that may be present on Jackson Park property or in Ostrich Bay. Separate RODs, currently under development, will be issued for OU 2 and OU 3.

This is the first 5-year review for Jackson Park. The triggering action for this review was the initiation of remedy construction at OU 1 in August 2000. Contaminants have been left at Jackson Park above levels that allow for unlimited use and unrestricted exposure.

The ROD documenting the remedies implemented at Jackson Park OU 1 was signed after October 17, 1986. Therefore, this is considered a statutory, rather than a policy, review.

This report was prepared as part of the CERCLA 5-year review process using Navy and U.S. Environmental Protection Agency (EPA) guidance (USEPA 2001 and U.S. Navy 2004b).

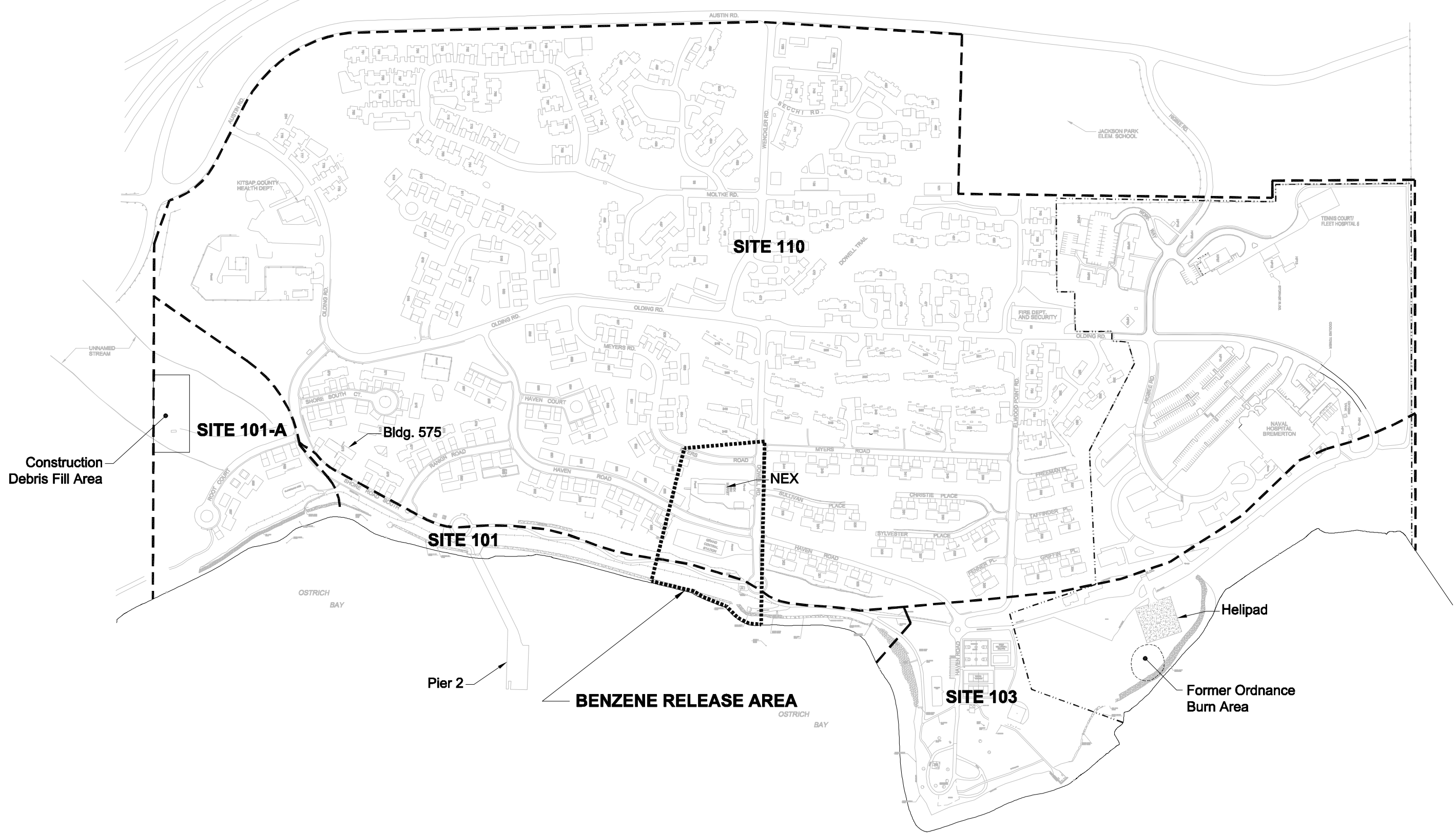
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U.S. NAVY

**Figure 1-1
Vicinity Map**

Delivery Order 0044
JPHC/NHB
FIVE-YEAR REVIEW



- LEGEND**
- Site Boundary Line
 - - - - - Naval Hospital Property Line

U.S. NAVY

Delivery Order 0044
 JPHC/NHB
 FIVE-YEAR REVIEW

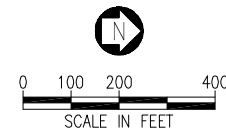


Figure 1-2
Operable Unit 1 Site Divisions

2.0 SITE CHRONOLOGY

The substantive events in the chronology of Jackson Park related to site discovery, investigation, and remediation are listed below. Details of these site activities follow.

- 1983: discovery and preliminary assessment (PA)
- 1992: Washington State Department of Ecology (Ecology) issues an Enforcement Order
- 1993: site inspection (SI)
- 1994: placed on National Priorities List
- 1995: site divided into OU 1, terrestrial environment, and OU 2, marine environment
- 1996: remedial investigation (RI) complete
- 1998: feasibility study (FS) complete
- 1997–1999: post-FS investigations
- 2000: Record of Decision
- 2000: remedial action construction initiated; OU 3 added to address abandoned ordnance
- 2002: remedial action construction complete; closeout report for OU 2 issued
- 2003: PA/SI completed for OU 3

The JPHC/NHB was identified by EPA as a potential site of hazardous substance releases in 1981. The Navy conducted PAs at JPHC/NHB beginning in 1983 (U.S. Navy 1983 and 1988). In February 1992, Enforcement Order DEC92TC-005 was issued by Ecology in accordance with the Washington State Model Toxics Control Act (MTCA). This enforcement order encompasses the entire Jackson Park property.

In 1994, EPA placed Jackson Park on the NPL. The NPL is designed to categorize, rank, and expedite investigation and cleanup of the nation's primary hazardous waste sites.

An SI was conducted at Site 110 in 1993 and the results documented in the site's final SI report (U.S. Navy 1994e). The Navy used the results of this report to conduct several removal actions at Site 110 (see Section 3.4). Based on the results of the SI and the removal actions that have taken place, the Navy and the State of Washington determined that a formal RI and risk assessment were not warranted at Site 110.

The Navy and the State of Washington determined that RI work was warranted at Sites 101, 101-A, and 103. Three phases of field work were conducted. The results of Phase I terrestrial and marine investigations were documented in the JPHC/NHB final Phase I RI report (U.S. Navy 1994b). The Phase I RI concluded with specific recommendations to collect additional data for the terrestrial and marine environments. The additional data collection is considered Phase II and was performed in two separate tasks. The Phase II terrestrial data collection was performed in December 1993 and the Phase II marine data collection in July 1994 (U.S. Navy 1994d and 1995a).

In May 1995 to expedite remedial actions, the Navy administratively separated the site into OU 1, which addresses the terrestrial environment, and OU 2, which addresses the marine environment. Human health risks, including terrestrial and marine exposures, are addressed in OU 1. The final Phase II OU 1 supplemental RI report (U.S. Navy 1995a) summarized the terrestrial findings from the Phase I RI and the findings from the Phase II terrestrial investigation.

After completion of the final Phase II supplemental RI report, additional field work (referred to as Phase III) was conducted in August 1996. The Phase III investigation was designed to address specific data gaps associated with surface water seeps and outfalls along the Ostrich Bay shoreline and with a former waste burning area near NHB. The final FS for JPHC/NHB was issued in April 1998 (U.S. Navy 1998b), incorporating all data collected through 1997 (Phases I, II, and initial portion of III).

Phase III field work and data analysis continued after publication of the final FS. Several additional studies were conducted at OU 1 between 1997 and 1999. One result of these investigations was the discovery of the source of the Benzene Release Area in 1998. Also during this time, munitions-related investigations began (in 1998). In the summer of 2000, the Navy designated a third operable unit, OU 3, to address all potential munitions-related issues.

The ROD for OU 1 was signed on August 10, 2000.

Post-ROD activities at the site are described in Sections 4 and 6.

3.0 BACKGROUND

The Jackson Park site is located in eastern Kitsap County, approximately 2 miles northwest of Bremerton, Washington (Figure 1-1). The Jackson Park site occupies a total of approximately 206 acres on a sloping hillside bordering Ostrich Bay. The housing area itself comprises about 158 acres, with the naval hospital occupying the rest of the site. Ostrich Bay is part of the Puget Sound marine environment. The Jackson Park properties are bounded to the north by the community of Erlands Point, to the west by State Route 3, and to the south by an undeveloped wooded area. The topography slopes from a maximum elevation of 180 feet above mean sea level at the west edge down to a relatively flat shoreline area along Ostrich Bay. Much of Jackson Park is developed as high-density residential housing for Navy personnel and dependents. Drinking water for OU 1 is supplied by the City of Bremerton public water system.

JPHC/NHB is the site of the former Naval Magazine Puget Sound (Naval Magazine), which was established in 1904 as an ammunition depot to store ordnance. Operations expanded during World War I to include ordnance manufacturing and processing, projectile loading and cleaning, and ordnance demilitarization.

The Naval Magazine became the U.S. Naval Ammunition Depot (NAD) Puget Sound around 1916. After World War I, the name was changed to NAD Bremerton. Operations at NAD Bremerton were stepped up during World War II. After the end of World War II, the facility's primary role shifted to ordnance demilitarization.

In 1948, command of NAD Bremerton was transferred to Bangor, and NAD Bremerton was renamed the Bremerton Annex. By 1959, the ammunition depot was no longer needed at the property and the area was placed under caretaker status. The annex was closed, but remained Navy property. Portions of the former depot property were then conveyed to Kitsap County, the City of Bremerton, and the State of Washington. Beginning around 1965, a portion of the remaining property was converted to military housing and renamed the Jackson Park Housing Complex. As housing construction continued in the early 1970s, the Navy demolished most of the remaining depot structures at the site. Around 1981, a gas station was added to the Navy Exchange (NEX) convenience store located within the Jackson Park Housing Complex. Construction of additional housing at the site continued into the 1990s. Naval Base Kitsap is the current owner of Jackson Park Housing Complex.

In May 1995, the site was divided into OU 1, to address the terrestrial environment and human health risk for both the terrestrial and marine environments, and OU 2, to address the marine environment. OU 3 was added in 2000 to address the abandoned ordnance in both the marine and terrestrial environments.

OU 1 consists of four sites: Sites 101, 101-A, 103, and 110 (Figure 1-2). A fifth site, the Benzene Release Area, overlaps Sites 101 and 110 and was discovered after the FS, but was included in the ROD. It is discussed here as a separate site. The subsections below provide a description of each of the sites at Jackson Park, including physical characteristics, land and resource use, the history of contamination, any removal actions performed prior to the signing of the ROD, and the basis for taking remedial action.

Two time-critical removal actions have occurred at OU 3, and those actions are summarized at the end of this section. The time-critical removal actions were completed as part of the (then) OU 1. RODs are under development for OU 2 and OU 3.

3.1 SITE 101

Site 101 includes a strip of shoreline approximately 2,400 feet long and 200 feet wide and is located primarily east of South Shore Road along Ostrich Bay up to Elwood Point. The historical industrial processes at Site 101 included ordnance production and destruction (demilitarization), storage of ordnance, and recycling and disposal of ordnance wastes. Waste ordnance (explosive dry powders) was produced daily in the loading and sifting buildings. The rooms in the loading and sifting buildings were rinsed with water daily to prevent the explosive powders from accumulating and forming an explosive atmosphere. Most liquid wastes were flushed into tile drains and discharged directly to Ostrich Bay. Some waste liquids were removed from the waste stream and transported by truck to a recycling processing area on site.

Investigations conducted in 1992 revealed diesel and motor oil contamination in subsurface soils immediately east of Building 575 (originally referred to as Building 91), along South Shore Road. Building 575 is a housing unit located in Site 110, along the Site 101/Site 110 border. The area of contaminated soil extended across site borders to include portions of Site 110, 101, and 101-A. The petroleum contamination in the soil was likely caused by releases from former NAD Building 67 (an industrial building) and/or former NAD Building 122 (a boiler house/fuel pumping facility). Buildings 67 and 122 were demolished prior to construction of the housing units.

Soil removal was conducted from September 1993 through February 1994. The area of soil excavation was east of Building 575 in portions of Site 101 and 101-A. The excavation included removal of the buried foundation of former NAD Building 122. Confirmation sampling conducted in the excavation indicated levels of total petroleum hydrocarbons (TPH) below the MTCA cleanup level in two of six sample locations (U.S. Navy 1994a). Contaminated soils were left in place beneath Building 575 to ensure the structural stability of the building. Engineered backfill designed for low permeability was used to fill the excavation. This design,

together with the natural underlying glacial till, will decrease the likelihood that the small amounts of remaining contamination will migrate to groundwater.

The human health risk assessment conducted for the site found unacceptable risks to current and future residents from exposure to soil, sediment, and marine tissue. For soil, the COCs were carcinogenic polycyclic aromatic hydrocarbons (cPAHs) and arsenic; for sediment the COC was arsenic; and for marine tissue the COCs were antimony, 3,3'-dichlorobenzidine, pentachlorophenol (PCP), and vanadium (future residents only).

Groundwater in glacial outwash deposits (Vashon Recessional Outwash) in the nearshore portions of OU 1 (all of Sites 101 and 103 and the majority of Site 101-A) is a zone of perched groundwater above the Vashon Till, a layer of relatively impermeable glacial till. This groundwater is not a potential source of drinking water because there is insufficient yield to support drinking water wells. A number of chemicals detected in groundwater did have concentrations exceeding drinking water standards; however, the basis for remedial action is the concentrations of chemicals that exceed cleanup criteria protective of the marine environment (nearest surface water body) at the point where groundwater enters the marine environment. At Site 101, four chemicals detected in seeps and outfalls in at least one sample prior to the signing of the ROD exceeded cleanup criteria: benzene, arsenic, mercury, and nickel. Two of these chemicals, mercury and nickel, were found by the ecological risk assessment to be an ecological hazard.

3.2 SITE 101-A

Site 101-A lies to the south of Site 101 and includes approximately 880 lineal feet of shoreline and 7 acres of adjacent uplands. The site currently includes a former construction debris landfill and the housing area around Root Court to the edge of Ostrich Bay (Root Court is the most south-eastern portion of the housing complex). Historical industrial processes associated with Site 101-A include ordnance production and demilitarization and ordnance sifting and loading. An incinerator and a boiler house were also present at Site 101-A. Demilitarization used high temperature and steam. As described for Site 101, rooms in the loading and sifting buildings were rinsed with water daily to prevent accumulation of explosive materials. The liquid wastes were flushed into tile drains and discharged directly to Ostrich Bay. The shoreline area was backfilled during the construction of the Naval Magazine (early 20th century) and housing units (1970s).

Six underground storage tanks (USTs) and some associated pipes and fuel distribution lines were removed from Site 101-A in 1993. All petroleum-impacted soils were removed from beneath four of the tanks along with the tanks (U.S. Navy 1994c). Soils and groundwater beneath the

other two tanks were found to be contaminated with petroleum hydrocarbons. Petroleum-contaminated soils above groundwater were removed from these excavations, but soils beneath the water table containing petroleum hydrocarbons above the MTCA Method A cleanup level were not removed. An engineered backfill on top of geotextile fabric was designed to contain any remaining contamination by decreasing the permeability of the soil. After the excavation was complete, samples of downgradient wells indicated no migration of petroleum hydrocarbons through the groundwater (U.S. Navy 1994c).

An additional source of contamination in Site 101-A was structural debris from ordnance storage bunkers at Site 110, which was disposed of in a debris fill area south of Root Court (Figure 1-2).

The human health risk assessment conducted for the site found unacceptable risks from exposure to soil, sediment, and marine tissue to current and future residents. For soil, the COCs were cPAHs and beryllium; for sediment the COC was arsenic; and for marine tissue the COCs were antimony, 3,3'-dichlorobenzidine, and PCP.

As with Site 101, groundwater beneath Site 101-A is not a drinking water source because of insufficient yield from the perched aquifer, and the basis for remedial action is protection of the marine environment. At Site 101, two chemicals detected in seeps and outfalls in at least one sample prior to the signing of the ROD exceeded cleanup criteria: arsenic and mercury. Mercury was identified in the ecological risk assessment as a major risk contributor.

3.3 SITE 103

Site 103 consists of a low, flat promontory referred to as Elwood Point and approximately 500 feet of shoreline to the east of the hospital. The site includes a helicopter pad, recreation fields, playing courts, a picnic area, and, formerly, a railroad transfer pier. The land ownership of Site 103 is split between the Housing Complex and the Hospital (Figure 1-2). The historical industrial processes and facilities associated with Site 103 were maintenance of locomotives, sand-blasting, military and civilian housing, barracks, a cafeteria, latrines, paint and oil storage, and a railroad transfer pier. Ordnance wastes were burned on a concrete slab on the north side of Elwood Point; trash was burned in an area farther north along the shoreline of the site (Figure 1-2). An incinerator was also present at Site 103. Landfilling took place from 1910 to 1959 and included sands, gravels, and artificial materials such as concrete and metal debris.

In 1998, significant erosion was occurring along the north shore of Site 103, near the helipad.

The erosion threatened a potential release into the marine environment of contaminants present in fill material. A removal action was conducted to temporarily prevent further erosion along approximately 75 feet of shoreline. The removal action included excavating the bank back to a slope of approximately 3H: 1V, armoring the slope with rock, and covering the area with a gravel mix to act as a sacrificial material during storm events.

The human health risk assessment conducted for the site found unacceptable risks from exposure to soil, sediment, and marine tissue to current and future residents. For soil, COCs were cPAHs, arsenic (current residents), and polychlorinated biphenyls (PCBs) (future residents); for sediment the COC was arsenic; and for marine tissue the COCs were antimony, vanadium (future residents only), 3,3'-dichlorobenzidine, and PCP.

Like all the shoreline areas of OU 1, groundwater beneath Site 103 is not a drinking water source and the basis for remedial action is protection of the marine environment. At Site 103, six chemicals detected in seeps and outfalls in at least one sample prior to the signing of the ROD exceeded cleanup criteria: arsenic, mercury, silver, 1,1-dichloroethene, trichloroethene (TCE), and vinyl chloride. Mercury and silver were identified in the ecological risk assessment as major risk contributors.

3.4 SITE 110

Site 110 includes the majority of the JPHC and NHB. Figure 1-2 shows that the northern portion of Site 110 is owned by Naval Hospital Bremerton and the southern portion is part of the Jackson Park Housing Complex property. Historical activities at Site 110 primarily consisted of ordnance production and storage of ordnance and inert materials. Six bunkers were originally used for ordnance storage at the site. Three bunkers are used as warehouses, a fourth is being used as storage for household goods, and the remaining two have been demolished. Ordnance wastes were found in at least 13 of the structures (including the ordnance storage bunkers) that were removed during the early 1970s' demolitions. Buildings most heavily used for ordnance were steam-cleaned prior to demolition. In 1959, all explosives were moved from the bunkers to the Naval Ammunitions Depot Bangor. Levels of lead, arsenic, and cPAHs in soil exceeded the MTCA Method A cleanup levels for residential surface soil near four of the six bunkers (U.S. Navy 1994e). The affected bunkers were Buildings 100, 101, 103, and 104. Between August 1994 and June 1995, the soils containing contamination above MTCA Method A cleanup levels for residential surface soil, including an area within the Jackson Park Elementary School yard, were excavated and properly disposed of. However, arsenic concentrations above the MTCA Method A cleanup level of 20 mg/kg remain in soil underneath paved areas in front of two of the bunkers (Buildings 100 and 101) (U.S. Navy 1995b). The highest remaining arsenic

concentration beneath the pavement is 273 mg/kg. The pavement serves as a barrier to prevent human exposure to these soils.

