U.S. Environmental Protection Agency

Second Five-Year Review Report

for the

Wyckoff/Eagle Harbor Superfund Site

Bainbridge Island, Washington

September 26, 2007

US Army Corps of Engineers®
Seattle District

Second Five-Year Review Report

for the

Wyckoff/Eagle Harbor Superfund Site
Bainbridge Island,
Kitsap County, Washington

September 26, 2007

PREPARED BY:
U.S. Army Corps of Engineers, Seattle District
Seattle, Washington

PREPARED FOR:
U.S. Environmental Protection Agency, Region 10
Seattle, Washington

Approved by:

Dan Opalski, Director
Environmental Cleanup Office
U.S. EPA, Region 10

9/26/07
Date

Table of Contents

Figures

Tables

Appendices

List of Acronyms and Abbreviations

ABC	Association of Bainbridge Communities
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
ASTDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BIJAC	Bainbridge Island Japanese American Community
BMP	Best Management Practice
BNA	base/neutral and acid extractable
Cal EPA	California Environmental Protection Agency
CDF	confined disposal facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
CLARC	Cleanup Levels and Risk Calculations
COC	chemical of concern
CY	cubic yard(s)
DAF	dissolved air flotation
DNAPL	dense non-aqueous phase liquid
DOH	Washington State Department of Health
EBS	exposure barrier system
Ecology	Washington State Department of Ecology
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
ERA	Expedited Response Action
ESD	Explanation of Significant Differences
FS	Feasibility Study
FYR	Five-Year Review
GAC	granular activated carbon
gpm	gallons per minute
HPAH	high-molecular-weight polycyclic aromatic hydrocarbon
HPO	Hydrous/Pyrolysis/Oxidation
ITTAP	In-situ Thermal Technologies Advisory Panel
IRIS	Integrated Risk Information System
LTM	long-term monitoring
LNAPL	light non-aqueous phase liquid
LPAH	low-molecular-weight polycyclic aromatic hydrocarbon

MCL	Maximum Contaminant Level
MCUL	Minimum Cleanup Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MLLW	mean lower low water
MTCA	Model Toxics Control Act
NA	not applicable
NAPL	non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRRB	National Remedy Review Board
O&M	operation and maintenance
OMMP	Operations, Maintenance, and Monitoring Plan
OMI	Operations and Maintenance International
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCC	Pollution Control Commission
PCP	pentachlorophenol
PM	Project Manager
ppb	parts per billion
ppm	parts per million
PRP	potentially responsible party
PSEP	Puget Sound Estuary Program
PSR	Pacific Sound Resources
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RPM	Remedial Project Manager
SCI	Site Condition Index
SIM	selected ion monitoring
SMS	Sediment Management Standards
SQS	Sediment Quality Standards
SSC	Superfund State Contract
SVOC	semivolatile organic compounds
SVPS	sediment vertical profiling system
TBC	To Be Considered criteria

TSDF	treatment, storage and disposal facility
UAO	Unilateral Administrative Order
UCLM	upper confidence limit on the mean
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
USC	United States Code
USGS	U.S. Geological Survey
VOC	volatile organic compound
WAC	Washington Administrative Code
WDFW	Washington State Department of Fish and Wildlife
WQS	Water Quality Standards
WSDOT	Washington State Department of Transportation

Executive Summary

The Wyckoff/Eagle Harbor Superfund Site is located on the east side of Bainbridge Island, Kitsap County, in central Puget Sound, Washington. The site includes the former Wyckoff wood-treating facility, contaminated sediments in adjacent Eagle Harbor, and other upland sources of contaminants including a former shipyard. The site is divided into four Operable Units (OUs): the West Harbor OU, the East Harbor OU, and the Soil and Groundwater OUs of the former Wyckoff facility.

Remedies for each OU include the following:

West Harbor OU – This OU includes a former shipyard and is currently the site of the Washington State Department of Transportation (WSDOT) ferry maintenance facility. Remedies identified for this OU in the 1992 Record of Decision (ROD) included evaluation and control of upland sources of contamination, excavation and upland disposal of mercury-contaminated sediments, and placement of a clean sediment cap over areas of concern. The September 1992 ROD for the West Harbor OU was amended in December 1995 to include construction of nearshore fill and a confined disposal facility in intertidal areas adjacent to the former shipyard property to contain contaminated sediments, and implementation of contaminant source control measures at the former shipyard property to prevent soil contaminants from entering Eagle Harbor through groundwater seeps or surface water runoff.

East Harbor OU – In 1993 and 1994, the U.S. Environmental Protection Agency (EPA) placed clean sediments over 54 acres of highly contaminated subtidal sediments as part of a non-time-critical removal action. The September 1994 ROD for the East Harbor OU called for maintaining the existing sediment cap and capping remaining subtidal areas of concern, monitoring the success of natural recovery in intertidal areas, enhancing existing institutional controls to reduce public exposure to contaminated fish and shellfish, long-term monitoring of the sediment cap, and demolishing in-water structures.

In the fall/winter of 2007, EPA will construct an exposure barrier system (EBS) on the West Beach to extend the existing subtidal cap into the intertidal sediments from approximately −10 feet MLLW to +10 feet MLLW. This action is necessary to address residual polycyclic aromatic hydrocarbon (PAH) contamination recently discovered in the subtidal and intertidal zone west of the Former Process Area. This will be documented in an Explanation of Significant Differences (ESD) from the 1994 ROD.

Soil and Groundwater OUs – An Interim ROD was issued in September 1994 for the Groundwater OU, which focused on the actions necessary to contain contaminated groundwater at the Wyckoff Site: i.e., replace the existing treatment plant, maintain and upgrade the extraction system, install a physical barrier, and seal onsite drinking water wells that could act as conduits for the migration of contaminants to deeper aquifers.

In February 2000, EPA issued a ROD for the Soil and Groundwater OUs that conditionally selected thermal remediation (i.e., steam injection) as the cleanup remedy. This remedy included constructing a sheet pile wall around the highly contaminated Former Process Area of the Wyckoff Site, conducting a pilot study to test the effectiveness of thermal remediation, consolidating contaminated soil from outside to within the Former Process Area, monitoring the lower-aquifer groundwater, and implementing institutional controls. The ROD stated that if the thermal remediation pilot study did not meet performance goals, the contingency of site containment would be implemented. The containment remedy would consist of a surface soil cap over the Former Process Area, containment of contaminated groundwater and non-aqueous phase liquid (NAPL) with a sheet pile wall and a groundwater extraction system, construction of a replacement treatment plant for ongoing treatment of contaminated groundwater, shoreline protection for the sheet pile wall, and long-term monitoring of hydraulic containment and contaminant distribution and movement.

This is the second Five-Year Review Report that has been prepared for the Wyckoff/Eagle Harbor Superfund Site; the first report was completed in September 2002 and triggered the initiation of a second Five-Year Review period. This second Five-Year Review found that where the remedial actions have been implemented for each OU, the work was done in accordance with the requirements of the Records of Decision. Immediate threats have been addressed. EPA will continue to monitor the remedies that are in place to confirm continued protectiveness.

For the East Harbor OU, construction of the EBS on the West Beach is scheduled to be completed by March 2008; institutional controls (e.g., signage) are currently in place to restrict access to the area.

For the Soil and Groundwater OUs, the soil and upper-aquifer groundwater within the Former Process Area and the East Beach intertidal area remain contaminated and will continue to be addressed by EPA.

Outstanding issues and follow-up actions to be addressed to ensure ongoing protectiveness of human health and the environment are discussed in the Five-Year Review Summary Form that follows.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name ***(from WasteLAN)*****: Wyckoff/Eagle Harbor Superfund Site**		
EPA ID ***(from WasteLAN)*****: WAD009248295**		
Region: 10	**State: WA**	**City/County: Bainbridge Island, 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 ____________________		
Author name: U.S. Army Corps of Engineers (USACE), Seattle District		
Author title: NA	**Author affiliation: NA**	
Review period:** 3 / 01 / 2007 to 9 / 15 / 2007		
Date(s) of site inspection: 5 / 31 / 2007 and 6 / 13 / 2007		
Type of review: √ Post-SARA • Pre-SARA • NPL-Removal only • Non-NPL Remedial Action Site • NPL State/Tribe-lead • Regional Discretion		
Review number: • 1 (first) √ 2 (second) • 3 (third) • Other (specify) __________		

Five-Year Review Summary Form, cont'd.

Triggering action:

• Actual RA Onsite Construction at OU #____ • Actual RA Start at OU#____

• Construction Completion √ Previous Five-Year Review Report

• Other (specify)

Triggering action date *(from WasteLAN)*: 9 / 26 / 2002
Due date *(five years after triggering action date)*: 9 / 26 / 2007

* ["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, cont'd.

Issues:

Soil and Groundwater Operable Units

- Ongoing operation and maintenance of the groundwater extraction and treatment system and institutional controls are addressing immediate threats. Contamination within the Former Process Area is currently stable and conditions are protective of human health and the environment.
- EPA plans to issue an Explanation of Significant Differences (ESD) for the contingency containment remedy pending the outcome of discussions with regulatory and governmental stakeholders.

East Harbor Operable Unit

- Construction of an exposure barrier system (EBS) in the fall/winter of 2007 will address residual contamination in the West Beach intertidal and subtidal areas.
- Monitoring of residual contamination in the North Shoal and East Beach areas will continue.
- Existing ROD criteria will be re-evaluated as necessary for: (1) new information relating to potential risks of tribal consumption of fish and shellfish in accordance with the EPA Framework (August 2007); and (2) effects of sediment contamination on juvenile fish and fish eggs based on recent and expected scientific information.

Recommendations and Follow-up Actions:

- At the request of EPA, the Agency for Toxic Substances and Disease Registry (ATSDR) is conducting a health consultation for all four Operable Units at the Wyckoff/Eagle Harbor Superfund Site to evaluate any potential public health issues related to real or possible human exposure to toxic materials.

Soil and Groundwater Operable Units

- Advance additional soil borings in the southeastern portion of the Former Process Area to further characterize aquitard conditions.
- Install additional monitoring wells in the Former Process Area.
- Document final remedy selection and proceed with implementation.

East Harbor Operable Unit

- Construct the EBS on the West Beach per the ESD.
- Evaluate additional potential response actions in the North Shoal and East Beach areas as appropriate based on continued monitoring.
- Evaluate potential risks of tribal consumption of fish and shellfish in accordance with the EPA Framework (August 2007) and the effects of sediment contamination on fish.