During construction of new homes at JPHC in 1995, a disposal site was discovered at the northeast corner of Olding Road and Elwood Point Road. Drums uncovered by the housing construction contractor were sampled and the contents determined to be petroleum products and lime wastes. Samples of materials removed from the disposal site confirmed the presence of asbestos in pipe insulation, petroleum products and lime waste in the drums, petroleum contamination in soils, and creosote-PAH compounds in timber. In March 1995, all waste and contaminated soil were removed and disposed of. Confirmation samples collected from the excavation prior to backfilling reported no petroleum detections above MTCA Method A soil cleanup levels (U.S. Navy 1995b and 1995c).

Four USTs were removed from Site 110 in 1996. The tanks probably stored fuel oil and diesel fuel. There were no records of installation date, cathodic protection, or tank tightness for any of the USTs. All four tanks were found in good condition with little corrosion and no holes or damage. The tanks and all associated petroleum-contaminated soil were removed and disposed of properly (U.S. Navy 1996a, 1996b, 1996c, and 1996d).

Based on the removal actions that have taken place, the Navy and the State of Washington determined that a formal RI report and a risk assessment were not warranted at Site 110.

Groundwater in the upper portion of Site 110 occurs in the Vashon Advance Outwash deposits (beneath the Vashon Till), a regionally important aquifer. Groundwater within this aquifer is potable; however it is not being used for drinking at JPHC/NHB, nor is it likely to be so used in the future. The nearest domestic wells are 0.75 mile from the site and are upgradient of JPHC/NHB. The basis for remedial action for upland Site 110 groundwater is chemical exceedances above drinking water criteria. Five metals, arsenic, beryllium, manganese, nickel, and vanadium, have been detected above drinking water criteria in a least one groundwater sample.

3.5 BENZENE RELEASE AREA

The Benzene Release Area is located within Sites 101 and 110. The area is defined by two seeps that discharge through pipes along the shore of Ostrich Bay, and an upgradient area of known soil or groundwater contamination that extends approximately 450 feet upgradient of the seeps.

Phase III seep sampling at Site 101 identified one shoreline outfall that was discharging water containing benzene and petroleum above state cleanup levels. In 1996, Ecology conducted an independent investigation of seeps and groundwater in this area. In 1997 and 1998, a second investigation was conducted by the Navy in an attempt to determine the source and extent of benzene and petroleum contamination in upgradient soil and groundwater. The upgradient area includes portions of Site 101 and 110. The results of these investigations were reported in the draft benzene release investigation report (U.S. Navy 1998a); however, no source of contamination was defined. In November 1999, additional field work was conducted. This third benzene release investigation identified a source of the benzene and petroleum contamination near the fuel dispenser island at the NEX gas station located at Dowell Road and Sullivan Place in Site 110.

Groundwater beneath the Benzene Release Area exists both as perched groundwater (as described for Site 101, it cannot be used for drinking) and deeper groundwater beneath the Vashon Till. At the time the ROD was signed, it was thought that deeper groundwater had not been impacted. Therefore, the basis for remedial action is protection of the marine environment, and the chemicals in seeps and outfalls (located in Site 101) that exceed surface water criteria are TPH-gasoline and benzene. The issues associated with the deeper groundwater are discussed further in Sections 4 and 6 of this report. No risk assessment was conducted for the Benzene Release Area.

3.6 OU 2

Because many historical operations at the Depot may have resulted in the discharge of wastes containing munitions-related compounds, these operations were suspected to have an impact on sediment quality in the bay. OU 2 includes all marine sediments and addresses all ecological risks from chemical contamination on Navy property within Ostrich Bay. The bay is the southernmost water body adjacent to Dyes Inlet. Immediately east of OU 2 is the Port Washington Narrows, a constricted inlet that enables tidal exchange with central Puget Sound. OU 2 includes Navy-owned property extending out from the shoreline to a distance where the water depth is 24 feet at mean lower low water (MLLW). The remaining property in Ostrich Bay is managed by the State of Washington (Department of Natural Resources) or is privately owned.

The OU 2 remedial action objective (RAO) is to reduce the ecological risk in the marine environment in Ostrich Bay. To that end, a detailed analysis of several cleanup alternatives for Ostrich Bay sediments was completed in 1997. The analysis was documented in the 1998 feasibility study and focused on the identification and evaluation of alternatives that were readily

implementable, cost efficient, and effective for mitigating potential ecological risks to the marine environment. Alternatives included No Action, Natural Recovery, Enhanced Natural Recovery, and Sediment Capping. A closeout report was issued in 2002 to summarize the technical information related to the site and for use in making remedial decisions. The Navy has concluded that while nearshore sediments contained low levels of munitions-related compounds, the majority of sediment contamination in Ostrich Bay was likely associated with the transport of metals-contaminated sediments into the Bay from Dyes Inlet and other sources. The Navy, Ecology, and EPA are currently in negotiations regarding the best approach to remediation for OU 2. The proposed schedule for the draft OU 2 ROD is September 2006.

3.7 OU 3

For all the OU 1 remedial actions described in Section 4, screening and clearance of munitions and explosives of concern (MEC) occurred prior to any remedial activities for the terrestrial and marine portions of the site. Any actions related to MEC are now considered part of OU 3.

The 2004 Interagency Agreement divides OU 3 into OU 3T-JPHC, OU 3T-NHB, and OU 3M to allow separate considerations of all munitions issues by geographical area and environment, both terrestrial (T) and marine (M). OU 3T-JPHC and OU 3T-NHB include all portions of JPHC/NHB located above the 0 MLLW line. OU 3M addresses munitions in Ostrich Bay below 0 foot MLLW where contamination is located.

OU 3 cleanup actions included the following munitions removal activities:

- Recovery of munitions items in 1975
- Navy explosive ordnance disposal clearance in 1981
- Shell casings removal along the beach in 1994
- Removal of live munitions and inert scrap items from the shoreline in 1998
- Investigation and removal at the railroad pier at Elwood Point, the ammunition transfer pier (Pier 2 and former Pier 1), and the former mooring dolphins south of Elwood Point between 1999 and 2001
- Two time-critical removal actions in 2000 and 2001 at the shoreline recreation area at Elwood Point

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The results of the 2003 PA/SI for OU 3 concluded that additional investigation is warranted for OU 3M (U.S. Navy 2003f). The PA/SI included a hazard assessment, and it identified less than 1 percent of the site as medium, medium-high, or high relative hazard. The proposed schedule for the draft OU 3T-JPHC ROD is November 2006 and for the OU 3T-NHB ROD is May 2008. The proposed schedule for the draft OU 3M ROD is May 2009.

4.0 REMEDIAL ACTIONS

Previous Navy investigations identified four areas within OU 1 at Jackson Park that warranted inclusion in the CERCLA RI/FS. These four sites plus one area discovered post-RI/FS were included in the ROD process. For all of these areas, some remedial action was required. This section provides a brief description of the selected remedy and the specific remedial actions for each of these areas.

The overall RAOs for OU 1 are as follows:

- Prevent dermal contact with or ingestion of soil containing concentrations of COCs above state cleanup levels.
- Verify that concentrations of inorganics in Site 110 groundwater are below background levels or state and federal drinking water applicable or relevant and appropriate requirements (ARARs).
- Reduce the potential for erosional transport of chemicals in soil to the marine environment.
- Protect ecological receptors in the marine environment and human health by attaining compliance with water quality standards for marine surface water at the point of groundwater discharge.
- For shellfish from Ostrich Bay, reduce risks from subsistence-level ingestion to less than 1×10^{-5} excess carcinogenic risk, or less than a noncarcinogenic hazard index (HI) of 1.

4.1 SITE 101

4.1.1 Remedy Selection

The COCs in soil at Site 101 were cPAHs and arsenic, and COCs in groundwater at the point where groundwater enters the marine environment were arsenic, mercury, nickel, and benzene.

To achieve RAOs, the remedial action components specified in the OU 1 ROD include the following:

- A vegetated cover consisting of a minimum 1-foot-thick soil cover plus sufficient topsoil to support vegetation was to be installed over the identified areas where COCs in surface soils exceeded the remedial goals.
- Shoreline stabilization measures were to be installed along the shoreline to limit erosion of soils that may contain COCs. Along the entire JPHC/NHB shoreline (includes areas of Sites 101-A and 103), anthropogenic debris that was present in shoreline and intertidal areas was to be removed and properly reused, recycled, or disposed of.
- Regular inspection and maintenance of the shoreline stabilization measures and soil covers were to be conducted and documented. The inspections also were to occur after major storm events. Physical maintenance was to be provided as needed.
- Permanent restrictions were to be placed on the property by the Navy to limit or prevent activities that could disturb the engineered soil cover over the impacted soil between South Shore Road and Ostrich Bay.
- Permanent restrictions were to be placed on the property by the Navy to prevent construction of drinking water wells in the uppermost water-bearing unit. These restrictions apply to shallow groundwater above the Vashon Till.
- For the designated intertidal areas and adjacent shoreline owned by the Navy, land use restrictions were to be implemented to address procedures for controlling construction and maintenance activities to prevent activities that may interfere with or compromise the function of the shoreline stabilization system. The restrictions were to include requirements for ongoing monitoring and maintenance of the shoreline stabilization system.
- A shellfish sampling program was to be implemented. The Navy, with concurrence from EPA, Ecology, and the Washington State Department of Health decide when shellfish on JPHC/NHB beaches can be harvested and the purpose of those harvests, e.g., subsistence, recreational, commercial, or ceremonial gathering.
- Signs were to be posted along the shoreline to notify JPHC residents (and any members of the general public) of any harvest restrictions.

4.1.2 Remedy Implementation

Remedy implementation for Site 101 occurred primarily from June 2000 through June 2001. During this time, a soil cover was placed over the areas of impacted surface soil from the shoreline to west of Shoreline Road. Soil cover was at least 12 inches deep, and sod was placed on top of the fill. An indicator layer composed of black, square-hatched, polyethylene geotextile fabric was placed beneath the clean fill. The indicator layer was labeled with water resistant tags permanently attached to the fabric. The tags read "Caution. Contact commanding office prior to digging below this barrier."

Shoreline stabilization remedial actions occurred during the summer of 2000. Stabilization activities consisted of the following:

- Removal of miscellaneous debris on the shoreline
- Installation of a rock shelf from the southern edge of Site 101 up to Pier 2 and from the approximate terminus of Dowell Street up to the beginning of Site 103
- Slope stabilization with geotextile and vegetation in selected areas
- Seawall repair (from the stormwater outfall basin approximately 1,400 feet north to the sanitary sewer lift station)
- Installation of armor rock revetment and vegetation
- Construction of granite beach access stairs near the Dowell Street terminus
- Placement of shellfish harvesting restriction signs in several locations.

4.1.3 Operation, Maintenance, and Monitoring

The operation, maintenance, and monitoring program for Site 101 specified by the ROD consists of fulfilling ROD-mandated monitoring requirements, managing the institutional controls program, and maintaining erosion controls for the site.

COCs in the groundwater beneath Site 101 are required to meet ROD remediation goal (RGs) at the point where groundwater enters the marine environment (point of compliance). To this end, the Land Use Control Plan specifies permanent restrictions to be placed on use of shallow groundwater (above the Vashon Till) as a drinking water source. In addition, as part of the long-term monitoring plan for Jackson Park, three seeps (SP-710, SP-711, and SP-713) and two

outfalls (OF-709 and OF-712) located within Site 101 were selected to be sampled (Figure 4-1). These locations have been sampled four times since the signing of the ROD, in accordance with the ROD specifications. Shellfish monitoring was also conducted as part of the long-term monitoring program. The results of shellfish sampling in areas offshore of Sites 101, 101-A, and 103 are discussed in Section 6.4.

Institutional Controls

The area of Site 101 where impacted soils are covered by the geotextile liner is an area where institutional controls regarding excavation and construction are required. Figure 4-2 shows the location of these controlled areas. Such controls have been incorporated into the Land Use Control Plan (published concurrently with this document). Remedy maintenance inspections for Site 101 commenced in the spring of 2004, and inspections will be conducted semiannually. The maintenance inspection included examining the soil-capped areas to ensure that erosion was not occurring and the vegetation was healthy. Inspection of the seawall and pocket beach included confirming that the seawall was intact, that the drains were functioning adequately, that there was no significant erosion, that the vegetation in the pocket beach area was doing well, and that the armor stone revetment was maintained with a minimal amount of erosion.

4.2 SITE 101-A

4.2.1 Remedy Selection

The COCs in soil at Site 101 were cPAHs and beryllium, and COCs in groundwater at the point where groundwater enters the marine environment were arsenic and mercury.

To achieve the RAOs, the remedial action components specified in the OU 1 ROD include the following:

- A vegetated cover consisting of a minimum 1-foot-thick soil cover plus sufficient topsoil to support vegetation was to be installed over the identified areas where COCs in surface soils exceeded the remedial goals.
- Shoreline stabilization measures were to be installed along the shoreline to limit erosion of soils that may contain COCs.
- Regular inspection and maintenance of the shoreline stabilization measures and soil covers were to be conducted and documented. Inspections were also to occur after major storm events. Physical maintenance was to be provided as needed.

- Permanent restrictions were to be placed on the property by the Navy to limit or prevent activities that may disturb the former construction debris landfill, the engineered soil cover over the debris in the Root Court cul-de-sac, or the petroleum-impacted soil in the vicinity of the playground. The Navy will be able to conduct digging and construction activities (e.g., building construction, utilities improvements, or maintenance) subject to restoring the integrity of the soil cover and taking necessary preventive measures to protect against short-term and long-term risks from contaminants.
- Permanent restrictions were to be placed on the property by the Navy to prevent construction of drinking water wells in the uppermost water-bearing unit. These restrictions apply to groundwater that is present in limited quantities above the Vashon Till.

4.2.2 Remedy Implementation

Remedy implementation occurred throughout OU 1, including Site 101-A, from June 2000 through June 2002. During this time, a soil cover was placed over the Root Court cul-de-sac area. Soil cover over this area was placed as described in Section 4.1.2, and a labeled indicator layer was placed under the clean material, also as described in 4.1.2.

Shoreline stabilization work along the beach area of Site 101-A occurred in the summer of 2000. Work consisted of removing miscellaneous debris along the shoreline, placing shellfish harvest restriction signs, and installing a low rock shelf at the toe of the slope.

The operation, maintenance, and monitoring program for Site 101-A specified by the ROD consists of fulfilling ROD-mandated monitoring requirements, managing the institutional controls program, and maintaining erosion controls for the site.

4.2.3 Operation, Maintenance, and Monitoring

The operation, maintenance, and monitoring program for Site 101-A specified by the ROD consists of fulfilling ROD-mandated monitoring requirements, managing the institutional controls program, and maintaining erosion controls for the site.

COCs in the groundwater beneath Site 101-A are required to meet ROD RGs at the point where groundwater enters the marine environment (point of compliance). To this end, the Land Use Control Plan specifies permanent restrictions to be placed on use of shallow groundwater (above the Vashon Till) as a drinking water source. In addition, as part of the long term monitoring plan for Jackson Park, one seep (SP-715) and one outfall (OF-716) located within Site 101-A were

selected to be sampled (Figure 4-1). These locations have been sampled four times since the signing of the ROD. Long-term monitoring results are discussed in Section 6.4.

Institutional Controls

The construction debris landfill and the areas of petroleum-impacted subsurface soil in the vicinity of Root Court are areas where land use restrictions will be required (i.e., controls on excavation and construction), and these areas are incorporated into the Land Use Control Plan. Figure 4-2 shows the areas of Site 101-A that require land use restrictions. Compliance inspections of the areas shown on Figure 4-2 will be implemented as part of the Land Use Control Plan to ensure that these areas remain undisturbed and that the soil cap continues to function as planned. Remedy maintenance inspections for the rock shelf along the shoreline of Site 101-A commenced in the spring of 2004 and were described in Section 4.1.3.

4.3 SITE 103

4.3.1 Remedy Selection

The COCs in soil at Site 103 were cPAHs and arsenic, and COCs in groundwater at the point where groundwater enters the marine environment were arsenic, mercury, silver, 1,1-dichloroethene, TCE, vinyl chloride.

To achieve the RAOs, the remedial action components specified in the OU 1 ROD include the following:

- A vegetated cover consisting of a minimum 1-foot-thick soil cover plus sufficient topsoil to support vegetation was to be installed over the identified areas where COCs in surface soils exceeded the RGs.
- Shoreline stabilization measures were to be installed along the shoreline to limit erosion of soils that may contain COCs. The intent of the remedial design will be to provide no net loss of productive fish and shellfish habitat.
- Permanent restrictions were to be placed on the property by the Navy to limit or prevent activities that may disturb the former ordnance burn area at Site 103.
- Regular inspection and maintenance of the shoreline stabilization measures and soil covers were to be conducted and documented. The inspections were also to

occur after major storm events. Physical maintenance was to be provided as needed.

- For the portions of Site 103 where residential soil cleanup levels were exceeded, land use restrictions were to be put in place to prevent use of the site for residential occupancy.
- Permanent restrictions were to be placed on the property by the Navy to prevent construction of drinking water wells in the uppermost water-bearing unit. These restrictions apply to groundwater that is present in limited quantities above the Vashon Till.
- For the designated intertidal areas and adjacent shoreline owned by the Navy, land use restrictions were to be implemented to address procedures for controlling construction and maintenance activities to prevent activities that may interfere with or compromise the function of the shoreline stabilization system. These restrictions were to include requirements for ongoing monitoring and maintenance of the shoreline stabilization system.
- A shellfish sampling program was to be implemented. The Navy, with concurrence from EPA, Ecology, and the Washington State Department of Health will decide when shellfish on JPHC/NHB beaches can be harvested and the purpose of those harvests, e.g., subsistence, recreational, commercial, or ceremonial gathering.
- Signs were to be posted along the shoreline to notify the JPHC residents (and any members of the general public) of any harvest restrictions.
- An investigation (including a geophysical survey) was to be conducted at Site 103 to attempt to identify the source of three volatile organic compounds (VOCs), 1,1-dichloroethene, TCE, and vinyl chloride, that exceeded remedial goals in seeps and outfalls along the north shoreline of Elwood Point. The Navy was to conduct an investigation to attempt to define a source of VOCs that may exist inland of the seeps and outfalls.
- An environmental monitoring program was to be conducted to include sampling of intertidal seeps and outfalls
- Approximately 450 wooden pilings from abandoned Navy structures, including part of Pier 2 in Site 101, the fishing pier on Elwood Point and its associated

wooden pilings, and mooring dolphins offshore of Sites 101 and 103, were to be removed from Ostrich Bay and properly disposed of off site.

4.3.2 Remedy Implementation

Remedy implementation for Site 103 occurred primarily during 2001, although the bulk of the shoreline stabilization activities were completed in the late summer and early fall of 2000. The soil-cover activities occurred during 2001. In the soil subgrade, a subsurface drainage system was installed. Where the ground was not covered with sports facilities, soil cover was placed as described in Section 4.1.2. For two areas of the site (shown on Figure 4-2), a labeled indicator layer (described in 4.1.2) was placed under the clean material to identify the areas where remaining subsurface contamination is still present.