Protectiveness Statement(s):

West Harbor Operable Unit

- The remedies have been implemented and are achieving the ROD objectives and Applicable or Relevant and Appropriate Requirements (ARARs). Institutional controls are effective in controlling access to the upland areas, and fish and shellfish advisories and regulations are currently in place to prevent the ingestion of contaminated fish and shellfish.

Soil and Groundwater Operable Units

- The final soil and groundwater remedy for the Former Process Area is expected to be documented in 2008. The remedy is expected to be protective of human health and the environment and to comply with ARARs upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through operation of the groundwater extraction and treatment system, the sheet pile wall to prevent the lateral movement of contamination, and institutional controls to prevent exposure to contaminated soil and groundwater.

East Harbor Operable Unit

- Phases 1-3 of the subtidal and intertidal cap have been implemented and are protective of human health and the environment. The remedy for residual contamination in the West Beach intertidal area is expected to be protective of human health and the environment upon completion and, in the interim, institutional controls are in place to limit exposure.
- Areas of residual contamination in the North Shoal and East Beach areas are posted to restrict public access. Fish and shellfish advisories and regulations are currently in place to prevent the ingestion of contaminated fish and shellfish.

1. Introduction

1.1 Purpose of the Five-Year Review

The purpose of a Five-Year Review is to determine whether the remedy at a site is protective of human health and the environment. This review is required because hazardous substances, pollutants, or contaminants remain at the Wyckoff/Eagle Harbor Superfund Site above levels that allow for unlimited use and unrestricted exposure. This report describes the Five-Year Review methods, results, and conclusions, and presents recommendations to address issues found during the review process at the Wyckoff/Eagle Harbor Superfund Site.

1.2 Authority for Conducting the Five-Year Review

The U.S. Environmental Protection Agency (EPA) conducted this Five-Year Review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states:

> *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.*

EPA interpreted this requirement further in the NCP. 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

1.3 Who Conducted the Five-Year Review

EPA Region 10 conducted this Five-Year Review of the remedial actions implemented at the Wyckoff/Eagle Harbor Superfund Site. This review was conducted for the entire site from March through September 2007. The U.S. Army Corps of Engineers (USACE) provided support to EPA in the data analysis and evaluation of remedy protectiveness for this Five-Year Review. USACE also conducted site inspections on behalf of EPA.

1.4 Review Status

This is the second Five-Year Review for the Wyckoff/Eagle Harbor Superfund Site. The triggering action for this review was the first Five-Year Review completed in September 2002. This second review was initiated in March 2007 and completed in September 2007.

2. Site Chronology

Event	Date
The Pollution Control Commission (PCC) reported direct discharge of oily material from the wood-treating facility to Puget Sound; oil was observed on the beach adjacent to the facility.	December 1952
EPA began investigating the property due to reports of oil observed on the beach adjacent to the Wyckoff property.	1971
EPA and the Washington State Department of Ecology (Ecology) reported oil seepage to Eagle Harbor, and required the Wyckoff Company to take immediate action to determine the source and reduce or eliminate seepage.	April 1972
The U.S. Coast Guard issued a Notice of Violation for oil discharged from the facility to Puget Sound.	May 1975
The National Oceanic and Atmospheric Administration (NOAA) advised EPA and Ecology that samples of sediments, fish, and shellfish from Eagle Harbor contained elevated levels of polycyclic aromatic hydrocarbons (PAHs) in both sediments and biota.	March 1984
EPA issued a Unilateral Administrative Order (UAO) requiring the Wyckoff Company to conduct environmental investigation activities under the Resource Conservation and Recovery Act (RCRA) Section 3013 (42 United States Code [USC] §6924), and Ecology issued an Order requiring immediate action to control stormwater runoff and the seepage of contaminants. Data collected at the time revealed the presence of significant soil and groundwater contamination.	August 1984
The Wyckoff/Eagle Harbor Superfund Site was proposed for listing on the National Priorities List (NPL).	September 1985
NOAA completed a study relating the presence of polycyclic aromatic hydrocarbons (PAHs) in sediment to the high rate of liver lesions in English sole from Eagle Harbor.	1985
The Wyckoff Company entered into an Administrative Order on Consent (AOC) with EPA for further investigation of the wood treatment facility.	March 1987
The Wyckoff/Eagle Harbor Superfund Site was added to the NPL.	July 1987
Under an AOC, the Wyckoff Company agreed to conduct an Expedited Response Action (ERA). The ERA, intended to minimize releases of oil and contaminated groundwater to Eagle Harbor, called for a groundwater extraction and treatment system and other source control measures.	July 1988
The Wyckoff Company ceased wood-preserving operations.	December 1988