During the remedial activities for both the soil and the shoreline portions of the site, the remediation crew was on alert for anything that could possibly be a source of VOCs (e.g., piping or buried drums), particularly vinyl chloride. A geophysical survey was conducted in the northern portion of the site to identify potential buried sources of VOCs. However, the data were reviewed and proved to be inconclusive. During remediation of the northern portion of the site some drums of unknown material were located and sampled, but these drums did not contain vinyl chloride. No other suspect materials were found. Therefore, the source of the VOCs is still unknown (U.S. Navy 2002a).

Shoreline stabilization remedial actions occurred primarily during the summer of 2000. Stabilization activities consisted of the following:

- Removal of debris and construction of a pocket beach along the south side of Site 103
- Removal of debris and construction of a low rock shelf with vegetation at the top of the shelf (described in Sections 4.2.2) along 550 feet of shoreline
- Construction of a set of granite beach access stairs 100 feet north of the fishing pier abutment (fishing pier has been removed; see below)
- Armor rock revetment and vegetation along approximately 500 feet of shoreline at the northwest end of Site 103
- Placement of shellfish harvesting restriction signs at several locations

As part of the remedy for protection of shellfish, the creosote-treated pilings associated with the pier on Elwood Point, fender piles around Pier 2 in Site 101, and a string of moorage dolphins (offshore from Sites 101 and 103) were removed during the summer of 2001. Pier 2 remains; however only the abutment remains of the fishing pier at Elwood Point. Pilings removed included the following:

- 114 creosote piles from the string of dolphins
- 152 creosote fender piles and associated horizontal timbers around Pier 2
- 184 creosote-treated wood pilings, pier decking, and a steel terminus from the pier at Elwood Point

During remedial activities, the locations of the remaining underwater stubs of the pilings were recorded. A subtidal marine evaluation report was prepared in 2002 as an Appendix to the remedial action closure report for OU 1 (U.S. Navy 2002a).

4.3.3 Operation, Maintenance, and Monitoring

The operation, maintenance, and monitoring program for Site 103 specified by the ROD consists of fulfilling ROD-mandated monitoring requirements, managing the institutional controls program, and maintaining erosion controls for the site.

COCs in the groundwater beneath Site 103 are required to meet ROD RGs at the point where groundwater enters the marine environment (point of compliance). To this end, the Land Use Control Plan will specify permanent restrictions to be placed on use of shallow groundwater (above the Vashon Till) as a drinking water source. In addition, as part of the long-term monitoring plan for Jackson Park, two seeps (SP-707 and SP-704) and one outfall (OF-705) were selected to be sampled. SP-704 could not be located, and a replacement seep (SP-703) was located after two rounds of sampling had already occurred. SP-703 could not be located during the summer 2004 sampling, and another replacement seep (SP-702) was sampled in 2004. All locations have been sampled up to four times since the signing of the ROD. Monitoring results are discussed in Section 6.4.

Shellfish monitoring was also conducted as part of the long-term monitoring program. Shellfish sampling in areas offshore of Sites 101, 101-A, and 103 occurred in 2002 and 2004. Results are discussed in Section 6.4.

Institutional Controls

The two areas of Site 103 where impacted soils are covered by a geotextile liner are areas where institutional controls regarding excavation and construction are required (Figure 4-2). In addition, residential development is not allowed on the site. Such controls are incorporated into the Land Use Control Plan. Remedy maintenance inspections for Site 103 commenced in the spring of 2004, and inspections will be conducted semiannually. The maintenance inspections (described in Section 4.1.3) included examining the soil capped areas (playground, baseball field, and sports court areas) to confirm that erosion was not occurring and the vegetation was healthy. Inspection of the seawall included confirming that the seawall was intact, that the drains were functioning adequately, that there was no significant erosion, and that the armor stone revetment was maintained with a minimal amount of erosion.

4.4 SITE 110

4.4.1 Remedy Selection

The COCs in soil at Site 110 were cPAHs and arsenic, and COCs in groundwater in the upland areas below the Vashon Till were arsenic, beryllium, manganese, nickel, and vanadium.

To achieve the RAOs, the remedial action components specified in the OU 1 ROD include the following:

- Surface soil containing arsenic and cPAHs above the cleanup levels in residential backyard areas on the east side of Haven Road will be excavated and properly disposed of. The affected backyard area(s) were to be excavated to a maximum 2-foot depth to remove the contaminated surface soil, backfilled with clean fill, and revegetated. The volume of soil requiring excavation was estimated at 2,600 cubic yards. The remedial design would include a sampling program to characterize the exact extent of soils exceeding the cleanup levels.
- Soil containing arsenic and cPAHs above cleanup levels remains beneath paved areas in front of bunkers 100 and 101. Land use restrictions and requirements were to address maintenance of the asphalt cover and procedures for controlling activities that involve digging or construction that could cause exposure to contaminants in soil.

- Permanent restrictions were to be placed on the property by the Navy to prevent construction of drinking water wells in the uppermost water-bearing unit. These restrictions apply to groundwater that is present in limited quantities above the Vashon Till in the eastern portion of the site closest to the shore.
- An environmental monitoring program was to be conducted to include sampling of four existing Site 110 monitoring wells located in the western half of the site and screened in groundwater located beneath the Vashon Till to redetermine groundwater background concentrations. Permanent restrictions will be placed on the property by the Navy to prevent construction of drinking water wells at Site 110 (groundwater present below the Vashon Till) unless the chemical data from the environmental monitoring program demonstrate that inorganics at Site 110 are not present above the cleanup levels.

4.4.2 Remedy Implementation

The soils impacted with cPAHs and arsenic east of two residential buildings along Haven Road were further investigated in June 2001 and March 2002. The additional sampling efforts identified areas where soils contained cPAHs above the RG. Excavation and disposal of the cPAH soil from the upper 2 feet occurred in June 2002. A buffer zone was established to protect existing trees, and no excavation occurred in the zone. Pipe debris assumed to contain asbestos, lead-wrapped wire, and railroad ties assumed to be creosote-treated were discovered, removed, and properly disposed of during excavation. After excavation, clean material was backfilled into the area and covered with sod.

4.4.3 Operation, Maintenance, and Monitoring

The operation, maintenance, and monitoring program for Site 110 specified by the ROD consists of fulfilling ROD-mandated monitoring requirements, managing the institutional controls program, and maintaining erosion controls for the site.

Two rounds of sampling were required in the ROD to be conducted at four existing monitoring wells (MW-11, MW-13, MW-14, and MW-15) to determine concentrations of total and dissolved inorganics. In addition, wells representative of background metals concentrations were to be selected and sampled (MW-40 and MW-41). The groundwater background study was completed in 2001 and post-ROD sampling on site occurred in 2002 and 2004. Well MW-11 cannot be located and is considered lost, therefore, three wells were sampled in 2002. Subsequent to 2002, MW-14 was damaged during construction activities in 2003, but was repaired in late fall 2004 for future sampling. Two wells, MW-13 and MW-15, were sampled in

2004. Data from both the on-site sampling and the background study are presented in Section 6.4.

Institutional Controls

Two areas under pavement in front of Buildings 100 and 101 contain arsenic in soil above the ROD RG. A third area on the east side of South Shore Road near its intersection with Root Court (near the boundary of Sites 101, 101-A, and 110) contains petroleum compounds above MTCA Method A. These three areas require controls to prevent uncontrolled excavation or construction, and the areas in front of the buildings also require maintenance of the existing asphalt cover (see Figure 4-2). Such controls are being incorporated into the Land Use Control Plan currently under development.

4.5 BENZENE RELEASE AREA

4.5.1 Remedy Selection

The overall RAO for the Benzene Release Area was to prevent impacts to ecological receptors in the marine environment and to protect human health by attaining compliance with water quality standards for marine surface water at the point of groundwater discharge (benzene is the COC).

To achieve this objective, the remedial action components specified in the OU 1 ROD include the following:

- Oxygen-releasing chemicals were to be placed in the subsurface using one or more of the following methods: injection of a slurry, backfilling of boreholes or open pits, or placement in monitoring wells.
- Limited excavation and disposal of petroleum-contaminated soil would occur if significant petroleum contamination were to be found above the seasonal high-water table. The specific quantities and locations of any excavation were to be determined in the remedial design.
- An environmental monitoring program was to be conducted to verify effectiveness of the remedy.

4.5.2 Remedy Implementation

Field work for the remedial actions in the Benzene Release Area occurred in April and May 2001. Fifty-six oxygen-releasing compound (ORC) injection locations (35 in the source area, 21

downgradient), four new monitoring wells, and one replacement monitoring well were installed during the field effort. Approximately 8,400 pounds of ORC was placed in the source area, and 5,040 pounds was placed downgradient. No excavation of petroleum soils was conducted during this remedial action.

4.5.3 Operation, Maintenance, and Monitoring

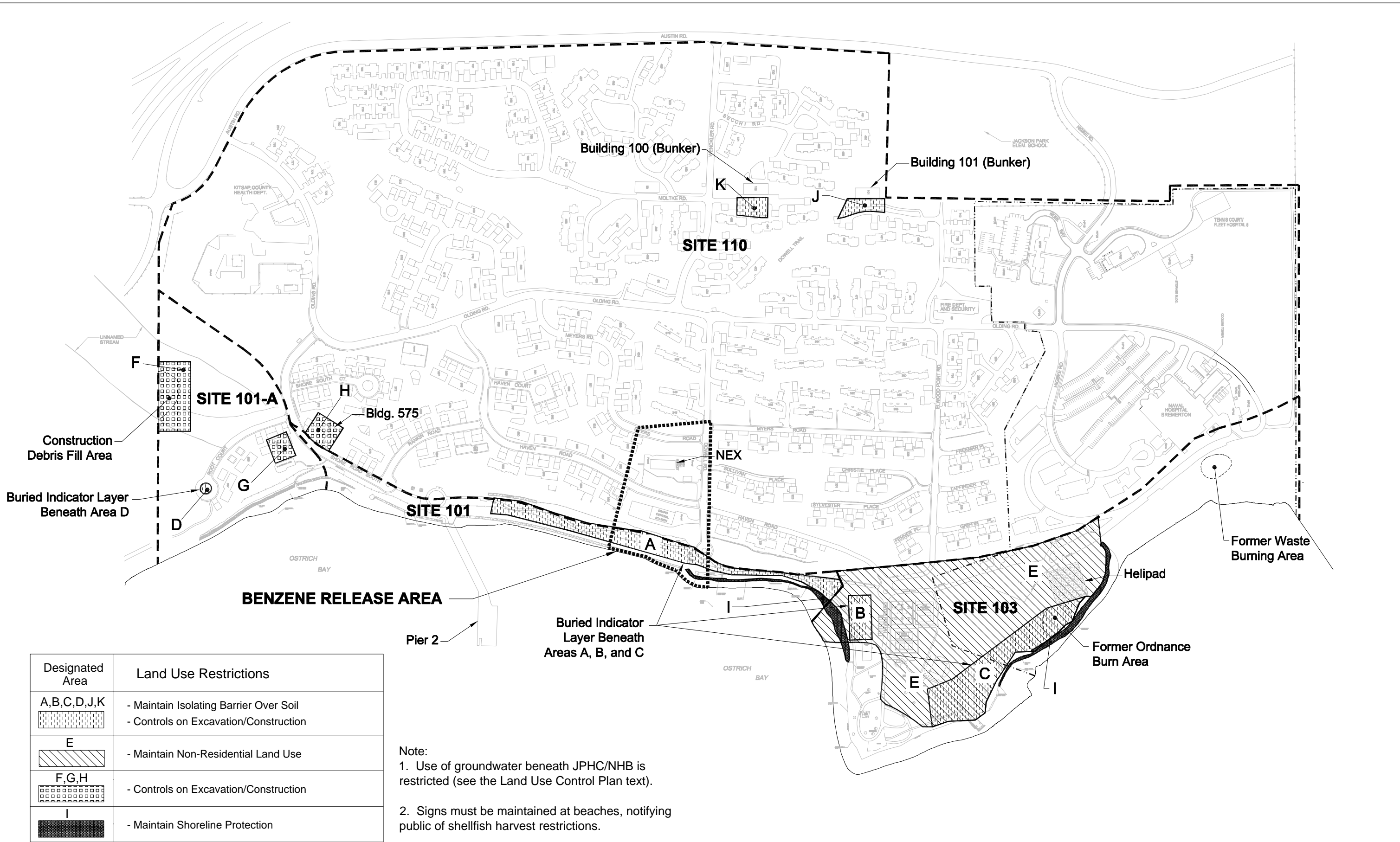
The operation, maintenance and monitoring program for the Benzene Release Area specified by the ROD consists of fulfilling ROD-mandated monitoring requirements for the site.

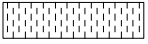
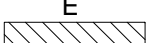
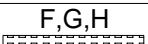
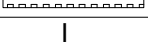
The ROD specified that, initially, sampling of groundwater, seeps, and outfalls should occur quarterly for 2 years. Initial monitoring occurred from August 2001 through May 2003, and routine monitoring was continued after the 2-year period at the point of compliance (the outfall and seeps at Site 101). The outfall/seep results for Site 101 are also part of the long-term monitoring for the Benzene Release Area. Eight rounds of data are available and are discussed in Section 6.4. Eight wells were selected for quarterly sampling, three in the source area and five downgradient. During monitoring, it was discovered that the source wells were screened in the perched groundwater, and the downgradient wells were screened in the deeper groundwater beneath the Vashon Till. The wells screened in the deeper groundwater are all located close to the shoreline, downgradient from the source area (MW-4, MW-880, MW-881, MW-882, and MW-883). The three wells in the source area screened in the shallow groundwater could not be sampled for many of the quarterly monitoring periods, because these wells were either completely dry or had insufficient water for sampling.

Institutional Controls

The selected remedy for the Benzene Release Area does not include any institutional controls. The institutional controls that are included in the selected remedy for groundwater for Sites 101 and 110 prevent construction of drinking water wells within the Benzene Release Area.

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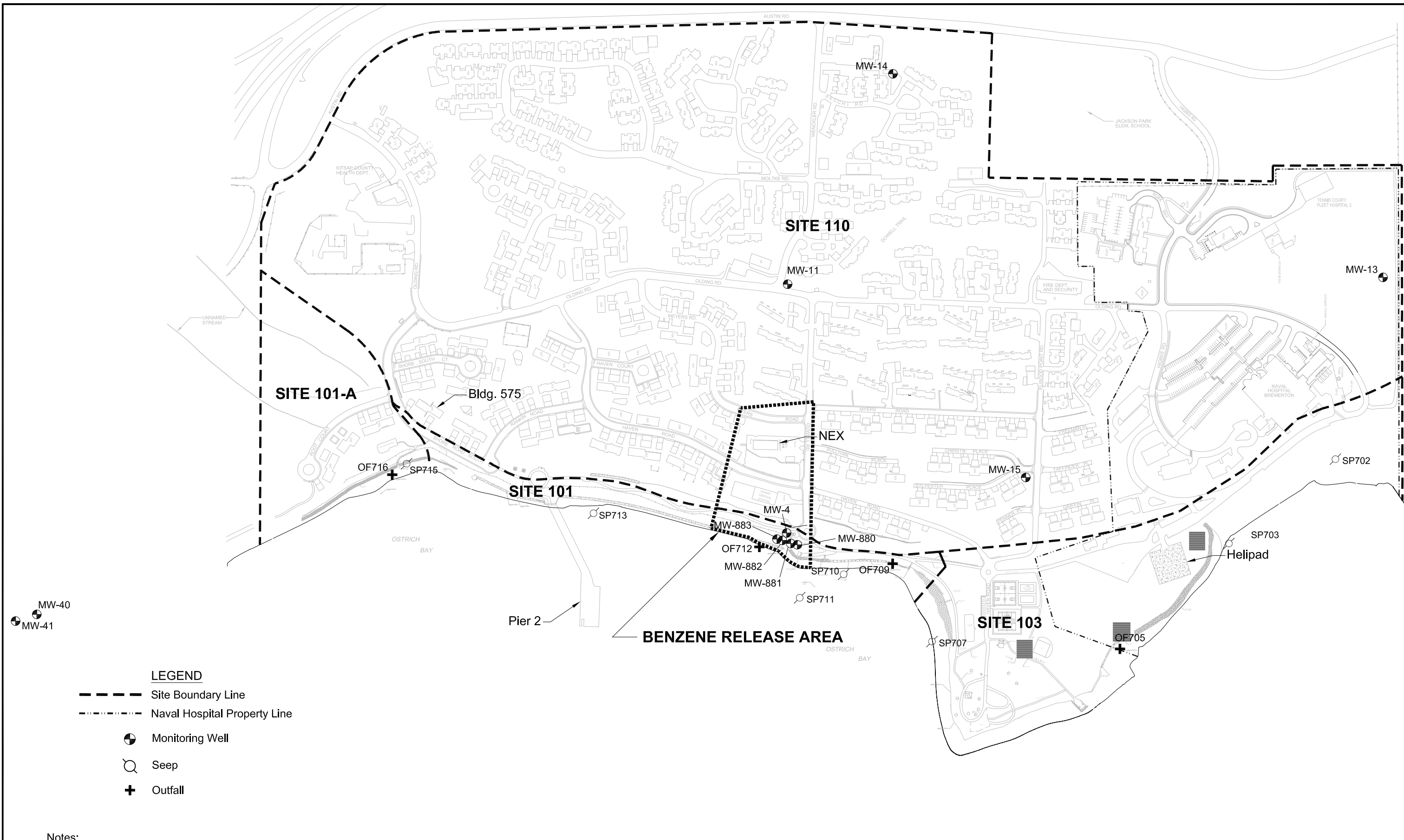
Designated Area	Land Use Restrictions
A,B,C,D,J,K 	- Maintain Isolating Barrier Over Soil - Controls on Excavation/Construction
E 	- Maintain Non-Residential Land Use
F,G,H 	- Controls on Excavation/Construction
I 	- Maintain Shoreline Protection

LEGEND
 - - - Site Boundary Line
 - - - - - Naval Hospital Property Line

Note:
 1. Use of groundwater beneath JPHC/NHB is restricted (see the Land Use Control Plan text).
 2. Signs must be maintained at beaches, notifying public of shellfish harvest restrictions.

U.S. NAVY	Delivery Order 0044 JPHC/NHB FIVE-YEAR REVIEW	 SCALE IN FEET	Figure 4-1 Land Use Restrictions
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Notes:
 1. Sampling locations based on 2002 survey data from CH2M HILL, when available (U.S. Navy 2002c). Remaining sampling locations based on 1996 RI/FIS location data.
 2. Sampling location SP704 could not be located and was replaced by SP702 (2004) and SP703 (2003).

<p>U.S. NAVY</p>	<p>Delivery Order 0044 JPHC/NHB FIVE-YEAR REVIEW</p>		<p align="right">Figure 4-2 Long-Term Monitoring Sampling Locations</p>
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FINAL FIRST FIVE-YEAR REVIEW OF RECORD OF DECISION
Jackson Park Housing Complex and Naval Hospital Bremerton
Naval Facilities Engineering Command Northwest
Contract No. N44255-02-D-2008
Delivery Order 0044

Section 5.0
Revision No.: 0
08/26/05
Page 5-1

5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

This is the first 5-year review for this site.

6.0 FIVE-YEAR REVIEW PROCESS

6.1 FIVE-YEAR REVIEW TEAM

The Navy is the lead agency for this 5-year review. Personnel from NAVFAC NW, Naval Base Kitsap, and NHB represented the Navy in this 5-year review. Project managers and other staff from the EPA and Ecology, the other 5-year review team members, have participated in the review process. Both the EPA and Ecology are cosignatories of the ROD for Jackson Park. All team members had the opportunity to provide input to this report.