Event	Date
A Remedial Investigation (RI) for Eagle Harbor was completed.	November 1989
A groundwater extraction and treatment system began operation at selected wells.	January 1990
EPA issued a UAO requiring the Wyckoff Company (now renamed as Pacific Sound Resources, Inc.) to continue the ERA with enhancements. The UAO called for increased groundwater extraction and treatment rates, improved system monitoring, and removal of sludge stored or buried at the Wyckoff facility.	June 1991
A Feasibility Study (FS) for Eagle Harbor was completed.	November 1991
EPA conducted a time-critical removal action at the Wyckoff facility: Removed approximately 29,000 tons of creosote sludges; disposed of 100,000 gallons of contaminated oils; disposed of 430 cubic yards of asbestos; installed 300 feet of steel sheetpiling; repaired and constructed 150 feet of bulkhead; and recycled 660 long tons of steel from retorts, tanks, and other onsite steel.	June 1992 - April 1994
A Record of Decision (ROD) was signed for the West Harbor OU. The selected remedy called for: (1) evaluation and control of upland sources of contamination; (2) excavation and upland disposal of mercury-contaminated sediments; and (3) placement of a clean sediment cap over areas of concern.	September 1992
EPA placed approximately 209,000 cubic meters of clean sediment materials over a 54-acre area of contaminated sediments in Eagle Harbor.	September 1993 - March 1994
EPA assumed responsibility for operation and maintenance (O&M) of the groundwater extraction and treatment system because Pacific Sound Resources, Inc. was financially unable to do so.	November 1993
An AOC for Remedial Design for the West Harbor OU was issued to PACCAR Inc., the Washington State Department of Transportation (WSDOT), and Bainbridge Marine Services.	November 1993
A time-critical removal action was conducted at the groundwater extraction system and treatment plant to repair/replace failing equipment, upgrade system parts, and clean out system units.	May - December 1994
Pacific Sound Resources, Inc., and their principals settled their CERCLA liability with EPA and the federal and tribal natural resource trustees in a Consent Decree.	August 1994
A focused RI/FS was completed for the Groundwater OU.	July 1994

Event	Date
EPA issued an Interim ROD for the Groundwater OU, which included the following elements: (1) replace the existing treatment plant; (2) evaluate, maintain, and upgrade the existing extraction system; (3) install a physical barrier, i.e., a slurry wall to prevent further releases of contaminants to Eagle Harbor and Puget Sound; and (4) seal onsite wells.	September 1994
EPA completed the ROD for the East Harbor OU, which included the following elements: (1) monitor and maintain the existing sediment cap, and install additional capping in remaining subtidal areas of concern; (2) monitor the success of natural recovery in intertidal areas; (3) enhance existing institutional controls to reduce public exposure to contaminated fish and shellfish; and (4) demolish in-water structures.	September 1994
EPA signed a Superfund State Contract (SSC) with Ecology for the Groundwater OU Interim Remedial Action.	November 1994
RI field investigations for the Soil and Groundwater OUs were conducted.	1994 - 1995
EPA sealed and abandoned 12 onsite wells, including two deep drinking water wells, because of concerns that they could provide conduits for the migration of contaminants to the deep aquifers.	January - June 1995
Seven original extraction wells were abandoned and replaced by eight new groundwater extraction wells. Additional treatment plant upgrades included piping replacement, carbon handling, and installation of a dewatering press.	June - December 1995
An Amendment to the ROD for the West Harbor OU (September 1992) was issued. The amendment included the following changes to the 1992 ROD: (1) construction of a nearshore fill and confined disposal facility (CDF) in intertidal areas adjacent to the former shipyard property, with hotspot sediments to be placed inside the CDF and capped with clean material and asphalt; and (2) implementation of contaminant source control measures at the former shipyard property to prevent soil contaminants from entering Eagle Harbor through groundwater seeps or surface water runoff.	December 1995
A non-time-critical removal action was conducted in the Former Process Area. Site structures were demolished, and debris was removed and disposed of offsite.	January - June 1996
West Harbor OU potentially responsible parties (PRPs) constructed the remedy at the old shipyard in accordance with the December 1995 ROD Amendment. Upland construction included: (1) soil stabilization of two upland hotspot areas; (2) installation of a tidal barrier system adjacent to the landfill located in the northwest corner of the upland area; (3) installation of a cutoff drainage system along the northern boundary of the site to intercept and cut off surface and shallow subsurface water run-on; and (4) installation of an asphalt-concrete cap across the former Bainbridge Marine Services upland. Sediment remedial actions included: (1) removal, treatment, and offsite disposal of sediments (those that exceeded the Dangerous Waste [DW] criteria); (2) removal and disposal in an onsite	March - December 1997

Event	Date
CDF of hotspot sediments containing more than 5 milligrams per kilogram (mg/kg) total mercury; (3) backfilling of sediment dredge areas to pre-existing grade elevations; (4) placement of a thick cap (1 meter) over sediments containing >2.1 mg/kg mercury; and (5) placement of a thin cap (15 centimeters) over sediments exceeding chemical or biological cleanup standards. In addition, new aquatic habitat was constructed to mitigate the loss of 0.9 acres from remedial construction. This new habitat included enhancing the face of the CDF berm face and the surface of the tidal flow barrier and sediment cap with gravel/cobble layers.	
EPA issued a Water Quality Certification for the West Harbor OU remedial work.	April 1997
West Harbor OU PRPs provided the Suquamish Tribe with $110,000 for clam enhancements and other restoration projects performed by the Tribe.	Summer 1997
West Harbor OU PRPs constructed a 2-acre Schel-chélb Estuary at the south shore of Bainbridge Island (the “South Bainbridge Estuarine Wetland and Stream Restoration Site”). Planting occurred during February through late Spring 1998.	Summer 1997 - Spring 1998
Removal of upland subsurface structures, such as process piping, utility lines, foundations, concrete pads, and asphaltic concrete, was completed at the Wyckoff/Eagle Harbor Superfund Site.	November 1997
EPA issued a Proposed Plan for the Soil and Groundwater OUs which preferred containment as the cleanup strategy for soil and groundwater.	November 1997
Design for a replacement groundwater treatment plant was completed. The plant was not constructed pending a final decision regarding the Groundwater OU remedy.	July 1998
Long-term O&M associated with the containment strategy were of concern to Ecology. EPA evaluated thermal technologies for possible application at the Wyckoff Site, conducting laboratory studies, meeting several times with the In-situ Thermal Technologies Advisory Panel (ITTAP), and evaluating the results of various other thermal technologies studies and site demonstrations.	1998 - 1999
EPA presented the results of the thermal technologies evaluation activities and proposed a new remedy for the removal of contaminants in soil and groundwater at the Wyckoff Site to the National Remedy Review Board (NRRB).	July 1998
West Harbor OU PRPs established a 0.6-acre eelgrass planting site immediately west of the West Harbor OU CDF and cap.	September - October 1998
A Focused Feasibility Study Comparative Analysis of Containment and Thermal Technologies was completed.	April 1999