6.2 COMMUNITY NOTIFICATION AND INVOLVEMENT

There are specific requirements pursuant to CERCLA Section 117(a), as amended, that require certain reports to be released to the public and that the public be notified of proposed cleanup plans and remedial actions. The community notification and involvement activities are described below.

6.2.1 History of Community Involvement

Community relations activities have established communication between the citizens living near the site, other interested organizations, the Navy, EPA, and Ecology. The actions taken to satisfy the statutory requirements also provided a forum for citizen involvement and input to the Proposed Plan and the ROD. These actions included the creation of a community relations plan and periodic meetings between the public and the agencies in the form of Restoration Advisory Board (RAB) meetings. RAB meetings have occurred periodically beginning in 1995.

The purpose of the RAB is to act as a forum for the discussion and exchange of information between the Navy, regulatory agencies, and the community on environmental restoration topics. RAB meetings provide an opportunity for the stakeholders to review progress and participate in the decision making process by reviewing and commenting on actions and proposed actions involving releases or threatened release at the installation.

The Proposed Plan for JPHSC/NHB OU 1 was issued in October 1999 and mailed to all residences at JPHC and other members of the public. An open house and public meeting were held on October 20, 1999. The public comment period expired on November 4, 1999, and a response to public comments was included in the ROD (the Responsiveness Summary).

6.2.2 Community Involvement During the 5-Year Review

A notice was inserted by the Navy in local papers on September 27 and 28, 2004, informing the public that the site is currently undergoing a 5-year review, when, where, and how they could receive information, and how to provide comments on the protectiveness of the remedy. There has been no public response resulting from the notice. Also, selected community members (primarily RAB members) were interviewed as part of the site interview process described in Section 6.6.

6.3 DOCUMENT REVIEW

Documents reviewed during this 5-year review of the ROD for OU 1 were those documents describing the construction and monitoring of the selected remedies and the Inspection and Maintenance Plan for Jackson Park.

The documents that were reviewed are listed below:

- The signed ROD (U.S. Navy, Ecology, and USEPA 2000).
- The remedial action closeout report addressing completed remedy construction for all areas except the Benzene Release Area (U.S. Navy 2002a)
- The as-built submittal for the Benzene Release Area remediation (U.S. Navy 2001a)
- The long-term monitoring reports (groundwater, shellfish, seep, and outfall monitoring) (U.S. Navy 2003a, 2003b, 2003d, 2004a, and 2004d)
- The groundwater background reassessment report (U.S. Navy 2001b)
- The Benzene Release Area monitoring report (U.S. Navy 2003a)
- The shellfish human health risk assessment (U.S. Navy 2003c)
- The early spring 2004 inspection report (U.S. Navy 2004c)

Review of these documents provided much of the information included in Sections 3 and 4 regarding the description of the sites, the RAOs and selected remedy components for each site, and the status of remedy implementation and monitoring at each site.

6.4 DATA REVIEW

Long-term monitoring of groundwater, seeps, outfalls, and shellfish was required under the ROD and has been occurring since the completion of the remedial actions. Monitoring began in late June of 2002 and has continued to the present. The monitoring results for each of the OU 1 areas are discussed below. Results from the shellfish sampling are discussed separately, because they were collected in the bay offshore from three sites, Sites 101, 101-A, and 103. In addition to monitoring locations within the affected areas of Jackson Park, the ROD also specified that background metals concentrations in groundwater be re-evaluated in a separate study. The results of the groundwater background re-evaluation are reported in Section 6.4.5.

The ROD specified that at least 10 seeps and outfalls for the combined shore areas (Sites 101, 101-A, and 103) should be sampled as part of the long-term monitoring. Ten locations were originally selected and apportioned as follows: five seep and outfall locations in Site 101, two locations in Site 101-A, and three locations in Site 103.

6.4.1 Seep and Outfall Sampling for Site 101

Three seeps (SP-710, SP-711, and SP-713) and two outfalls (OF-709 and OF-712) located within Site 101 were selected to be sampled (Figure 4-1). For location SP-711, there was insufficient flow for sampling during two of the four sampling rounds for which data are available. Therefore, only four locations within Site 101 have data for all four sampling events. During the sampling events, four chemicals (beryllium, cyanide, dissolved copper, and benzene) were detected at least once above their respective RGs or background concentrations established for the site (see Table 6-1).

Benzene at OF-712 is the only chemical consistently detected at any of the seeps and outfalls at Site 101. This location is downgradient of the Benzene Release Area, which is discussed in Section 6.4.6. Concentrations of benzene detected at OF-712 are consistent with the concentration trends observed at the other sampling locations for the Benzene Release Area.

6.4.2 Seep and Outfall Sampling for Site 101-A

One seep (SP-715) and one outfall (OF-716) located within 101-A were selected to be sampled (Figure 4-1). These locations have been sampled four times since the beginning of the long-term monitoring program in 2002. Two chemicals (beryllium and mercury) were detected at least once above the RGs or background concentrations established for the site. The RG exceedances are presented on Table 6-2.

6.4.3 Seep/Outfall Sampling for Site 103

Two seeps (SP-707 and SP-704) and one outfall (OF-705) were selected to be sampled at Site 103 (Figure 4-1). SP-704 could not be located, and no other seeps were found during the first two rounds of monitoring. However, a north-side seep was located during the second round of monitoring (SP-703) and was selected as a replacement for SP-704 in the 2003 monitoring. Another substitute seep (SP-702) was sampled in 2004. Data are available for four rounds of sampling since the signing of the ROD. Four chemicals (arsenic, beryllium, cyanide, and mercury) have been detected at least once above the RGs or background concentrations established for the site Table 6-3. TCE was detected in the outfall sample on the north side of Elwood Point (OF-705) in 2003 and 2004 at concentrations below the ROD RG. (VOCs were not analyzed in earlier rounds of sampling at this location.)

6.4.4 Shellfish Sampling

Shellfish monitoring was also conducted as part of the long-term monitoring program. Shellfish monitoring has been conducted according to the ROD specifications: up to 16 shellfish tissue samples were to be collected every 2 years from Ostrich Bay and analyzed for antimony, arsenic, vanadium, 3,3'-dichlorobenzidine, pentachlorophenol, and ordnance compounds. The first round of shellfish sampling was to occur after the pilings were removed, and the first sampling round occurred in the summer of 2002, post-remediation. Additionally, background concentrations of antimony, arsenic, and vanadium in shellfish tissue were to be established, through either sample collection at off-site locations, or review of information from other sources.

Two rounds of sampling were to be conducted prior to the 5-year review. This sampling occurred in 2002 and 2004 for clams (littleneck and manila) and crabs (graceful crab). Samples were analyzed as specified in the ROD for three metals (arsenic, antimony, and vanadium), two semivolatile organic compounds (SVOCs) (3,3'-dichlorobenzidine and PCP), and ordnance compounds. The results of the 2002 sampling were that arsenic, vanadium, and two ordnance compounds (research demolition explosive [RDX] and 4-amino-2,6-dinitrotoluene) were detected in clam tissue; arsenic, vanadium, and one ordnance compound (1,3,5-trinitrobenzene; detected in only one sample) were detected in crab tissue. Vanadium concentrations appeared to be comparable to background. The laboratory qualified all the ordnance detections (which were less than 1 mg/kg wet weight), noting that without further confirmation there was uncertainty regarding the reported detections.

A human health risk evaluation of the 2002 sampling results was completed in 2003 (U.S. Navy 2003c) to assess whether the shellfish met the RAOs stated in the ROD: reduce risk from subsistence-level ingestion of shellfish from Ostrich Bay to less than 1×10^{-5} excess cancer risk, or less than a noncarcinogenic HI of 1. Risks and hazards were estimated for arsenic and the two

ordnance compounds detected in clams and for arsenic only detected in crabs. The other detected chemicals were screened out of the risk assessment because they were not a health concern. The cumulative total cancer risks calculated for the site were 4×10^{-6} and 2×10^{-4} for current residential and future subsistence, respectively. The noncancer HIs calculated for the site were <1 and 5 for current residential and future subsistence, respectively. Incremental risks and hazards calculated for future subsistence were 4×10^{-5} and 0.9, respectively. Risks and hazards were due primarily to arsenic.

The 2004 shellfish sampling results were similar to the 2002 results. Antimony and vanadium were not detected, or were detected at background concentrations for both clam and crab tissue. Arsenic concentrations in clam and crab tissue in 2004 were very similar to the 2002 sampling, indicating risk assessment results would be the same as those obtained for the 2002 data if a similar risk methodology was employed. Arsenic concentrations are presented on Table 6-4.

In 2004, RDX was the only ordnance compound detected in clam tissue. RDX was detected in three samples in 2004, compared to only one sample in 2002. However, the concentrations were very similar (albeit slightly lower in 2004): 0.46 mg/kg in 2002 and 0.2 to 0.3 mg/kg in 2004. No ordnance compounds were detected in crab tissue in 2004. No SVOCs were detected in either crab or clam tissue.

6.4.5 Groundwater Sampling for Site 110

The ROD specified that the results from two groundwater sampling rounds at Site 110 were to be used to determine the need for restrictions on future groundwater use at Site 110. Post-ROD sampling occurred in 2002 and 2004. Four upland wells were selected for sampling in the ROD; however, one well, MW-11, could not be located and is considered abandoned. Therefore, only three wells were sampled in 2002. In 2004, only two wells were sampled, because MW-14 was damaged during some construction activities such that it cannot be resampled. No samples exceeded the site-specific background values (discussed below) or RGs. Results are presented on Table 6-5.

Also, as part of the evaluation of upland groundwater, the ROD required a re-evaluation of background concentrations in groundwater. Once new background concentrations were established, the RGs for metals in groundwater were to be re-evaluated. During late 2000 and 2001, 10 sampling rounds were completed in 2 off-site wells (MW-40 and MW-41). Four of the metal COCs in the ROD (arsenic, copper, lead, and zinc) have RGs based on background concentrations, because background concentrations were higher than the most stringent regulatory criteria. Five additional metal COCs did not have a previous calculated background concentration (beryllium, mercury, nickel, silver, and thallium). For the four metals with

background RGs, the new background determinations in the 2001 report (U.S. Navy 2001b) affect the RGs presented in the ROD. For the five metal COCs that did not have a previously calculated background concentration, only the new background results for mercury could affect revision of the ROD RGs, since only mercury's background concentrations were above the most stringent regulatory criteria. Section 7.2.1 contains a discussion of the background concentrations from the 2001 study for arsenic, copper, lead, zinc, and mercury in comparison to the RGs established in the ROD.

6.4.6 Seep, Outfall, and Groundwater Sampling for the Benzene Release Area

As required in the ROD, eight rounds of seep, outfall, and groundwater monitoring have been conducted for the Benzene Release Area from August 2001 through May 2003. Samples were analyzed for benzene, ethylbenzene, toluene, and xylenes (BTEX), methyl-tert-butyl-ether (MTBE), and equivalent total petroleum hydrocarbons (ETPH). Only benzene and ETPH results are discussed here, because the other constituents either never exceeded their RGs or were not detected.

Benzene

The benzene concentrations detected in the groundwater monitoring network prior to ORC injection (November 1999) through the post-ORC injection monitoring period (August 2001 to May 2003) are presented on Table 6-6. Monitoring wells screened within the shallow perched groundwater generally had low concentrations of benzene. At HC-2, benzene was detected at low concentrations (below 1 µg/L), and HC-5 ranged in concentration from 2.49 to 373 µg/L during this monitoring period. As mentioned previously, groundwater samples could not be collected from HC-4 due to insufficient water volume.

Benzene concentrations detected in the deeper groundwater had fluctuating levels. The highest concentrations of benzene in the groundwater were detected at MW-4. Benzene concentrations at MW-4 changed from 12,500 in May 2002 to 19,100 µg/L in August 2002, then to 12,500 µg/L in May 2003. This demonstrates that additional data are needed to clearly identify a trend.

Benzene concentrations had declining trends at MW-882 (4,400 µg/L in August 2002 to 1,580 µg/L in May 2003) and MW-883 (2,460 µg/L in August 2002 to 1,560 µg/L in May 2003). Benzene levels at MW-880 and MW-881 were relatively stable during this monitoring period.

From November 1999 through February 2003, benzene was not detected in six sampling rounds at Seep-R, except in Round No. 4 on May 2002. Benzene was detected at Seep-L in November 2002 and February 2003 at concentrations below the 43 µg/L ROD-specified cleanup criterion. Benzene concentrations at the New Seep sampling location ranged from 42 to 344 µg/L. Additional data are required to establish a data trend.

Equivalent Total Petroleum Hydrocarbons

ETPH did not exceed the ROD-specified cleanup level of 1,000 µg/L at Seep-L or Seep-R during the monitoring period. However, the ETPH level at New Seep did slightly exceed 1,000 µg/L during November 2002 (1,470 µg/L) and May 2003 (1,220 µg/L). ETPH concentrations are presented on Table 6-6.

6.5 RESULTS OF SITE INSPECTION

The site inspection checklist is included as Appendix A. This section contains a summary of the site inspection findings. The site visit occurred on September 9, 2004, and was conducted by the following personnel:

- Larry Tucker, NAFAC NW
- Mike Hardiman, Naval Base Kitsap
- Robert Mitchell, Naval Hospital Bremerton
- Michael Meyer, URS Corporation
- Sharon Quiring, URS Corporation

The site visit included verifying that remedial actions were complete (for those items that could be visually inspected) and inspecting all portions of the site covered by institutional controls.

6.5.1 Completed Remedial Actions

The following remedial actions were visually inspected during the time of the visit:

- Shoreline stabilization work (includes shoreline of Sites 101, 101-A, and 103)
- Removal of the fishing pier at Elwood Point (Site 103)

The site walk verified that these activities have been completed.

6.5.2 Inspection of Institutional Controls

Institutional controls that could be visually inspected were the following:

- Maintenance of the asphalt cover in front of Buildings 100 and 101 (Site 110)
- No observed digging/excavation in any of the areas where disturbance is prohibited without a dig permit (see Figure 4-2)
- Prevention of erosion for all the areas with digging/excavation restrictions (all areas noted on Figure 4-2)
- Shellfish harvesting prohibition signs at all the shoreline areas (Sites 101, 101-A, and 103)
- Maintenance of nonresidential land use for Site 103
- Maintenance of the shoreline stabilization measures—specifically, rock shelves and stairways, seawall, and armor revetment require maintenance to prevent erosion of impacted soils into Ostrich Bay.

The site walk verified that the institutional controls listed above are functioning as designed with a few minor exceptions. The exceptions were the following:

- At Site 101, minor erosion was observed beneath one set of beach stairs, one of the vegetated areas above the soil cover had few plants, small rocks from the revetment were seen on the beach, and several of the shellfish harvest prohibition signs were damaged.
- At Site 110, minor alligator cracking was observed in the asphalt in front of Building 100.

6.6 RESULTS OF INTERVIEWS

Interviews were conducted with persons familiar with the CERCLA actions at JPHC/NHB. Interviewees were selected from the Navy (including NAVFAC NW, Naval Base Kitsap, and NHB), Navy contractors working at JPHC/NHB, EPA, Ecology, and the community. Interview instructions and questions were sent to potential interviewees via hard-copy mail and e-mail; responses to questions were returned either by e-mail or telephone (at the discretion of the interviewee). Not all those invited to comment chose to do so. Interview responses are

documented in Appendix B. Highlights of the interview responses are summarized in the following subsections.

6.6.1 Navy Personnel

Two broad categories of Navy personnel were interviewed: personnel associated directly with the facility (Naval Base Kitsap and NHB) and NAVFAC NW personnel.

Naval Base Kitsap and NHB

Both Naval Base Kitsap and NHB indicated that the remedy was functioning well for the most part, except the Benzene Release Area. At this area, ORC appeared to have initially caused a decrease in benzene concentrations, but concentrations increased after that. The interviewee noted that subsequent investigations identified a possible additional source of contamination unaffected by the ORC treatment. One interviewee also noted that interest in the cleanup and followup actions by the general community is very low.

NAVFAC NW Personnel

Two people from NAVFAC NW responded. There was general agreement with the Naval Base Kitsap response above: the remedy is functioning with the exception of the Benzene Release Area. Other issues noted were that the Land Use Control Plan had not been developed, that inspections had not begun until 2004, and that there continued to be displacement of small rocks along the shoreline stabilization area, but that the overall stability of the shoreline had not been affected.

6.6.2 Agency Personnel

Ecology responded that they did not feel the remedy was functioning for the Benzene Release Area, but that other parts of the remedy appeared to be functioning, with the exception of inspections and controls as part of a Land Use Control Plan. EPA did not choose to respond.

6.6.3 Community

The Suquamish Tribe responded, noting the issues with the Benzene Release Area and institutional control plans and inspections that previous interviewees have discussed. The Tribe expressed concern regarding shellfish restrictions and reiterated a desire to have those restrictions removed in the future. The Tribe requested that they be actively involved in the evaluations and discussions regarding shellfish and that they continue discussions with the Navy regarding the culturally significant area on Elwood Point.

**Table 6-1
 Remediation Goal Exceedances at Site 101**

Chemical	RG (µg/L)	Sample Concentration (µg/L)			
		Summer 2002 (Location)	Fall 2002 (Location)	Summer 2003 (Location)	Summer 2004 (Location)
Beryllium (total)	0.0793	0.104 (SP-713)	No exceedances	No exceedances	No exceedances
Cyanide	1	4 (SP-713)	No exceedances ^a	6 J (OF-712)	No exceedances ^a
Copper (dissolved)	2.5 ^b	2.9 (OF-709)	No exceedances	No exceedances	No exceedances
Benzene	43	150 (OF-712)	51 (OF-712)	90 (OF-712)	44 (OF-712)

^aThe sampling round with no exceedances of cyanide had a sample quantitation limit of 10 µg/L, an order of magnitude higher than the RG.

^bThe RG listed here is based on the revised groundwater background analysis. The original RG in the Record of Decision was based on the old background a lower ARAR value. See discussion in Section 7.2.

Notes:

ARAR – applicable or relevant and appropriate requirement

J – Concentration is an estimated value.

µg/L – microgram per liter

RG – remediation goal

**Table 6-2
 Remediation Goal Exceedances at Site 101-A**

Chemical	RG (µg/L)	Sample Concentration (µg/L)			
		Summer 2002 (Location)	Fall 2002 (Location)	Summer 2003 (Location)	Summer 2004 (Location)
Beryllium (total)	0.0793	No exceedance	0.151J (OF-716)	No exceedances	No exceedances
Mercury	0.1 ^a	No exceedance	0.34 (OF-716)	No exceedances	No exceedances

^aThe RG listed here is based on the revised groundwater background analysis. The original RG in the Record of Decision was a lower ARAR value. See discussion in Section 7.2.1.

Notes:

ARAR – applicable or relevant and appropriate requirement

J – Concentration is an estimated value.

µg/L – microgram per liter

RG – remediation goal

**Table 6-3
 Remediation Goal Exceedances at Site 103**

Chemical	RG (µg/L)	Sample Concentration (µg/L)			
		Summer 2002 (Location)	Fall 2002 (Location)	Summer 2003 (Location)	Summer 2004 (Location)
Arsenic	3.7 ^a	No exceedances	No exceedances	4.05J (SP-707)	No exceedances
Beryllium (total)	0.0793	No exceedances	0.097 (SP-707)	0.083 (SP-707)	No exceedances
Cyanide	1	10 (OF-705)	No exceedances ^b	No exceedances ^b	No exceedances ^b
Mercury	0.1	No exceedances	0.2 (SP-707)	No exceedances	No exceedances

^aThe RG listed here is based on the revised groundwater background analysis. The original RG in the ROD was a lower ARAR value. See discussion in Section 7.2.1.