Event	Date
West Harbor OU PRPs repaired a 3-feet-deep by 2-feet-wide by 5-feet-long depression that had developed adjacent to the CDF on the shoreline edge of the asphalt-concrete cap during March and April 1999.	June 1999
Conceptual design for thermal remediation of the Soil and Groundwater OUs was completed.	September 1999
EPA issued a second Proposed Plan for the Soil and Groundwater OUs. This Proposed Plan replaced the November 1997 Proposed Plan and presented a change in the cleanup strategy. EPA's preferred remedy in this second plan (now the selected cleanup remedy) focused on an innovative thermal remediation technology, called steam injection, to actively remove contaminants from the soil and groundwater.	September 1999
Removal of the West Dock (in the East Harbor OU) was completed.	December 1999
EPA issued the ROD for the Wyckoff Soil and Groundwater OUs, conditionally selecting steam injection as the cleanup remedy. Components of this remedy included: (1) constructing a sheet pile wall around the highly contaminated zone of the Former Process Area; (2) conducting a pilot study to test the applicability and effectiveness of steam injection; (3) consolidating hotspots from the Former Log Storage/Peeler Area to the Former Process Area; (4) monitoring the lower-aquifer groundwater; and (5) implementing institutional controls.	February 2000
EPA and Ecology signed a Superfund State Contract (SSC) for the Soil and Groundwater OUs.	May 2000
The following construction activities were completed: installation of over 1,800 lineal feet of sheet pile containment wall around the Former Process Area; installation of 530 lineal feet of sheet pile wall within a 1-acre area of the site for the steam injection pilot study; creation of 2 acres of habitat beach to mitigate for habitat loss resulting from construction of the outer sheet pile wall; and extension of the existing sediment cap by an additional 15 acres.	February 2001
The following construction activities were completed: installation of a vapor cap over the thermal remediation pilot study area, all 16 injection wells, seven extraction wells, and over 600 thermal monitoring devices; boiler building, and construction of an onsite water well for boiler feed water; removal of an additional 10,000 cubic yards [CY] of contaminated soil (20,000 CY of contaminated soil were removed during habitat beach construction) to complete cleanup of the Former Log Storage/Peeler Area; and completion of capping in Eagle Harbor -- more materials were placed, extending out several hundred feet from the Wyckoff Site to form a gently sloping beach which connects the habitat beach to the west with existing intertidal areas to the east.	February 2002

Event	Date
The following construction activities were completed: modifications to the existing groundwater treatment plant for treatment of new waste streams extracted from the thermal remediation pilot study area; installation of a boiler, water softening equipment, heat exchangers, a thermal oxidizer, a compressor, injection and extraction pumps, associated conveyance pumps and piping, and other pilot system equipment in the boiler building and within the pilot area; and startup of all new equipment.	September 2002
The First Five-Year Review Report for the Wyckoff/Eagle Harbor Superfund Site was completed.	September 26, 2002
The thermal remediation pilot study was conducted.	October 2002 – April 2003
An upgradient cutoff wall soil and groundwater investigation was completed.	September 2004
An engineering evaluation for thermal and containment alternatives was completed.	April 2005
A soil investigation of the south hillside was conducted. The purpose of the investigation was to assess potential contamination on the hillside adjacent to the Former Process Area in anticipation of the City of Bainbridge Island's purchase of the property.	October 2005
Groundwater investigations – including annual groundwater sampling and semi-annual groundwater level measurements – were conducted and are still ongoing.	2004 to present
An exposure assessment for Eagle Harbor surface water was completed.	December 2005
An additional tidal barrier was constructed between the CDF and the adjacent estuary at the West Harbor OU. The barrier was required because monitoring of seeps emanating from the initial tidal barrier contained elevated levels of metals.	August 2006
The Thermal Remediation Pilot Study Summary Report was completed.	October 2006
An investigation into the nature and extent of sediment contamination along the West Beach was conducted. This investigation identified an area of residual PAH contamination along the lower portion of the West Beach, leading to the recommendation to cover the area with an exposure barrier system (EBS).	November 2006
The construction contract for the replacement groundwater treatment plant at the Wyckoff Site was awarded.	March 2007
The construction contract for the EBS at the West Beach was awarded.	September 2007
The Second Five-Year Review Report for the Wyckoff/Eagle Harbor Superfund Site was completed.	September 26, 2007

3. Background

3.1 Physical Characteristics and Land Uses

The Wyckoff/Eagle Harbor Superfund Site is located on the east side of Bainbridge Island in central Puget Sound, Washington (Figure 1). (Figures referenced in this report are provided together following Section 10.) The Wyckoff Site includes the former Wyckoff Company wood-treatment facility, contaminated subtidal and intertidal sediments in Eagle Harbor, and other upland sources of contamination to the harbor, including a shipyard formerly located in Eagle Harbor. At the Wyckoff Site, soil and groundwater are contaminated with creosote (along with its accompanying PAHs), pentachlorophenol (PCP), and other wood-treatment compounds. Marine sediments in Eagle Harbor are contaminated with PAHs and other organics associated with wood treating, as well as with heavy metals such as mercury, copper, lead, and zinc from the former shipyard.