^bThe sampling round with no exceedances of cyanide had a sample quantitation limit of 10 µg/L, an order of magnitude higher than the RG.

Notes:

ARAR – applicable or relevant and appropriate requirement

J – Concentration is an estimated value.

µg/L – microgram per liter

RG – remediation goal

Table 6-4
Arsenic Concentrations in Shellfish

Shellfish	2002 Site Sampling (mg/kg)	2002 Reference Area Sampling (mg/kg)	2004 Site Sampling (mg/kg)	2004 Reference Area Sampling (mg/kg)
Clam	10.1 to 35.6 Average of 20.55	13.8 to 15.4 Average of 14.57	11.5 to 37.4 Average of 23.8	14.1 to 24.0 Average of 18.5
Crab	23.4 to 64.2 Average of 44.7	26.8 to 45.7 Average of 38.6	29.4 to 66.4 Average of 39.8	34.6 to 42.0 Average of 38.6

Notes:

All arsenic concentrations are reported as dry weight.
mg/kg - milligram per kilogram

**Table 6-5
 Metals Concentrations in Groundwater at Site 110**

Chemical	RG (µg/L)	MW-13 (µg/L)	MW-14 (µg/L)	MW-15 (µg/L)
Summer 2002 Sample Results for Total Metals				
Arsenic	3.7 ^a	0.2U	0.3J	0.8
Beryllium	0.0792	0.006U	0.006U	0.043
Manganese	2240	6.54J	7.10J	324J
Nickel	100	2.63	4.97	16.5
Vanadium	112	3J	3.29	9.09
Summer 2004 Sample Results for Total Metals				
Arsenic	3.7 ^a	0.4	Not sampled	1
Beryllium	0.0792	0.03U	Not sampled	0.05U
Manganese	2240	6.34	Not sampled	371
Nickel	100	5.86	Not sampled	26.1
Vanadium	112	3.82	Not sampled	11.1

^aThe RG listed here is based on the revised groundwater background analysis. See discussion in Section 7.2.1.

Notes:

J – Concentration is an estimated value.

µg/L - microgram per liter

RG – remediation goal

U – Chemical not detected, value is the sample quantitation limit.

Table 6-6
Analytical Results for Groundwater Monitoring—November 1999
(Pre-ORC) and August 2001 Through May 2003 (Post-ORC)

Sampling Location	Round No.	Date Collected	ETPH ^a (µg/L)	Benzene (µg/L)
Cleanup Levels^b:			1,000	43
HC-2 Shallow groundwater, source area	--	11/18/99	17 J	5 U
	1	8/7/01	NS	NS
	2	11/8/01	NS	NS
	3	2/1/02	176	0.509
	4	5/8/02	177	0.909
	5	NS	NS	NS
	6	NS	NS	NS
	7	2/12/03	176 U	0.5 U
	8	5/14/03	176 U	0.5 U
HC-4 Shallow groundwater, source area	--	11/17/99	51,600	41
	1	8/7/01	NS	NS
	2	11/8/01	NS	NS
	3	2/1/02	13,500	25 U
	4	5/16/02	NS	NS
	5	NS	NS	NS
	6	NS	NS	NS
	7	NS	NS	NS
	8	NS	NS	NS
HC-5 Shallow groundwater, source area	--	11/18/99	18 J	5U
	1	8/7/01	NS	NS
	2	11/8/01	NS	NS
	3	2/1/02	2,850	89.5
	4	5/9/02	4,060	373
	5	NS	NS	NS
	6	NS	NS	NS
	7	2/11/03	178	2.49
	8	5/13/03	193	18.1

Table 6-6 (Continued)
Analytical Results for Groundwater Monitoring—November 1999
(Pre-ORC) and August 2001 Through May 2003 (Post-ORC)

Sampling Location	Round No.	Date Collected	ETPH^a (µg/L)	Benzene (µg/L)
MW-4 Deep groundwater, downgradient from source area	--	11/19/99	169	11
	1	8/7/01	116,000	18,000
	2	11/9/01	61,100	17,600
	3	2/1/02	111,000	15,900
	3b	3/12/02	107,000	13,400
	4	5/8/02	62,500	12,500
	5	8/26/02	74,300	19,000
	6	11/18/02	69,400	15,100
MW-880 Deep groundwater, downgradient from source area	7	2/13/03	50,300	13,100
	8	5/15/03	56,200	12,500
	1	8/7/01	547	40.7
	2	11/9/01	571	26.9
	3	1/31/02	1,120	237
	3b	3/18/02	1,500	315
	4	5/16/02	2,420	379
	5	8/27/02	1,830	396
MW-881 Deep groundwater, downgradient from source area	6	11/11/02	4,400	337
	7	2/11/03	2,050	288
	8	5/20/03	1,340	306
	1	8/7/01	2,070	315
	2	11/9/01	742	329
	3	1/31/02	3,410	780
	3b	3/15/02	4,210	706
	4	5/14/02	2,510	456
MW-882 Deep groundwater, downgradient from source area	5	8/29/02	1,320	256
	6	11/12/02	473	53.2
	7	2/12/03	1,990	239
	8	5/14/03	1,060	181 J
	1	8/7/01	41,500	6,240
	2	11/8/01	20,500	6,400
	3	1/31/02	12,200	3,320
	3b	3/14/02	11,000	2,170
MW-882 Deep groundwater, downgradient from source area	4	5/13/02	21,500	3,870
	5	8/27/02	17,400	4,400
	6	11/13/02	14,000	2,590

Table 6-6 (Continued)
Analytical Results for Groundwater Monitoring—November 1999
(Pre-ORC) and August 2001 Through May 2003 (Post-ORC)

Sampling Location	Round No.	Date Collected	ETPH^a (µg/L)	Benzene (µg/L)
MW-882 (Continued)	7	2/17/03	11,100	2,330
	8	5/13/03	5,980	1,580
MW-883 Deep groundwater, downgradient from source area	1	8/7/01	20,900	3,120
	2	11/8/01	15,900	5,140
	3	1/31/02	4,660	1,150
	3b	3/13/02	5,820	1,420
	4	5/9/02	11,400	2,620
	5	8/28/02	11,200	2,460
	6	11/14/02	11,000	2,260
	7	2/18/03	4,230	722
Seep-L	--	11/18/99	--	260
	1	8/7/01	NS	NS
	2	11/8/01	NS	NS
	3	2/1/02	NS	NS
	3b	3/14/02	260	42.1
	4	5/10/02	200	24.9
	5	NS	NS	NS
	6	11/13/02	179	3.85
7	2/11/03	178	3.07	
8	NS	NS	NS	
Seep-R	--	11/18/99	--	5U
	1	8/7/01	NS	NS
	2	11/8/01	176 U	0.50 U
	3	2/6/02	176 U	0.5 U
	3b	3/14/02	176 U	0.5 U
	4	5/10/02	181	5.33
	5	NS	NS	NS
	6	11/13/02	176 U	0.5 U
7	2/11/03	176 U	0.5 U	
8	NS	NS	NS	
New Seep	6	11/13/02	1,470	136
	7	2/11/03	257	42.0
	8	5/20/03	1,220	344

Table 6-6 (Continued)
Analytical Results for Groundwater Monitoring—November 1999
(Pre-ORC) and August 2001 Through May 2003 (Post-ORC)

^aEquivalent total petroleum hydrocarbons (ETPH) calculated from results of simultaneous analysis of volatile petroleum hydrocarbons and benzene, ethylbenzene, toluene, and xylenes (BTEX).

^bAs established by the Record of Decision, or based on Model Toxics Control Act Method B surface water cleanup levels (Ecology, CLARC, Version 3.1, November 2001).

Notes:

--Pre-ORC injection sample not identified with a sampling round number. (All numbered sampling rounds were post-ORC injection.)

Bolded value indicates cleanup level exceedance.

µg/L - microgram per liter

NS - not sampled

ORC - oxygen-releasing compound

7.0 TECHNICAL ASSESSMENT

7.1 FUNCTIONALITY OF REMEDY

This section answers the question, “Is the remedy functioning as intended by the decision documents?” Each component of the remedy is discussed in the sections that follow, generally in the order that the components were described in Section 4. In cases where a single overall action was taken to address multiple remedy components, those components are grouped within the sections below.

7.1.1 Functionality of Remedy for the Shoreline (Sites 101, 101-A, and 103)

The remedy for the shoreline is functioning as designed and progress is being made towards meeting the RAOs. Three of the four RAOs for the site were related to protection of the marine environment:

- Reduce the potential for erosional transport of chemicals in soil to the marine environment.
- Protect ecological receptors in the marine environment and human health by attaining compliance with water quality standards for marine surface water at the point of groundwater discharge.
- For shellfish from Ostrich Bay, reduce risks from subsistence-level ingestion to less than 1×10^{-5} excess carcinogenic risk and less than a noncarcinogenic HI of 1.

Shoreline remedial actions included shoreline stabilization, monitoring of seeps and outfalls, and monitoring of shellfish tissue in Ostrich Bay.

Shoreline Stabilization

The shoreline stabilization along Ostrich Bay from Sites 101-A to 103 was constructed to prevent the erosion of contaminants in soil in order that soil contaminants would not enter the marine environment. In addition, impacted soil remaining in the shoreline areas of Sites 101 and 103 was covered and vegetated to further prevent the movement of contaminants into the bay.

The shoreline stabilization efforts appear to be working effectively to prevent erosional transport, based on observations made during the site visit, the reports of interviewees, and the results of the inspection report. Continued effectiveness requires ongoing inspection and maintenance to address the minor issues observed (some erosion beneath beach stairs, the movement of rock from the revetment to the beach by wave action over time, and some stressed vegetation at Site 101). The appropriate programs and activities are in place and are fulfilling inspection and maintenance requirements. The required land use controls are being formalized in a Land Use Control Plan being prepared concurrently with this 5-year review. The site inspections for this 5-year review indicate that the required land use controls have been maintained since signing the ROD, in spite of the lack of a formal Land Use Control Plan, and that the institutional controls component of the remedy is functional.

Seep and Outfall Monitoring

Ongoing monitoring of the seeps and outfalls along the shoreline has been performed as specified in the ROD, and four rounds of monitoring data were available for the 5-year review. There have been few exceedances of the water quality RGs specified in the ROD, with the exception of benzene, due to the Benzene Release Area (see Section 7.1.4). Other than benzene, there have been minor exceedances of RGs for five chemicals: arsenic, beryllium, cyanide, mercury, and copper. Arsenic and copper concentrations only exceeded once in the first round of sampling conducted in the summer of 2002, and no COCs (except benzene) exceeded RGs in the summer 2004 sampling. None of the exceedances has been large or has occurred at a consistent location. These results suggest that the soil removal and covering efforts that have occurred at the site over the last several years are effective in reducing chemical concentrations entering the marine environment from groundwater.

Shellfish Monitoring

Shellfish monitoring has been conducted as specified in the ROD for clams and crabs. Two rounds of data are available. A risk assessment was conducted on the first round of data collected in 2002 and found a slight exceedance over the target cancer risk goal in the ROD of 1×10^{-5} . The risk assessment results were 4×10^{-5} , due to ingestion of arsenic for a subsistence harvester. Sample results from the latest round of tissue sampling in 2004 found that the average arsenic concentration in clam tissue from the site was about 30 percent higher than the average arsenic concentration in clam tissue collected from Twanoh State Park. For the crab tissue samples collected in 2004, the average arsenic concentration at the site exceeded the average arsenic concentration from Twanoh Park by 4 percent. Arsenic concentrations in 2004 appear to be very similar to those found in 2002, and concentrations in both 2002 and 2004 appear to be above background arsenic concentrations collected in the reference area. The other two COC metals, antimony and vanadium, were not detected in shellfish (antimony) or were present at

background concentrations (vanadium). Three ordnance compounds total have been detected in shellfish (two in clams, one in crab). Only one ordnance compound, RDX, was detected in 2004 (in three clam tissue samples). The data are too limited to be able to analyze concentration trends for either metals or ordnance compounds.

The pilings offshore of Sites 101 and 103 were thought to be a potential source of 3,3'-dichlorobenzidine and PCP and these COCs were a potential concern in shellfish. The pilings have been removed and 3,3'-dichlorobenzidine and PCP have not been detected in shellfish. While the source of those two SVOCs is not definitively known, the remedy of pilings removal may have functioned as intended and removed the source for those two compounds.

Signs have been posted at regular intervals along Ostrich Bay to warn that shellfish harvesting is not allowed in the area.

7.1.2 Functionality of Remedy for Upland Soil Areas (Sites 101, 101-A, 103, and 110)

The remedy for the upland soil areas is functioning as designed. The fourth RAO for the site—prevention of dermal contact with or ingestion of soil containing concentrations of COCs above state cleanup levels—has been achieved by removing surface soil containing COCs above cleanup levels and by covering the subsurface soil that still contains COCs above RGs. An additional restriction was placed on land use at Site 103 of no residential development. For the areas of JPHC/NHB where subsurface COCs remain above cleanup levels, institutional controls are in place that would prevent uncontrolled digging or disturbance of any of these areas and would also prevent residential development at Site 103. The restricted areas have been clearly identified on maps and a Land Use Control Plan is being prepared concurrently with this 5-year review to ensure proper management of those areas. Base instructions are being developed to implement the Land Use Control Plan.

7.1.3 Functionality of Groundwater Remedy for Site 110

No specific remedy was implemented for the upland groundwater. Metal concentrations in groundwater at upland wells in Site 110 were to be sampled post-ROD and results re-evaluated, using new background data to assess whether concentrations really exceeded RGs. If there were no exceedances, the restrictions on the use of this groundwater for drinking could be lifted with the concurrence of EPA and Ecology. While fewer wells have been sampled than specified in the ROD, because some wells could not be located or were damaged during construction, the available results are all well below both the original RGs and the revised background concentration values. Therefore, groundwater use restrictions are not necessary for upland groundwater beneath Site 110 (outside of the Benzene Release Area; see Section 7.1.4).

7.1.4 Functionality of Remedy for Benzene Release Area

The remedial action at the Benzene Release Area, ORC injection, appears to have maximized its effectiveness in its ability to reduce benzene concentrations, and the ORC remedy does not appear to be functioning as designed. Specifically, the reductions in benzene concentrations have not been significant and, in most cases, the measured benzene concentrations are still well above the RG. Benzene concentrations in the deeper aquifer downgradient of the site and at the point of compliance (the shoreline seeps and outfalls) generally show declining concentrations, although still above the RG. However, concentrations have increased after an initial decline in some cases, and, in other cases, the decreases have not been substantial. An evaluation of the post-ORC injection groundwater monitoring data in 2002 and 2003 indicated that the groundwater monitoring system was not adequate to fully assess the impact of the ORC injection. The residual BTEX/gasoline contamination in the soil is providing a continual source of BTEX to the groundwater, which affects the efficiency of using ORC injections.

Based on the results of the quarterly monitoring and a possible explanation for the limited effectiveness of the ORC is that the residual contamination in the soil appears to be providing a continual source of BTEX to groundwater. The addition of ORC to remediate source area soils was expected to be effective only in reducing contaminants in localized permeable zones within the till. It was not known at the time of remedy implementation that groundwater beneath the Vashon Till was impacted. Assessment of the deeper groundwater quality directly beneath the source area is not possible with the current monitoring locations, because the source area wells are screened within the upper to middle portions of the Till and are representative of perched groundwater. Thus, the effect of the ORC application in reducing concentrations of benzene in the source area soil is uncertain.

7.1.5 Operation and Maintenance Costs

Operation and maintenance (O&M) costs over the first 5 years subsequent to the ROD were estimated in the ROD to be \$992,000, including the costs of the first 5-year review. The breakdown in the ROD was as follows:

- Soil O&M: \$117,000
- Groundwater O&M: \$265,000
- Marine tissue O&M: \$356,000
- Benzene Release Area O&M: \$254,000

Actual O&M costs for 2002 through 2005 are approximately \$833,000. These costs include this 5-year review, development of the Land Use Control Plan, the activities in the Benzene Release Area, and the long-term monitoring program.

7.2 CONTINUED VALIDITY OF ROD ASSUMPTIONS

This section answers the question, “Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?” Therefore, this section reviews any changes to ARARs used to establish RGs in the ROD and reviews any changes to risk assessment assumptions (exposure and toxicity) to evaluate the protectiveness of the remedy.

7.2.1 Review of Applicable or Relevant and Appropriate Requirements

In the preamble to the NCP, EPA stated that ARARs are generally “frozen” at the time of ROD signature, unless new or modified requirements call into question the protectiveness of the selected remedy. Five-year review guidance (USEPA 2001) indicates that the question of interest in developing the 5-year review is not whether a standard identified as an ARAR in the ROD has changed in the intervening period, but whether this change to a regulation calls into question the protectiveness of the remedy. If the change in the standard would be more stringent, the next stage is to evaluate and compare the old standard and the new standard and their associated risk. This comparison is done to assess whether the currently calculated risk associated with the standard identified in the ROD is still within EPA’s acceptable excess cancer risk range of 10^{-4} to 10^{-6} . If the old standard is not considered protective, a new cleanup standard may need to be adopted after the 5-year review through CERCLA’s processes for modifying a remedy.

All the ARARs identified in the ROD were reviewed for changes that could affect the assessment of whether the remedy is protective. Based on this review, it was concluded that three of the regulations listed as ARARs have changed. These regulations are the following:

- Washington State MTCA regulations
- Federal marine ambient water quality criteria
- Washington State marine surface water quality standards

The ARAR review is summarized as follows:

- MTCA cleanup levels for groundwater and surface water have changed for some of the COCs as a result of changes in the assessment of chemical toxicity (see

MTCA column on Table 7-1 and Section 7.2.2). None of these changes affects the protectiveness of the remedy.

- All the Washington State marine surface water standards for protection of aquatic life for the chemicals listed have either remained the same or been raised. Therefore, there is no impact on the protectiveness of the remedy.
- Some of the federal ambient water quality criteria for marine water for protection of aquatic life have stayed the same, some have been lowered (lead, nickel, silver, and zinc), and two (copper and mercury) have been raised. Overall, there is no impact on the protectiveness of the remedy (see further discussion in this section).

In addition to reviewing the ARARs for changes, the ROD required a re-evaluation of the RGs for metals in groundwater subsequent to the post-ROD study on background metals in groundwater, which was completed in 2001 (U.S. Navy 2001b). The revised values, based on the above regulatory changes and the new groundwater background information, are presented on Table 7-1 together with the RG values from the ROD for groundwater.

In the typical RG selection process, background concentrations are selected as the RG if background exceeds the most stringent ARAR; otherwise, the most stringent ARAR is selected. At Jackson Park, the RGs for metals were selected based on background data available at the time of the ROD. A larger, more comprehensive background data set was then generated after the ROD was signed, and the RGs for metals were re-evaluated. As a result of this evaluation, the RGs for five metals (arsenic, copper, lead, zinc, and mercury) were revised. The reasons for the changes are summarized on Table 7-2.

The revised RGs for arsenic and mercury are higher than those in the ROD, and the RG for lead is virtually the same as determined in the ROD; therefore, there are no impacts on the protectiveness of the remedy for these three metals. The revised RGs for copper and zinc are lower than those in the ROD. In the post-ROD monitoring, no concentrations of copper or zinc ever exceeded the revised RGs; therefore, there are no impacts to the protectiveness of the remedy.

7.2.2 Review of Risk Assessment Assumptions

Risk assessment assumptions were also reviewed as part of the requirement to assess protectiveness of the remedy. The two areas where changes have occurred since the ROD are toxicity values for four chemicals and the fish ingestion exposure parameter.

Toxicity Values

As part of the RG selection process in the ROD, MTCA Method B values protective of surface water exposures were selected as the RG if there were no background values and if the Method B value was the most stringent ARAR (see Table 7-1). If Method B values were to be calculated now, revisions to the toxicity criteria for three chemicals would result in different MTCA Method B values than those presented in the ROD. Toxicity values have changed for beryllium, benzene, and vinyl chloride since completion of the ROD. Therefore, MTCA Method B values were recalculated using current toxicity values and compared to the ROD RGs. The results of the recalculation and the specific toxicity changes are presented in Table 7-3 and are discussed below.

Beryllium. EPA's Integrated Risk Information System (IRIS) does not currently report an oral carcinogenic toxicity value (slope factor) for beryllium and considers the data inadequate to evaluate carcinogenicity by ingestion (USEPA 2004). The previous study that the EPA used to estimate the oral slope factor used to calculate the MTCA Method B value in the ROD ($4.3 \text{ [mg/kg-d]}^{-1}$) was based on a study now considered by EPA to be inadequate for the assessment of carcinogenicity (USEPA 2004). The chronic oral studies did not report increased incidences of tumors in rodents, but were conducted at doses that may have been too low to cause cancer effects. Despite the uncertainties in the dose range, EPA has concluded that beryllium cannot be evaluated as a carcinogen by the oral route (ingestion) and, therefore, should be evaluated as a noncarcinogen for the purposes of the MTCA Method B calculation. (Note: Inhaled beryllium is characterized as a "likely" human carcinogen as reported by EPA's IRIS [USEPA 2004].) Because MTCA Method B surface water values are protective of an ingestion pathway (eating fish), the oral pathway is the pathway of concern. If the current oral reference dose (0.002 [mg/kg-d]) is used to calculate the MTCA Method B value, the new value would be $273 \text{ }\mu\text{g/L}$. This change does not affect the protectiveness of the remedy, since the RG is considerably lower than the new MTCA Method B value. In addition, the long-term monitoring at the site's seeps and outfalls has detected beryllium infrequently and at concentrations only slightly greater than the RG.

Benzene. At the time of the ROD, the oral slope factor for benzene was not available on IRIS; therefore, the inhalation slope factor ($0.029 \text{ [mg/kg-d]}^{-1}$) was used to calculate MTCA Method B. Currently, IRIS reports an oral slope factor of $0.055 \text{ (mg/kg-d)}^{-1}$. Because MTCA Method B surface water values are protective of an ingestion pathway (eating fish impacted by the chemical), the oral slope factor should be used for the MTCA Method B surface water calculations. Ecology is now using the oral slope factor in the benzene surface water calculation (http://www.ecy.wa.gov/programs/tcp/tools/CLARC_v_3.1). Using the current oral slope factor to calculate the MTCA Method B value, results change from 43 to $22.7 \text{ }\mu\text{g/L}$. Using the

new slope factor, the cancer risk of the RG of 43 $\mu\text{g/L}$ is 2×10^{-6} , below the ROD cancer risk goal of 1×10^{-5} . Because the ROD cancer goal is still being met, the remedy designed to achieve the RG is protective, and no RG changes are recommended.

Vinyl Chloride. The oral slope factor for vinyl chloride, as reported in IRIS (USEPA 2004), has changed from 1.9 to 1.5 $(\text{mg/kg-d})^{-1}$. If the current oral slope factor is used to calculate the MTC Method B value, a slightly higher cleanup level would be calculated, changing it from 2.92 to 3.92 $\mu\text{g/L}$. This change would not influence the protectiveness of the remedy.

Exposure Parameters

An important part of the remedy for Jackson Park is the prevention of adverse human health effects from ingestion of shellfish in Ostrich Bay. There were no RGs developed for marine tissue. Instead, the ROD stated that harvesting restrictions were to be removed when health risks from ingesting shellfish at subsistence consumption levels met the RAOs. The ROD required shellfish harvesting restrictions, because the baseline risk assessment (done as part of the RI) identified possible health risks in excess of target health goals if shellfish were consumed at a subsistence level.

Subsequent to the original risk assessment, the Suquamish Tribe has conducted a study on tribal-specific fish ingestion rates (Suquamish 2000). At the time of the annual monitoring in 2002, information from this study was used (in a risk assessment conducted in 2003) to determine whether the remedy remained protective at the site. This analysis was conducted to address concerns presented by Ecology and the Suquamish Tribe. The Suquamish Tribe has "usual and accustomed" fishing rights in Ostrich Bay and, thus, Suquamish information is most applicable to subsistence harvesters in this area. If the Suquamish fish ingestion rate used in the 2003 risk assessment had been used to calculate the health risks identified in the ROD, risks would be similar (although slightly lower) than the risks identified in the original baseline risk assessment. Therefore, changes in shellfish ingestion rates do not affect the protectiveness of the remedy, and shellfish harvest restrictions required by the ROD remain in effect.

The exposure parameters used in the baseline risk assessment for subsistence harvesters were a combination of EPA default parameters and parameters obtained from peer-reviewed literature. None of these values has changed since the ROD was signed.

The EPA's recommended fish ingestion rate for a residential scenario has changed from the original risk assessment. EPA now recommends a fish ingestion rate of 17.5 g/day (USEPA 2002), in contrast to the value used in the original risk assessment of 8.6 g/day (based on Tetra

Tech 1988). The above change does not affect the protectiveness of the remedy for the following reasons:

- The shellfish harvest restrictions required by the ROD are based on subsistence, rather than residential, harvesting.
- Any actions protective of subsistence harvesters will also be protective of residential harvesters, because health risks from ingesting shellfish at a residential ingestion rate are lower than risks at a subsistence rate.

7.3 NEW INFORMATION

This section is in response to the question “Has any other information come to light that could call into question the protectiveness of the remedy?” No other information reviewed during this 5-year review, apart from what is included previously in this document, affects the protectiveness of the remedy.

7.4 TECHNICAL ASSESSMENT SUMMARY

Except for the Benzene Release Area, the remedies are functioning as designed, and progress towards meeting RAOs has been made since the completion of the remedy. The RGs established for the site indicate the remedy is still protective. The following summarizes the assessment:

- Erosion of soil into Ostrich Bay is being prevented by the shoreline stabilization work that occurred as part of the remedy.
- There are mechanisms in place to ensure that the shoreline stabilization system is inspected and properly maintained.
- Soil covers over areas containing concentrations above RGs are being maintained, and an institutional controls program is being implemented.
- The infrequent and low-magnitude exceedances of RGs at the seeps and outfalls indicate that most of the groundwater entering the Bay is in compliance with the goals of the remedy. Other than benzene, there have been minor exceedances over an RG for only five chemicals: arsenic, beryllium, cyanide, copper, and mercury. Except for benzene, there were no exceedances of RGs in the 2004 seep

and outfall sampling event. Past RG exceedances of beryllium and copper are unlikely to represent a health concern, based on ARAR and toxicity changes.

- While benzene concentrations entering the Bay still exceed the RG in the Benzene Release Area, concentrations have been generally decreasing over time. The latest monitoring data from 2004 found concentrations only slightly exceeding the RG at OF-712.
- Shellfish sampling has identified a shorter list of COCs than were identified in the ROD. No PCP or 3,3'-dichlorodibenzidine have been detected in shellfish tissue. Antimony and vanadium are either not detected, or are at background concentrations. Only three ordnance compounds were infrequently detected in shellfish tissue, and only one ordnance compound, RDX, was detected in 2004 (in three clam samples).
- Arsenic is the COC that is driving shellfish health risks, but incremental risks are only slightly above the ROD target goal.
- Groundwater restrictions in upland groundwater below the Vashon Till are no longer necessary, except in the Benzene Release Area.

**Table 7-1
 Chemical-Specific ARARs for Groundwater Sites 101, 101-A, and 103**

Chemical	Revised Background Concentrations From 2001 Study (µg/L) ^a	Chemical-Specific ARARs (µg/L)				ROD-Selected Cleanup Level (Includes Revisions Based on New Background) (µg/L)	RGs If Using Current Values (µg/L)	Remedy Protective? (Yes/No)
		WA Marine WQS ^b	Federal Marine WQC ^b	MTCA Method B (Surface Water) ^c	Federal NTR ^c			
Arsenic - total	3.71 (3.3)	36 ^d	36 ^d	0.0982	0.14	3.7	No change	Yes
Beryllium - total ^e	0.04 (NA)	NA	NA	273 (0.0793)	NA	273	No change	Yes
Copper - dissolved ^e	0.54 (58)	4.8 (2.5) ^f	4.8 (2.9) ^f	2660	NA	4.8	No change	Yes
Cyanide ^e	0	1 ^f	1 ^f	51900	220000	1	No change	Yes
Lead - dissolved ^e	0.08 (6)	8.1 (5.8) ^d	8.1 (8.5) ^d	NA	NA	6	5.8	Yes
Mercury - total	0.1 (NA)	0.025 ^d	0.94 (0.025) ^d	NA	0.15	0.1	No change	Yes
Nickel - dissolved	1.77 (NA)	8.2 (7.9)	8.2 (8.3) ^d	1100	4600	7.9	8.2	Yes
Silver - dissolved	0.04 (NA)	1.9 (1.2) ^f	1.9 (2.3) ^f	25900	NA	1.2	1.9	Yes
Thallium - total ^e	0.04 (NA)	NA	NA	1.56	6.3	1.56	No change	Yes
Zinc - dissolved ^e	2 (104)	81 (76.6) ^d	81 (86) ^d	16500	NA	81	No change	Yes
Benzene	0	NA	NA	22.7 (43)	71	43	22.7	Yes
Chlordane ^e	0	0.004 ^d	0.004 ^d	0.0013 (0.000354)	0.00059 (0.0022)	0.0022	0.00059	Yes
1,1-Dichloroethene	0	NA	NA	1.93	3.2	1.93	No change	Yes
Total petroleum hydrocarbon ^e	0	NA	NA	1,000 ^g	NA	1000	No change	Yes
Trichloroethene	0	NA	NA	55.6	81	55.6	No change	Yes
Vinyl chloride	0	NA	NA	3.69 (2.92)	525	2.92	3.69	Yes

Table 7-1 (Continued)
Chemical-Specific ARARs for Groundwater Sites 101, 101-A, and 103

^aBackground concentrations in this column were revised from the original ROD values based on U.S. Navy 2001b. Original ROD values are in parentheses.

^bWashington State water quality standard (WQS), based on protection of aquatic life. Original ROD values are in parentheses.

^cMTCA Method B groundwater cleanup level and National Toxics Rule (NTR) values are based on protection of human health from human consumption of organisms from adjacent surface water. Original ROD values are in parentheses.

^dBased on chronic exposure.

^eThese chemicals were found in inland groundwater, but not at the seeps and outfalls, which are the conditional point of compliance.

^fBased on acute exposure.

^gMTCA Method A groundwater cleanup level used.

Notes:

ARARs - applicable or relevant and appropriate requirement

µg/L - microgram per liter

MTCA - Model Toxics Control Act

NA - not available

RG - remediation goal

ROD - Record of Decision

WQC - water quality criteria

**Table 7-2
 Remediation Goal Revisions for Metals in Groundwater Based
 on New Background Information**

Metal	Remediation Goal in ROD		Remediation Goal Revision From New Background Data	
	Concentration (µg/L)	Comment	Concentration (µg/L)	Comment
Arsenic	3.3	Based on pre-ROD background information	3.7	New background value
Copper (dissolved)	58	Based on pre-ROD background information	4.8	Most stringent ARAR, since new background is lower than ARAR value
Lead (dissolved)	6	Based on pre-ROD background information	5.8	Most stringent ARAR, since new background is lower than ARAR value
Mercury	0.025	Most stringent ARAR	0.1	Based on practical quantitation limit of analytical methodology and no detections in background wells
Zinc (dissolved)	104	Based on pre-ROD background information	81	Most stringent ARAR, since new background is lower than ARAR value

Notes:
 ARAR - applicable or relevant and appropriate requirement
 µg/L - microgram per liter
 ROD - Record of Decision

**Table 7-3
 Changes in Toxicity Values**

Chemical	MTCA Method B Value in ROD Selected as RG (µg/L)	MTCA Method B Value for Surface Water, Based on New Toxicity (µg/L)	Reason for Revision
Beryllium	0.0793	273	See text for further discussion.
Benzene	43	22.7	Previously, an inhalation slope factor of $0.029 \text{ (mg/kg-d)}^{-1}$ was used; currently, an oral slope factor of $0.055 \text{ (mg/kg-d)}^{-1}$ is available.
Vinyl chloride	2.92	3.96	Oral slope factor changed from 1.9 to $1.5 \text{ (mg/kg-d)}^{-1}$.

Notes:

µg/L - microgram per liter
 mg/kg-d - milligram per kilogram per day
 MTCA - Model Toxics Control Act
 ROD - Record of Decision

8.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

This section presents the recommendations and follow-up actions identified as a result of the 5-year review process. Table 8-1 summarizes the recommendations.

8.1 LONG-TERM MONITORING AT SEEPS AND OUTFALLS ALONG OSTRICH BAY

Long-term monitoring at seeps and outfalls should be continued. The ROD indicated that the specifics of the monitoring program could be modified, based on the results, with concurrence from Ecology and EPA. No changes to the current monitoring program are recommended.

8.2 DRINKING WATER RESTRICTIONS FOR UPLAND GROUNDWATER

Based on the long-term monitoring results, groundwater use restrictions can be removed for the groundwater present below the Vashon Till in the upland portions of the site, except in the Benzene Release Area. With the removal of the restrictions, long-term monitoring can be discontinued at the Upland Wells.

8.3 SHELLFISH MONITORING

The ROD specified that after the 5-year review, the specific numbers and types of shellfish samples, sampling frequency, and analytical methods could be adjusted. The shellfish sampling was to terminate when human health risks associated with antimony, arsenic, vanadium, 3,3'-dichlorobenzidine, PCP, and ordnance compounds in shellfish declined to a 1×10^{-5} excess cancer risk and an HI of 1, or when these risks are reduced to a risk consistent with consumption of reference area shellfish. Shellfish monitoring should be continued at the site for arsenic, with a reduced sampling cycle of once every 5 years. This is because the risk assessment results for the 2002 monitoring data still exceeded the cancer RAO due to arsenic, even when the reference area concentrations are considered, and the arsenic results for 2004 appear very similar to 2002. Ordnance compounds have been detected infrequently at low levels. Although ordnance compounds did not represent a health risk based on the risk analysis of the 2002 data, there is insufficient data to analyze any trends, and analysis of shellfish tissue for ordnance compounds should also be continued. However, analysis of tissue for antimony, vanadium, 3,3'-dichlorobenzidine, and PCP should be discontinued on the basis of the monitoring results to date.

8.4 BENZENE RELEASE AREA

As noted in Section 7.1.4, the remedial action at the Benzene Release Area (ORC injection) appears to have maximized its effectiveness in its ability to reduce benzene concentrations, and concentrations at the site still exceed the RG.

The Navy's contractor is currently completing a work plan to implement a supplemental field investigation to further evaluate the vertical and horizontal extent of benzene contamination in soil and groundwater in the Benzene Release Area. The field investigation is based on recommendations made at the completion of post-ORC injection monitoring in 2002 and 2003. The additional data will be used to assess future remedial actions for the Benzene Release Area. The field investigation is expected to begin in June 2005 with a baseline groundwater sampling program to assess current site conditions. A drilling program to install additional monitoring wells and borings will be conducted in August and September 2005. Upon completion of the drilling program, groundwater monitoring will be conducted at previous and newly installed groundwater monitoring locations and at selected seep locations on the shoreline. The data collected from the investigation will be compiled in a report and submitted as a draft final for government agency review in March 2006.

**Table 8-1
 Recommendations and Follow-Up Actions**

Recommendation/ Follow-Up Action	Party Responsible	Oversight Agency	Milestone Date	Follow-Up Action: Affects Protectiveness	
				Current	Future
Implement enhancements to the remedy for the Benzene Release Area based on the results of the upcoming additional investigations.	U.S. Navy	EPA	December 2006	Yes	Yes
Implement the Land Use Control Plan being prepared concurrently with this 5-year review.	U.S. Navy	EPA	December 2005	No	No
Prepare institutional control base instructions	U.S. Navy	EPA	December 2005	No	No
Continue long-term monitoring at seeps and outfalls.	U.S. Navy	EPA	Ongoing	No	No
Continue shellfish monitoring with a revised analyte list and a reduced sampling frequency—once prior to each 5-year review.	U.S. Navy	EPA	December 2008	No	No
Discontinue use restrictions and monitoring for upland groundwater at Site 110.	U.S. Navy	EPA	December 2005	No	No

Note:
 EPA – U.S. Environmental Protection Agency

9.0 CERTIFICATION OF PROTECTIVENESS

The remedies implemented for OU 1 at JPHC/NHB are protective both in the short and long terms, with the exception of the Benzene Release Area. The remedy in the Benzene Release Area is considered protective in the short term because institutional controls are currently in place, and, therefore, there is no exposure to COCs in groundwater. Follow-up actions are necessary to address long-term protectiveness because COCs in soil remain a source of contamination to groundwater. Further investigation of groundwater impacts and the extent of residual source material in soil is planned for the summer of 2005. Additional actions will be recommended based on this further investigation. These additional actions will be selected to achieve long-term protectiveness in the Benzene Release Area.

The remedies for OU 2 and OU 3 will be selected based on their protectiveness of human health and the environment. The selected remedies are therefore expected to be protective, once selected and implemented.

FINAL FIRST FIVE-YEAR REVIEW OF RECORD OF DECISION
Jackson Park Housing Complex and Naval Hospital Bremerton
Naval Facilities Engineering Command Northwest
Contract No. N44255-02-D-2008
Delivery Order 0044

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10.0 NEXT REVIEW

The next 5-year review is tentatively scheduled for 2010.