3.1.1 Current Land Use

More than 20,000 people live on Bainbridge Island. Land use on Bainbridge Island is principally residential, with some commercial and industrial use. An urban area, formerly the City of Winslow (population 2,800), lies on the north shore of the Harbor. Residences, commercial centers, a city park, several marinas, a Washington State Ferry repair yard, a bulkhead enterprise, and a ferry terminal are located on the northern shoreline. The western and southern shores are primarily lined with residences, farms, marinas, and a boatyard. On the south shore at the harbor mouth, the former wood-treating facility extends into the harbor on fill. Eagle Harbor is heavily used by recreational boaters, “live-aboards,” and ferries to and from Seattle. Approximately 2,000 people live within one mile of the Wyckoff Site. The nearest residence is located less than 1/4 mile away.

A significant use of the harbor is ferry transport of vehicles and passengers between the City of Bainbridge Island and Seattle. Currently, approximately 23 ferry runs are made per day. The harbor is also used for moorage of pleasure boats, houseboats, and working boats. Fishing, crabbing, and clam-digging were common recreational activities until 1985, when the Bremerton-Kitsap County Health District issued a health advisory to address bacterial and chemical contamination of seafood in Eagle Harbor. The advisory, recommending against the harvest and consumption of fish and shellfish, has significantly reduced the recreational harvesting of seafood from the harbor.

Eagle Harbor is within the usual and accustomed fishing area of the Suquamish Tribe, whose reservation is located on the Kitsap Peninsula north of Bainbridge Island. The Suquamish Tribe retains the right to harvest fish and marine invertebrates and to have fishery resource habitat areas protected within the Tribe's usual and accustomed fishing area.

3.1.2 Reasonably Anticipated Future Land Uses for the Wyckoff Site

The current zoning of the Wyckoff property is Water-Dependent Industrial. Uses under the current zoning may include retail commercial, indoor entertainment, cultural and government facilities, associated parking, agriculture, boatyards, and marine sales and repair.

Significant land use changes in the past five years have included the sale of the property and development of a park on a portion of the Wyckoff Site. Reasonably anticipated land use in the next five years includes public use of the West Beach, hillsides, and park areas (Figure 2). Future use of the intertidal East Beach will continue to be restricted in accordance with institutional controls because of NAPL seeps. The Former Process Area will continue to be excluded from public use until the final remedy is implemented.

The entire Wyckoff Site was sold to the City of Bainbridge Island in three parcels between December 2004 and February 2006, for a total price of $8,288,000. The first parcel (21.7 acres, $4,900,000) contained the West Beach and adjacent hillside up to Eagle Harbor Drive. The second parcel sold was the property west of Eagle Harbor Drive (4.2 acres, $651,000). The final parcel includes the Former Process Area and the hillside up to Eagle Harbor Drive (23.1 acres, $2,737,000). Final sale of the property was completed on February 27, 2006.

The site of the former Eagledale Dock is at the publicly-owned Taylor Avenue road end, directly adjacent to the Wyckoff Site. The Bainbridge Island Japanese American Community (BIJAC) and the Bainbridge Island/North Kitsap Interfaith Council formed the Bainbridge Island WWII Nikkei Exclusion Memorial Committee to create a memorial honoring the Nikkei, who in 1942 were the first to be ordered from their homes and resettled in internment camps for the duration of World War II. The Memorial Committee has applied for National Historic Landmark status for the site.

Using grant money obtained from Ecology, a Bainbridge Island architect was contracted to design a concept for the Taylor Avenue road end incorporating the memorial. The Wyckoff Acquisition Task Force (a citizen committee formed to acquire the former Wyckoff Site for a public park) allocated approximately eight acres of the westernmost edge of the site adjacent to Taylor Avenue for this purpose.

Construction permits have been granted, including development of a cultural/memorial building, a pier, grading, boardwalks, a kiosk, turn-around roads, paths, parking facilities, wetland mitigation, and the memorial structure. As of June 2007, Phase I of the construction was complete, including the kiosk, the turn-around roads, parking facilities, and walking paths.

3.2 History of Contamination

From the early 1900s through 1988, a succession of companies treated wood at the Wyckoff property for use as railroad ties and trestles, telephone poles, pilings, docks, and piers. Initially the poles were treated by wrapping with burlap and asphalt, but by 1910 pressure treatment began with creosote/bunker oil. The Wyckoff wood-preserving plant was one of the largest in the United States, and its products were sold throughout the nation and the rest of the world. Wood-preserving operations included: (1) the use and storage of creosote, PCP, solvents, gasoline, antifreeze, fuel and waste oil, and lubricants; (2) management of process wastes; (3) wastewater treatment and discharge; and (4) storage of treated wood and wood products.

The main features of the wood-treating operation included: (1) a process area, which included numerous storage tanks and process vessels such as retorts; (2) a log storage and log peeler area; and (3) a treated log storage area.

There is little historical information about the waste management practices at the Wyckoff facility. Prior to reconstruction of the facility in the 1920s, it is reported that logs were floated in and out of a lagoon that once existed at the site. The lagoon has since been filled. Treated logs were also transported to and from the facility at a former West Dock via a transfer table pit, and the chemical solution that drained from the retorts after a treating cycle went directly on the ground and seeped into the soil and groundwater below the surface. This practice began around the mid-1940s and continued until operations ceased in 1988. Wastewater was also discharged into Eagle Harbor for many years, and the practice of storing treated pilings and timber in the water continued until the late 1940s. Further site contamination occurred due to drips from treated poles and releases of used treatment product. The log storage area was primarily used to store untreated wood.

Groundwater and soil at the wood-treating facility are contaminated with chemicals from the wood treatment process, primarily creosote-derived PAHs, PCP, aromatic carrier oils, and dioxins/furans. Since 1993, the onsite extraction system has removed approximately 100,000 gallons of NAPL from the ground and treated over 475 million gallons of contaminated groundwater. It is estimated that approximately 1 million gallons of NAPL still remain in the subsurface.

Sediments in areas of Eagle Harbor were contaminated with PAHs and other organic compounds as well as with metals, primarily mercury. The wood-treating facility was the major source of PAHs to the East Harbor through both past operating practices and contaminant transport through the subsurface. An additional source of contaminants to Eagle Harbor was created when sludge from tanks and sumps was used as fill material between an old and new bulkhead at the Wyckoff facility in the 1950s. In the West Harbor, PAH contamination in nearshore sediments appeared to be from combustion products, minor spills, and pilings and piers, while subtidal PAH contamination in the West Harbor is believed to reflect a combination of these sources, disposal practices at the former shipyard, and releases from the Wyckoff property. Elevated concentrations of metals, particularly near the former shipyard in the West Harbor, are associated with past shipyard operations, including the application, use, and removal (by sandblasting) of bottom paints and antifoulants. Recent research in Eagle Harbor has identified combustion sources that also add to the PAH load in sediments.

3.3 Initial Response

As the result of reports of oil observed on the beach adjacent to the Wyckoff facility, EPA began investigating the property in 1971. In 1984, EPA issued an order requiring the Wyckoff Company to conduct environmental investigations. Data collected at the time revealed the presence of significant soil and groundwater contamination. Numerous other investigations were conducted at the property (see Section 2) prior to initiation of an RI/FS for Eagle Harbor. The Wyckoff Company, EPA, Ecology, and NOAA all investigated aspects of the site in the early to mid-1980s under regulatory authority other than that of CERCLA. Although work was conducted under Resource Recovery and Conservation Act (RCRA) authority, the site was not considered a treatment, storage and disposal facility (TSDF).

The site, including Eagle Harbor, the wood-treating facility, and other sources of contamination to Eagle Harbor, was listed on the Superfund NPL in July 1987. In July 1988, the Wyckoff Company was ordered by EPA to install groundwater extraction wells and a groundwater treatment plant in an effort to halt the continuing release of wood-treating contaminants to Eagle Harbor.

A settlement with the Wyckoff Company (by now renamed Pacific Sound Resources, Inc.) was embodied in a Consent Decree entered in Federal District Court in August 1994. The Decree created the Pacific Sound Resources (PSR) Environmental Trust into which the heirs of the Wyckoff Company founders, owners, and operators placed all ownership rights and shares in the Company to allow the Trust to maximize liquidation of all company assets, including non-wood-treating holdings, for the benefit of the environment. The beneficiaries of the Trust are the U.S. Department of Interior, NOAA, and the Suquamish and Muckleshoot Tribes, as Natural Resource Trustees, as well as EPA (administrator of the Superfund trust fund) for reimbursement of CERCLA remedial costs. A Memorandum of Agreement was entered into by the beneficiaries of the Trust to ensure that settlement proceeds would be applied toward both environmental response and natural resource restoration goals.

Groundwater pump-and-treat systems were placed into service in 1990. In November 1993, EPA assumed control of the site and operation of the systems and discovered that both the treatment plant and extraction systems were in a state of disrepair. New extraction wells were installed to replace the original seven, and a variety of operational and process improvements were made to the treatment system.

The systems have been effective in recovering large amounts of oily creosote in the form of NAPL, and in helping to control the migration of contaminants from the groundwater to Eagle Harbor. The extracted groundwater contaminated with elevated levels of PAHs and PCP is treated to meet discharge standards for subsequent discharge through an outfall to Puget Sound.

Other actions taken to deal with the contamination have included demolition and removal of buildings, structures, above-ground and underground storage tanks, underground foundations and piping, asbestos, sludge, and some heavily contaminated soil. In the East Harbor, a 54-acre sediment cap was placed over contaminated subtidal sediments in 1993 and 1994.