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APPENDIX A

Site Inspection Forms

I. SITE INFORMATION			
Site name: <i>Jackson Park Housing Complex/Naval Hospital Bremerton</i>	Date of inspection: <i>September 9, 2004</i>		
Location and Region: <i>Bremerton, WA, Region 10</i>	EPA ID: <i>WA3170090044</i>		
Agency, office, or company leading the five-year review: <i>US Navy, URS Corporation</i>	Weather/temperature: <i>clouds/partly sunny 68 °F</i>		
Remedy Includes: (Check all that apply) <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <input checked="" type="checkbox"/> Landfill cover/containment <input type="checkbox"/> Access controls <input checked="" type="checkbox"/> Institutional controls <input type="checkbox"/> Groundwater pump and treatment <input type="checkbox"/> Surface water collection and treatment <input checked="" type="checkbox"/> Other <i>Soil removal; shoreline stabilization; groundwater, seep, and shellfish monitoring; oxygen-releasing compound remediation</i> </td> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> Monitored natural attenuation <input type="checkbox"/> Groundwater containment <input type="checkbox"/> Vertical barrier walls </td> </tr> </table>		<input checked="" type="checkbox"/> Landfill cover/containment <input type="checkbox"/> Access controls <input checked="" type="checkbox"/> Institutional controls <input type="checkbox"/> Groundwater pump and treatment <input type="checkbox"/> Surface water collection and treatment <input checked="" type="checkbox"/> Other <i>Soil removal; shoreline stabilization; groundwater, seep, and shellfish monitoring; oxygen-releasing compound remediation</i>	<input type="checkbox"/> Monitored natural attenuation <input type="checkbox"/> Groundwater containment <input type="checkbox"/> Vertical barrier walls
<input checked="" type="checkbox"/> Landfill cover/containment <input type="checkbox"/> Access controls <input checked="" type="checkbox"/> Institutional controls <input type="checkbox"/> Groundwater pump and treatment <input type="checkbox"/> Surface water collection and treatment <input checked="" type="checkbox"/> Other <i>Soil removal; shoreline stabilization; groundwater, seep, and shellfish monitoring; oxygen-releasing compound remediation</i>	<input type="checkbox"/> Monitored natural attenuation <input type="checkbox"/> Groundwater containment <input type="checkbox"/> Vertical barrier walls		
Attachments: <input checked="" type="checkbox"/> Inspection team roster in body of report <input checked="" type="checkbox"/> Site map in body of report			
II. INTERVIEWS (Check all that apply)			
1. Navy Staff			
Contact: <i>Karan Holmes, Remedial Project Manager, 09/12/04</i> Problems; suggestions; <input checked="" type="checkbox"/> Report attached: _____			
Contact: <i>Cindy O'Hare, Supervisor Environmental Engineer, 09/12/04</i> Problems; suggestions; <input checked="" type="checkbox"/> Report attached: _____			
Contact: <i>Mike Hardiman, Environmental Engineer, 09/12/04</i> Problems; suggestions; <input checked="" type="checkbox"/> Report attached: _____			
Contact: <i>Robert Mitchell, Environmental Specialist, 09/12/04</i> Problems; suggestions; <input checked="" type="checkbox"/> Report attached: _____			

2.	<p>O&M/LTM Contractor: <i>Bernie Wong, 09/12/04</i></p> <p>Interviewed <input type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. _____ Problems, suggestions; <input type="checkbox"/> Report attached: <i>Did not choose to respond.</i></p>												
3.	<p>Regulatory and Tribal authorities and response agencies</p> <p>Agency: <i>Department of Ecology</i> Contact: <i>Chris Mauer, Project Manager, 09/12/04</i></p> <p>Problems; suggestions; <input checked="" type="checkbox"/> Report attached: _____</p> <p>Agency: <i>Suquamish Tribe</i> Contact: <i>Denice Taylor, Environmental Scientist, 09/12/04</i></p> <p>Problems; suggestions; <input checked="" type="checkbox"/> Report attached: _____</p> <p>Agency: <i>U.S. EPA</i> Contact: <i>Harry Craig, Project Manager, 09/12/04</i></p> <p>Problems; suggestions; <input checked="" type="checkbox"/> Report attached: <i>Did not choose to respond</i></p>												
4.	<p>Members of the public</p> <p>Contact: <i>Field Ryan, RAB Member, 09/12/04</i></p> <p>Problems; suggestions; <input checked="" type="checkbox"/> Report attached: <i>Did not choose to respond</i></p>												
5.	<p>Other interviews (optional): None.</p>												
III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)													
1.	<p>O&M Records</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 45%;">G O&M manual</td> <td style="width: 20%;">G Readily available</td> <td style="width: 20%;">G Up to date</td> <td style="width: 15%;"><input checked="" type="checkbox"/> N/A</td> </tr> <tr> <td>G As-built drawings</td> <td><input checked="" type="checkbox"/> Readily available</td> <td>G Up to date</td> <td>G N/A</td> </tr> <tr> <td>G Maintenance logs</td> <td><input checked="" type="checkbox"/> Readily available</td> <td>G Up to date</td> <td>G N/A</td> </tr> </table> <p>Remarks: <i>No documents are located at the site, all applicable documents were located as part of the administrative record review in the NAVFAC NW offices.</i></p>	G O&M manual	G Readily available	G Up to date	<input checked="" type="checkbox"/> N/A	G As-built drawings	<input checked="" type="checkbox"/> Readily available	G Up to date	G N/A	G Maintenance logs	<input checked="" type="checkbox"/> Readily available	G Up to date	G N/A
G O&M manual	G Readily available	G Up to date	<input checked="" type="checkbox"/> N/A										
G As-built drawings	<input checked="" type="checkbox"/> Readily available	G Up to date	G N/A										
G Maintenance logs	<input checked="" type="checkbox"/> Readily available	G Up to date	G N/A										
2.	<p>Institutional Controls Inspection Records <input checked="" type="checkbox"/> Readily available G Up to date</p> <p>Remarks: <i>LUC Plan in production, not yet implemented. No inspections to date. However, the first maintenance inspection of the shoreline occurred in spring of 2004 according to the maintenance plan developed in 2003. The 2004 maintenance report was readily available in the NAVFAC NW offices.</i></p>												

B. Upland Areas (Sites 110 and 101-A) (1: Bldg 100/Bldg 101; 2: Root Court Cul-de-Sac; 3: Root Court/S. Shore Fill Areas; 4: Construction Debris Landfill)	
1.	<p>Are asphalt covers being maintained in front of Buildings 100 and 101? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Remarks: <i>Some minor alligator cracking was observed in the asphalt cover in front of Building 100. Also at Building 100, there was evidence of seam seals, possibly from utility cuts.</i></p>
2.	<p>Are soil and vegetative covers maintained/ healthy at the Root Court Cul-de-Sac? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Remarks: _____</p>
3.	<p>Any digging without dig permit in any of the upland areas? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Remarks: _____</p>
4.	<p>Are there any signs of erosion or exposed soils in the Root Court or Construction Landfill areas? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Remarks: _____</p>
5.	<p>Groundwater wells installed? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Remarks: <i>No new wells installed; only those needed for remedy monitoring.</i></p>
C. Shoreline (Site 101 and shoreline areas of Site 103)	
1.	<p>Are the rock shelf areas and stairways being maintained? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Remarks: <i>There is some minor erosion beneath the middle set of steps to the beach at Site 101</i></p>
2.	<p>Is the seawall being maintained? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Remarks: _____</p>
3.	<p>Is the armor stone revetment and associated stairways being maintained? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Remarks: <i>There were a few stones from the revetment that had been washed down to the beach but the large majority of stone was intact.</i></p>
4.	<p>Is the storm drainage system (catch basin, berm, swale, French drain, riprap slash pads) functioning to prevent erosion of the beaches? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Remarks: _____</p>
5.	<p>Are shellfish harvesting restriction signs present? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Remarks: <i>Several signs were broken, scheduled to be replaced.</i></p>

D. Institutional Controls (ICs)			
1.	Implementation and enforcement		
	Site conditions imply ICs properly implemented	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
	Site conditions imply ICs being fully enforced	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
	Type of monitoring (e.g., self-reporting, drive by): <i>self reporting</i>		
	Frequency: <i>Institutional Control Program not yet implemented; the Land Use Control Plan will be published concurrently with the five-year review. Shoreline maintenance inspections began in April 2004, and the plan is that they will be conducted semiannually.</i>		
	Responsible party _____		
	Contact _____		
	Name	Title	Date
			Phone no.
	Reporting is up-to-date	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Specific requirements in decision documents have been met	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Violations have been reported	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Other problems or suggestions; G Report attached: <i>Land Use Control Plan not yet adopted – in progress; however, substantive requirements of institutional controls in the ROD are functional.</i>		
2.	Adequacy	<input checked="" type="checkbox"/> ICs are adequate	<input type="checkbox"/> ICs are inadequate
	Remarks:	_____	
VI. REMEDY COMPONENTS			
A. Areas of Soil Cover and Asphalt Paving (Sites 103, 110, and 101-A)			
1.	Settlement (Low spots)	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Settlement not evident
	Areal extent _____	Depth _____	
	Remarks: _____		
2.	Cracks	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Cracking not evident
	Lengths _____	Widths _____	Depths _____
	Remarks: <i>Minor alligator cracking observed in front of Building 100 in Area 110</i>		
3.	Erosion	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Erosion not evident
	Areal extent _____	Depth _____	
	Remarks: _____		
4.	Holes	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Holes not evident
	Areal extent _____	Depth _____	
	Remarks: _____		
5.	Vegetative Cover	<input checked="" type="checkbox"/> Grass	<input checked="" type="checkbox"/> Cover properly established
	<input checked="" type="checkbox"/> No signs of stress		
	G Trees/Shrubs (indicate size and locations on a diagram)		
	Remarks: _____		

6.	Wet Areas/Water Damage	<input checked="" type="checkbox"/> Wet areas/water damage not evident	
	G Wet areas	G Location shown on site map	Areal extent _____
	G Ponding	G Location shown on site map	Areal extent _____
	G Seeps	G Location shown on site map	Areal extent _____
	G Soft subgrade	G Location shown on site map	Areal extent _____
	Remarks: _____		
B. Shoreline Stabilization			
1.	Seawall & Revetment	G Location shown on site map	<input checked="" type="checkbox"/> Erosion not evident
	Areal extent _____	Depth _____	
	Remarks: <i>One exception is some erosion underneath the middle beach steps at Site 101.</i>		
2.	Vegetative Growth	<input checked="" type="checkbox"/> Location shown on site map	G N/A
	G Vegetation is healthy and preventing erosion		
	Areal extent _____	Type _____	
	Remarks: <i>The only area of vegetative stress was a small area in Site 101 above the seawall at the bottom of Dowell Road. Reportedly, the vegetation never really got established here. The bark cover in the area was intact.</i>		
3.	Beach Maintenance (pocket beach area)	G Location shown on site map	
	<input checked="" type="checkbox"/> Erosion not evident		
	Areal extent _____	Depth _____	
	Remarks: _____		
4.	Storm Drainage System	G Location shown on site map	<input checked="" type="checkbox"/> Functioning G N/A
	Remarks: _____		
C. Groundwater, Seep, and Shellfish Monitoring			
1.	Monitoring Wells		
	<input checked="" type="checkbox"/> Properly secured/locked	G Functioning	G Routinely sampled
	G All required wells located	G Needs Maintenance	G Good condition
	Remarks: _____		
2.	Monitoring		
	Types of monitoring being conducted:		
	<input checked="" type="checkbox"/> Groundwater (Site 110)	<input checked="" type="checkbox"/> Seeps (shoreline areas)	<input checked="" type="checkbox"/> Shellfish
	Frequency: <i>Site 110 monitoring is complete (occurred twice). Seeps are being monitored annually and shellfish monitoring has occurred twice since the completion of the remedy.</i>		
	Remarks: _____		
3.	Data Trends		
	Describe results and trends: <i>See narrative of five-year review.</i>		

E. Other Remedy Components		
1. Soil excavations	<input checked="" type="checkbox"/> Completed	G Not Completed
2. ORC injected into soils at Benzene Release Area	<input checked="" type="checkbox"/> Completed	G Not Completed
3. Elwood Point pilings removed	<input checked="" type="checkbox"/> Completed	G Not Completed
VII. OVERALL OBSERVATIONS		
A. Implementation of the Remedy		
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). <i>See narrative of five-year review.</i>		
B. Adequacy of O&M		
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. <i>See narrative of five-year review. The O&M program is functioning as designed, except the Institutional Controls required as part of the Land Use Control Plan are currently under development. However, the substantive requirements of the ROD are being met.</i>		
C. Early Indicators of Potential Remedy Problems		
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. <i>See narrative of five-year review, no cost/scope issues</i>		
D. Opportunities for Optimization		
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. <i>See narrative of five-year review. The Benzene Release Area requires further investigation leading to remedy enhancement.</i>		

APPENDIX B

Interview Responses

INTERVIEW RECORD FOR FIRST FIVE-YEAR REVIEW
August 2000 through September 2005
Type 1 Interview – Navy Personnel
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted: Mike Hardiman
Title: Environmental Engineer
Organization: Naval Base Kitsap – Jackson Park
Telephone: 360-476-6082
E-mail: michael.hardiman@navy.mil
Address: 120 S. Dewey St., Bldg. 1013-1, Bremerton, WA 98314

Contact made by: Laura Scheffler
Response type: E-mail
Date: October 18, 2004

Summary of Communication

You are not obligated to answer every question. If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate “none” after “response.”

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (ROD) for OU 1, the implementation of the remedies at this OU, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since August 2000.

Response: I became involved with Installation Restoration (IR) at Jackson Park as the station representative in February 2003. Association with the site came after the selected remedies were in place, but have reviewed the ROD and related documents through involvement with this project and other IR work at Jackson Park.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy for the four sites that comprise OU1? For reference, the remedy components included:
 - Covering of surface soils with concentrations above remedial goals in non-residential areas;
 - Excavation of surface soils in backyards where concentrations exceeded remedial goals;
 - Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;

- Shoreline stabilization measures;
- Removal of old pilings at Elwood Point
- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/ Land use restrictions

Response: The selected remedies for impacted soil on the site all appear to be a success in preventing human expose to COC's and erosion of COC's to the marine environment. The treated wood piles in Ostrich Bay may have been a source of pentachlorophenol (PCP) in crab and clam tissue which was identified as a potential carcinogenic human health risk on the site. Removal of the piles would have eliminated this potential source in the area and this can be confirmed through the results of the continuing long-term monitoring program. It is anticipated that the long-term monitoring program will continue to demonstrate the effectiveness of the remedies. The institutional controls/land use restrictions have been adhered to since the signing of the OU 1 ROD. The controls at Jackson Park have been further strengthened by the ongoing munitions investigation (OU 3) with additional restrictions on digging due to the threat of buried munitions. With regard to the benzene release area please see Response 7.

3. Are you aware of any violations of the institutional controls requirements at any of the sites within OU 1 that could impact the protectiveness of this component of the remedies (e.g., unauthorized excavation, unauthorized use of groundwater)?

Response: I am not aware of any violations.

4. To the best of your knowledge, are regular inspections of the institutional controls remedy components being conducted and documented?

Response: The first documented inspection has recently taken place per the Final Inspection and Maintenance Plan for OU 1 (dated 3/14/03). Currently in preparation is a Land Use Control (LUC) Plan that will address the institutional controls at both commands related to OU 1. Upon completion, the LUC and the implementing instructions will further ensure that the institutional controls are being adhered to. Up to this point the intent of the institutional controls were met through other means such as the "no-digging" policy for residents and the environmental review process for projects.

5. To the best of your knowledge, has the on-going environmental monitoring performed at OU 1 since August 2000 been sufficiently thorough and frequent to meet the goals of the ROD? Have the monitoring data been timely and of acceptable quality?

Response: Environmental sampling has been conducted as stated in the ROD and has met the goals of ROD. The data has been timely and of acceptable quality. The inspections of the remedies had initially lagged other monitoring but it is anticipated that it will occur on a more regular cycle now per the Final Inspection and Maintenance Plan.

6. Do you know of any significant operation and maintenance difficulties with the shoreline stabilization components of the OU 1 remedy that could have impacted the protectiveness of this component of the remedy?

Response: Sections of the vegetation planted along the shoreline have shown signs of stress and/or mortality. The remedy is still protective and no significant erosion has been observed. Future actions should include measures to improve upon this as this may increase the potential for erosion.

7. What is your overall impression of the effectiveness of the on-going groundwater treatment (by oxygen-releasing chemicals) in the benzene release area?

Response: The treatment with the oxygen-releasing compound (ORC) initially appeared to be successful in treating contaminated groundwater and decreases in concentrations of contaminants were noted. Subsequent monitoring revealed that a source of contaminants was still present and apparently unaffected by the ORC. Further investigation is necessary and the Navy will pursue this in the near future.

8. Are you aware of any community concerns regarding implementation of the remedy at OU 1? If so, please give details.

Response: There is a restoration advisory board (RAB) for the Jackson Park IR work but community involvement has declined appreciably in the last several years. Several recent RAB's and related community meetings have been nearly devoid of community members. As such, I am not aware of any community concerns related to OU 1.

9. Do you have any overall comments, concerns, or suggestions regarding the effectiveness of the remedies in protecting human health and the environment at Jackson Park Housing Complex?

Response: No.

INTERVIEW RECORD FOR FIRST FIVE-YEAR REVIEW
August 2000 through September 2005
Type 1 Interview – Navy Personnel
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted: Karan Holmes
Title: Remedial Project Manager
Organization: EFA NW
Telephone: 360-396-0080
E-mail: karan.holmes@navy.mil
Address: Engineering Field Activity, Northwest
19917 7th Ave NE
Poulsbo, WA 98370

Contact made by: Laura Scheffler
Response type: E-mail
Date: October 20, 2004

Summary of Communication

You are not obligated to answer every question. If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate “none” after “response.”

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (ROD) for OU 1, the implementation of the remedies at this OU, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since August 2000.

Response: I am very familiar with JPCH/NHB OU1. I have been involved with JPHC/NHB for approximately 10 years – from RI/FS phase to present. Initial involvement was as Naval Hospital Bremerton Environmental Manager - 1994 to 2001. From 2001 to present I have been a Remedial Project Manager (RPM) at Jackson Park. As JPHC/NHB RPM I oversaw remedial construction for OU1, initiated Long Term Monitoring (LTM), and Benzene Seep Monitoring. Currently I manage the OU3T RI.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy for the four sites that comprise OU1? For reference, the remedy components included:
 - a. Covering of surface soils with concentrations above remedial goals in non-residential areas;

- b. Excavation of surface soils in backyards where concentrations exceeded remedial goals;
- c. Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
- d. Shoreline stabilization measures;
- e. Removal of old pilings at Elwood Point
- f. Long-term monitoring (groundwater, seeps, shellfish)
- g. Institutional controls/ Land use restrictions

Response:

- a. *Surface soil cover – Design and installation of the surface soil cover was effective as planned during the ROD and Remedial Design. General long-term effectiveness is good. There is room for improvement in the area of facility maintenance of the surface soil cover, particularly maintenance/replacement of vegetation and repair of vandalism caused damage.*
- b. *Excavation of backyard surface soils - Overall effectiveness has been excellent. Contaminated soil was removed and replaced with soil that was verified “clean.”*
- c. *Benzene release area – Limited contaminated soil removal was performed. Overall effectiveness of benzene seep remedial action has been poor. Benzene levels at the point of compliance have increased since remedial construction was completed. Additional remedial action is needed to reduce the benzene level at point of compliance.*
- d. *Shoreline stabilization – Overall effectiveness of the shoreline stabilization system is very good. Contamination has been contained as planned, landscaping in vegetated shelf has performed better than anticipated. Redistribution of smaller rock from the stabilization area to beach by residents has been a problem since installation and continues. This does not diminish overall effectiveness of the shoreline stabilization but does have the potential to affect shellfish populations.*
- e. *Piling removal – Remedy effectiveness due to piling removal has been excellent.*
- f. *Long-term monitoring – Long-term monitoring has been effective for seeps and outfalls. LTM of monitoring wells has been challenging due to destruction of two of the four on-site wells selected for monitoring. Monitoring at the two remaining wells indicates the remedy is effective.*

g. *Institutional controls/Land use restrictions – Overall effectiveness of institutional controls is questionable. Neither facility has a formal institutional control plan or policy to address the OUI remedy.*

3. Are you aware of any violations of the institutional controls requirements at any of the sites within OU 1 that could impact the protectiveness of this component of the remedies (e.g., unauthorized excavation, unauthorized use of groundwater)?

Response: No, I am not aware of any institutional control requirement violations. There are well enforced excavation procedures at the site (via a Dig Permit Procedures) to ensure compliance with the intent of excavation institutional controls. Drinking water is provided by the city and groundwater investigations to date indicate there is insufficient groundwater at the site to develop productive drinking water wells. However, since the institutional controls have not been formalized in a plan there is more potential for a violation during this time of significant regional change.

4. To the best of your knowledge, are regular inspections of the institutional controls remedy components being conducted and documented?

Response: No, regular inspections of the institutional control remedy component are not being conducted. Institutional controls have not been formally documented.

5. To the best of your knowledge, has the on-going environmental monitoring performed at OU 1 since August 2000 been sufficiently thorough and frequent to meet the goals of the ROD? Have the monitoring data been timely and of acceptable quality?

Response: Yes. Long term monitoring has been conducted in accordance with the ROD. The monitoring has been timely and of acceptable quality.

6. Do you know of any significant operation and maintenance difficulties with the shoreline stabilization components of the OU 1 remedy that could have impacted the protectiveness of this component of the remedy?

Response: No. There have not been any significant operation and maintenance problems/difficulties with the shoreline stabilization component. Disturbance of the small placement rock continues to be a problem, likely caused by housing residents.

7. What is your overall impression of the effectiveness of the on-going groundwater treatment (by oxygen-releasing chemicals) in the benzene release area?

Response: Overall effectiveness of the oxygen releasing compound remedy has been poor. Benzene levels have increased since installation of the selected remedy in several wells. Monitoring indicates benzene releases above the compliance level at the point of compliance (Ostrich Bay). Navy is planning to additional efforts to identify the benzene source. Limited staffing and funding have hampered these efforts.

8. Are you aware of any community concerns regarding implementation of the remedy at OU 1? If so, please give details.

Response: No. Community remains supportive of the Navy's efforts at the site.

9. Do you have any overall comments, concerns, or suggestions regarding the effectiveness of the remedies in protecting human health and the environment at Jackson Park Housing Complex?

Response: No overall comments.

INTERVIEW RECORD FOR FIRST FIVE-YEAR REVIEW
August 2000 through September 2005
Type 2 Interview – Regulatory Agency
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted: Chris Maurer
Title: Project Manager
Organization: Washington Department of Ecology
Telephone: 360-407-7223
E-mail: cmau461@ecy.wa.gov
Address: P. O. Box 47600
Lacey, WA 98504

Contact made by: Laura Scheffler
Response type: E-mail
Date: October 5, 2004

Summary of Communication

You are not obligated to answer every question. If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate “none” after “response.”

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (ROD) for OU 1, the implementation of the remedies at this OU, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since August 2000.

Response: Have been the State regulator at this site since mid-2000. Was involved in the final negotiations for the Record of Decision for OU – 1. Receive copies of all monitoring reports.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the remedy components included:
 - Covering of surface soils with concentrations above remedial goals in non-residential areas;
 - Excavation of surface soils in backyards where concentrations exceeded remedial goals;
 - Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
 - Shoreline stabilization measures;

- Removal of old pilings at Elwood Point
- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/ Land use restrictions

Response: The above bulleted remedies implemented to date appear to be achieving their goal. Evaluation of institutional controls is not possible because the Navy has not submitted an institutional controls plan establishing institutional controls for review and approval by the State.

3. Do you feel well informed about the remediation activities and progress at Jackson Park Housing Complex/Naval Hospital Bremerton? Please elaborate.

Response: Meet regularly with the Navy to review the progress of remediation at the site.

4. To the best of your knowledge, since August 2000 have there been any new scientific findings that relate to potential site risks and that might call into question the protectiveness of the remedy?

Response: On-going monitoring of the benzene release has shown that the current remediation method (use of oxygen-releasing compound) is a failure. A new treatment method needs to be proposed by the Navy and executed. For OU – 2, no evaluation of remedy protectiveness is possible as no remedy sufficiently protective and acceptable to the State has been proposed by the Navy. For OU – 3, no evaluation of remedy protectiveness is possible as the remedial investigation is still in progress and no remedy has been proposed.

5. What is your overall impression of the on-going effectiveness of the institutional controls components of the remedy?

Response: No evaluation of the effectiveness of institutional controls is possible as a plan establishing institutional controls for OU – 1 has not been submitted to the State for review and approval.

6. What is your overall impression of the effectiveness of the on-going groundwater treatment (by oxygen-releasing chemicals) in the benzene release area?

Response: On-going monitoring of the benzene release has shown that the current remediation method (use of oxygen-releasing compound) is a failure. A new treatment method needs to be proposed by the Navy and executed.

7. Since August 2000, have there been any complaints, violations, or other incidents related to Jackson Park Housing Complex/Naval Hospital Bremerton installation restoration issues that required a response by your office? If so, please provide details of the events and results of the responses.

Response: Continued recovery of munitions and explosives of concern at the site, especially in or near the shoreline causes ongoing concern. These concerns have been reduced through discussions with the Navy.

8. To the best of your knowledge, has the on-going program of environmental monitoring at Jackson Park Housing Complex/Naval Hospital Bremerton been sufficiently thorough and frequent to meet the goals of the ROD?

Response: For OU – 1, yes, with the exception of the benzene seep area. Additional monitoring wells may be needed to better understand the hydrogeology of this area. The Navy must continue monitoring the vegetation and groundcover for vigorous growth and erosion hazard and immediately replace any vegetation showing injury or signs of poor health. Likewise, for areas covered with fish mix, prompt repair of any damage or loss is essential. For OU – 2, no, more detailed monitoring of sediments for metals and munitions constituents is necessary.

9. Are you aware of any community concerns regarding implementation of the remedy at Jackson Park Housing Complex/Naval Hospital Bremerton? If so, please give details.

Response: No, community interest both within and without the site is low. This may change if significant quantities of ordnance or ordnance related materials are found during the OU – 3 remedial investigation.

10. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the cleanup measures implemented so far in protecting human health and the environment at Jackson Park Housing Complex/Naval Hospital Bremerton?

Response: Since the current method has proven ineffective, an alternative treatment method for the benzene seep area must be selected and promptly executed. In view of the high population density of the site, and the presence of children, selection of anomalies for excavation in OU – 3T must be extensive and conservative. In view of the large quantities of ordnance found in the waters of Ostrich Bay, significant funding and aggressive investigation of the Bay for OU – 3M is required. Close monitoring of Bay sediments to verify possible recovery of the sediments through natural attenuation is necessary.

INTERVIEW RECORD FOR FIRST FIVE-YEAR REVIEW
August 2000 through September 2005
Type 1 Interview – Navy Personnel
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted: Robert Mitchell
Title: Environmental Specialist (Contract)
Organization: Naval Hospital Bremerton
Telephone: 360-475-5019
E-mail: mitchellr@pnw.med.navy.mil
Address: Naval Hospital Bremerton
Code 014E
1 Boone Rd
Bremerton, WA 98312
Contact made by: Laura Scheffler
Response type: E-mail
Date: October 21, 2004

Summary of Communication

You are not obligated to answer every question. If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate “none” after “response.”

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (ROD) for OU 1, the implementation of the remedies at this OU, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since August 2000.

Response: I am familiar with JPCH/NHB OUI. I have been involved with NHB OUI for the past year. I attend monthly meeting with EFA personnel as needed .

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy for the four sites that comprise OU1? For reference, the remedy components included:
 - a. Covering of surface soils with concentrations above remedial goals in non-residential areas;
 - b. Excavation of surface soils in backyards where concentrations exceeded remedial goals;
 - c. Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
 - d. Shoreline stabilization measures;

- e. Removal of old pilings at Elwood Point
- f. Long-term monitoring (groundwater, seeps, shellfish)
- g. Institutional controls/ Land use restrictions

Response:

- a. *Surface soil cover – Design and installation of the surface soil cover was effective as planned during the ROD and Remedial Design. General long-term effectiveness is good. There is room for improvement in the area of facility maintenance of the surface soil cover, particularly maintenance/replacement of vegetation and repair of vandalism caused damage.*
- b. *Excavation of backyard surface soils - Overall effectiveness has been excellent. Contaminated soil was removed and replaced with soil that was verified “clean.”*
- c. *Benzene release area – Limited contaminated soil removal was performed. Overall effectiveness of benzene seep remedial action has been poor. Benzene levels at the point of compliance have increased since remedial construction was completed. Additional remedial action is needed to reduce the benzene level at point of compliance.*
- d. *Shoreline stabilization – Overall effectiveness of the shoreline stabilization system is very good. Contamination has been contained as planned, landscaping in vegetated shelf has performed better than anticipated. Redistribution of smaller rock from the stabilization area to beach by residents has been a problem since installation and continues. This does not diminish overall effectiveness of the shoreline stabilization but does have the potential to affect shellfish populations.*
- e. *Piling removal – Remedy effectiveness due to piling removal has been excellent.*
- f. *Long-term monitoring – Long-term monitoring has been effective for seeps and outfalls. LTM of monitoring wells has been challenging due to destruction of two of the four on-site wells selected for monitoring. Monitoring at the two remaining wells indicates the remedy is effective.*
- g. *Institutional controls/Land use restrictions – Overall effectiveness of institutional controls is questionable. Neither facility has a formal institutional control plan or policy to address the OUIremedy.*

3. Are you aware of any violations of the institutional controls requirements at any of the sites within OU 1 that could impact the protectiveness of this component of the remedies (e.g., unauthorized excavation, unauthorized use of groundwater)?

Response: No, I am not aware of any institutional control requirement violations. There are excavation procedures at the site (via a Dig Permit Procedures) to ensure compliance with the intent of excavation institutional controls. Drinking water is provided by the city and groundwater investigations to date indicate there is insufficient groundwater at the site to develop productive drinking water wells.

4. To the best of your knowledge, are regular inspections of the institutional controls remedy components being conducted and documented?

Response: No, regular inspections of the institutional control remedy component are not being conducted. Institutional controls have not been formally documented.

5. To the best of your knowledge, has the on-going environmental monitoring performed at OU 1 since August 2000 been sufficiently thorough and frequent to meet the goals of the ROD? Have the monitoring data been timely and of acceptable quality?

Response: Yes. Long term monitoring has been conducted in accordance with the ROD.

6. Do you know of any significant operation and maintenance difficulties with the shoreline stabilization components of the OU 1 remedy that could have impacted the protectiveness of this component of the remedy?

Response: None.

7. What is your overall impression of the effectiveness of the on-going groundwater treatment (by oxygen-releasing chemicals) in the benzene release area?

Response: Overall effectiveness of the oxygen releasing compound remedy has been poor. Benzene levels have increased since installation of the selected remedy in several wells. Monitoring indicates benzene releases above the compliance level at the point of compliance (Ostrich Bay). Navy is planning to additional efforts to identify the benzene source. Limited staffing and funding have hampered these efforts. (Based on info from EFANW).

8. Are you aware of any community concerns regarding implementation of the remedy at OU 1? If so, please give details.

Response: None.

9. Do you have any overall comments, concerns, or suggestions regarding the effectiveness of the remedies in protecting human health and the environment at Jackson Park Housing Complex?

Response: None

INTERVIEW RECORD FOR FIRST FIVE-YEAR REVIEW
August 2000 through September 2005
Type 1 Interview – Navy Personnel
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted: Cindy L. O’Hare
Title: Supervisor Environmental Engineer
Organization: EFA NW
Telephone: 360-396-0014
E-mail: cindy.o’hare@navy.mil
Address: 19917 7th Ave NE Poulsbo WA 98370

Contact made by: Laura Scheffler
Response type: E-mail
Date: October 4, 2004

Summary of Communication

You are not obligated to answer every question. If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate “none” after “response.”

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Records of Decision (ROD) for OU 1, the implementation of the remedies at this OU, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since August 2000.

Response: I was the RPM for Jackson Park during the end of the RI, the Proposed Plan, and ROD, and initial RD. In early 2001, I became the lead for another site, and in the summer of 2001 I became the supervisor of the RPM/RPMs involved with Jackson Park. I have been in the direct chain since. I am fairly familiar with Jackson Park, although I have not reviewed any reports for a few years.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy for the four sites that comprise OU1? For reference, the remedy components included:
 - Covering of surface soils with concentrations above remedial goals in non-residential areas;
 - Excavation of surface soils in backyards where concentrations exceeded remedial goals;

- Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
- Shoreline stabilization measures;
- Removal of old pilings at Elwood Point
- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/ Land use restrictions

Response: I believe the remedy is effective for it's purpose. The intent was address threats to human health, for sediments and terrestrial, and environment, for terrestrial. The intent was met. However, the benzene release area still requires work, although I am not aware of any present direct threat. The Land Use Control plan is not in place yet, but we know of no failures. The RPMs keep a close eye on the sites.

3. Are you aware of any violations of the institutional controls requirements at any of the sites within OU 1 that could impact the protectiveness of this component of the remedies (e.g., unauthorized excavation, unauthorized use of groundwater)?

Response: No.

4. To the best of your knowledge, are regular inspections of the institutional controls remedy components being conducted and documented?

Response: Yes. Although the O&M work did not start until early 2004.

5. To the best of your knowledge, has the on-going environmental monitoring performed at OU 1 since August 2000 been sufficiently thorough and frequent to meet the goals of the ROD? Have the monitoring data been timely and of acceptable quality?

Response: As far as I know. I have not personally reviewed the documents.

6. Do you know of any significant operation and maintenance difficulties with the shoreline stabilization components of the OU 1 remedy that could have impacted the protectiveness of this component of the remedy?

Response: No. We have a few small rocks that have fallen, but they do not hurt the overall stability.

7. What is your overall impression of the effectiveness of the on-going groundwater treatment (by oxygen-releasing chemicals) in the benzene release area?

Response: ORC depletes after a time, and the design called for reinstallation after about 6 months. So, it is not unexpected that the site still needs work. We have found more contaminant than any study prior to the ROD identified.

8. Are you aware of any community concerns regarding implementation of the remedy at OU 1? If so, please give details.

Response: The Suquamish tribe wishes to shellfish in Ostrich Bay and are deeply concerned about the reopening of the beds.

9. Do you have any overall comments, concerns, or suggestions regarding the effectiveness of the remedies in protecting human health and the environment at Jackson Park Housing Complex?

Response: No.

INTERVIEW RECORD FOR FIRST FIVE-YEAR REVIEW
August 2000 through September 2005
Type 3 Interview – Community Member
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted: Field Ryan
Title: RAB Community Center
Organization: Restoration Advisory Board
Telephone: 360-377-6782
E-mail:
Address: 2727 Marine Drive
Bremerton, WA 98312

Contact made by: Laura Scheffler
Response type: Mail
Date: October 13, 2004

Summary of Communication

You are not obligated to answer every question. If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate “none” after “response.”

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Record of Decision (RODs) for OU 1, the implementation of the remedies at the four areas of OU 1, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since August 2000.

Response: 5 years on RAB, I've had a stroke and don't remember much.

2. What is your overall impression of the on-going protectiveness of the remedies at Jackson Park Housing Complex/Naval Hospital Bremerton?

Response: Good

3. Do you feel well informed about the remediation activities and progress at Jackson Park Housing Complex/Naval Hospital Bremerton? Please elaborate.

Response: Good

4. What effects on the community have you observed as a result of on-going remedy implementation.

Response: Good

5. Are you aware of any community concerns regarding implementation of the remedies? If so, please give details.

Response: Good

6. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the cleanup measures implemented so far in protecting human health and the environment at Jackson Park Housing Complex/Naval Hospital Bremerton?

Response: Good

INTERVIEW RECORD FOR FIRST FIVE-YEAR REVIEW
August 2000 through September 2005
Type 5 Interview – Tribal Authority
Jackson Park Housing Complex/Naval Hospital Bremerton
Bremerton, Washington

Individual Contacted: Denice Taylor
Title: Environmental Scientist
Organization: Suquamish Tribe
Telephone: 360-394-8449
E-mail: dtaylor@suquamish.nsn.us
Address: PO Box 498
15838 Sandy Hook Road
Suquamish, WA 98392-0498

Contact made by: Laura Scheffler
Response type: E-mail
Date: October 11, 2004

Summary of Communication

You are not obligated to answer every question. If you are not familiar with the topic of a particular question, or have no information or opinion to offer, please indicate “none” after “response.”

1. Please describe your degree of familiarity with the Jackson Park Housing Complex/Naval Hospital Bremerton, the Record of Decision (ROD) for OU 1, the implementation of the remedies at this OU, and the monitoring and maintenance that has taken place since implementation of the remedies. Please also describe your involvement since August 2000.

Response: I have been involved with the JPHC site as the Suquamish Tribe's representative in the remediation process since October 2002. (Prior to that, Scott Pozarycki and Rich Brooks represented the Tribe's interests and priorities.)

I am familiar with the CERCLA administrative record for OU 1 and am actively involved in reviewing long-term monitoring results and assisting with Section 106 consultations involving cultural resources associated with the JPHC.

2. What is your overall impression of the on-going effectiveness of the components of the OU 1 remedy? For reference, the remedy components included:

- Covering of surface soils with concentrations above remedial goals in non-residential areas;
- Excavation of surface soils in backyards where concentrations exceeded remedial goals;
- Excavation of petroleum-impacted soils where concentrations were above remedial goals and the impacted soil was above the seasonal high-water table in the benzene release area;
- Shoreline stabilization measures;
- Removal of old pilings at Elwood Point
- Long-term monitoring (groundwater, seeps, shellfish)
- Institutional controls/ Land use restrictions

Response: Overall, the majority of remedy components appear to have been implemented as intended in the ROD. However, the effectiveness/protectiveness of several components is questionable. The benzene groundwater remedy (treatment with oxygen-releasing chemicals) did not function as intended and it is unclear if source control has been achieved. Long-term monitoring results also indicate that the RAO for groundwater (protect ecological receptors in the marine environment and human health by attaining compliance with water quality standards for marine surface water at the point of groundwater discharge) is not being achieved.

In addition, it appears that regular inspection and maintenance of some remedy components either is not occurring or is not being reported. Without this information, it is difficult to evaluate the effectiveness of the shoreline stabilization and habitat measures.

3. Do you feel well informed about the remediation activities and progress at Jackson Park Housing Complex/Naval Hospital Bremerton? Please elaborate.

Response: I feel informed about the remediation activities and progress related to OU 1. The interagency project management team receives periodic updates concerning site activities, budgets and schedules. At times, however, there is a lag in communications regarding ongoing or continuing efforts such as the benzene groundwater studies and cultural resource issues.

4. What effects have on-going remedy implementation had on the Tribe and the surrounding community?

Response: The JPHC is located in an area that is culturally important to the Suquamish Tribe and it is located within the Tribe's usual and accustomed (U&A) harvest area. The on-going remedy implementation is seen as an important element in restoring and preserving cultural, terrestrial and aquatic resources. It is anticipated that, in time, Tribal members will again be able to exercise treaty-reserved rights in this significant area.

5. Are you aware of any Tribal or other community concerns regarding the Tribal archaeological site at Elwood Point? If so, please give details.

Response: The Suquamish Tribe and the Navy worked together to formulate a cultural resources management plan for OU 1 remedial actions and the JPHC. As the survey was completed, there were significant delays in releasing survey results to the Tribe. The Tribe and the Navy have yet to engage in meaningful consultation regarding the survey findings, recommendation and necessary steps for future applications at the JPHC in general and Elwood Point in particular. Discussion to resolve these issues needs to be initiated.

6. Are you aware of any Tribal or other community concerns regarding the restrictions on shellfish harvesting? If so, please give details.

Response: As previously mentioned, the Suquamish Tribe has treaty-reserved rights within the U&A, which includes the JPHC. It is understood that restrictions on shellfish harvesting are necessary to protect human health in the short-term. However, restrictions are not acceptable as a long-term or permanent remedy. Evaluations and discussions regarding potential risks associated with shellfish consumption should focus on reducing contaminant concentrations to levels that are protective of ecological receptors and subsistence level consumers, rather than limiting access. Such evaluations and discussions should actively involve the Tribe, include the 2000 Suquamish consumption survey data, and incorporate relevant information from ongoing marine investigations and surveys in Ostrich Bay.

7. Are you aware of any other Tribal or other community concerns regarding implementation of the remedy? If so, please give details.

Response: Although the JPHC operating units are administratively separate, the effectiveness of the OU 1 remediation is intricately connected to the marine environment and ongoing efforts in Ostrich Bay. More of an effort should be made to integrate data and actions between the various operating units.

8. Do you have any other comments, concerns, or suggestions regarding the effectiveness of the cleanup measures implemented so far in protecting human health and the environment at Jackson Park Housing Complex/Naval Hospital Bremerton?

Response: I have no other comments at this time. Thank you for the opportunity to participate in this review.