3.4 Basis for Taking Action

The site has been divided into four OUs, which are shown in Figure 1, summarized below, and described in Sections 3.4.1 through 3.4.4:[1]

- **Soil OU:** surface and subsurface soil extending to the maximum elevation of the water table (or other fluid boundary) including the Former Process Area and the Former Log Storage/Peeler Area
- **Groundwater OU:** subsurface soil and groundwater beneath the maximum elevation of the water table (or other fluid boundary) extending toward Eagle Harbor and including groundwater contaminated by fluids migrating from the Former Process Area and the Former Log Storage/Peeler Area
- **West Harbor OU**: intertidal and subtidal surface sediments located within the West Harbor OU boundary
- **East Harbor OU**: intertidal and subtidal surface sediments located within the East Harbor OU boundary

3.4.1 Soil OU

The Soil OU is divided into three components: the Former Process Area, the Former Log Storage/Peeler Area, and the Well CW01 Area. The chemicals of concern (COC) in soil are nine PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b&k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and

[1] These OUs are sometimes referred to by the numbers historically assigned to them by EPA: OU 1 (the East Harbor OU), OU 2 (the Soil OU), OU 3 (the West Harbor OU), and OU 4 (the Groundwater OU).

naphthalene), PCP, and dioxins/furans. The primary contributor to cancer risk through soil ingestion by future residents (the residential exposure scenario was evaluated in the baseline human health risk assessment conducted as part of the RI for the Wyckoff Soil and Groundwater OUs) is benzo(a)pyrene, a carcinogenic PAH. The remaining carcinogenic high-molecular-weight PAHs (HPAHs), PCP, and dioxins/furans are the remaining contributors to cancer risk. The primary contributor to non-cancer risk is naphthalene, with a calculated hazard quotient of 22.8.

3.4.2 Groundwater OU

The Groundwater OU includes the soil and groundwater in the saturated zone beneath the Soil OU. The Groundwater OU is composed of two water-bearing zones separated by a layer of low-permeability material, called the aquitard. These water-bearing zones (i.e., the upper and lower aquifers) consist of sand and gravel with variable amounts of silt. The aquitard is composed of stiff marine silt and dense to hard glacial material. The aquitard appears to be continuous over most of the site; its thickness varies from 10 feet to 40 feet, but may be as thin as 4 feet in isolated areas, and in some locations it contains interbedded sand layers.

In the development of cleanup alternatives, the Groundwater OU was divided into three areas: the upper aquifer beneath the Former Process Area, the upper aquifer beneath the Former Log Storage/Peeler Area, and the lower aquifer.

Based on the USACE NAPL field exploration (USACE, May 2000), light NAPL (LNAPL) is distributed in the upper aquifer over the center and most of the eastern portion of the site. The thickest sequences of LNAPL are in the vicinity of the former tram loading area, on the south side of the transfer pit, where up to 10 feet of LNAPL-filled pore space was reported during the field exploration. The LNAPL-filled pore space generally thins to the north and the east. The accumulation of LNAPL is likely the result of dripping logs that were removed from the retorts at the Wyckoff Site as well as discharge from the retorts. Significant thicknesses of LNAPL occur at other locations across the eastern portion of the site and may be associated with historical contaminant release events.

The LNAPL extends to the current sheet pile wall and historically discharged onto the eastern and northern shorelines. In 1999 and 2000, the sheet pile wall was installed between the Former Process Area and the shorelines to prevent further migration and discharge of LNAPL from the Wyckoff Site. By design, the sheet pile wall did not encompass all of the contaminated upper-aquifer/ intertidal sediments. Residual contamination outside the sheet pile wall was expected to naturally attenuate. Residual contaminant seepage outside the sheet pile wall along the shoreline is limited to a small portion of the East Beach.

Dense NAPL (DNAPL) is present in the upper aquifer beneath most of the Former Process Area. As with LNAPL, the thickest sequences of DNAPL-filled pore space (14 feet total over the full thickness of the upper aquifer) occurs in the vicinity of the former tram loading area, and (as with LNAPL) the accumulation of DNAPL is likely the result of dripping logs that were removed from the retorts as well as discharge from the retorts. Significant occurrences of DNAPL are also found along the northwest shoreline and along the eastern edge of the facility, and may be related to localized sources and/or the migration of DNAPL along the more permeable gravel zones within the marine sand and gravel unit. Some of the DNAPL is trapped in the upper aquifer at various depths, and some appears to have migrated downward through the upper aquifer until it encountered the relatively low-permeability aquitard. The aquitard dips (slopes) toward the north and east. The DNAPL builds up above the aquitard, forming accumulations in depressions in the aquitard surface, and generally migrating "down-dip" along the aquitard surface toward Eagle Harbor. Further lateral migration of DNAPL toward Eagle Harbor was mitigated by the installation of the sheet pile wall in 1999 and 2000.

DNAPL has been observed within the aquitard in several borings located in the central portion of the site (near well CW12). It is not apparent how the DNAPL may have entered and migrated into the aquitard. However, borings show that the aquitard in this area contains very thin sand lenses (less than ¼-inch thick) and sand-filled fractures, which may have acted as conduits for DNAPL migration. Based on data collected to date, NAPL has not been identified in the lower aquifer.

The COCs in the upper-aquifer groundwater are 13 PAHs, PCP, and dioxins/furans, which are present in the groundwater in the form of mobile NAPL, dissolved constituents, and residual NAPL held in soil pore spaces. Volatile organic compounds (VOCs) and base/neutral and acid extractables (BNAs) are also present in the groundwater; however, for purposes of cleanup, they are assumed to be co-located with the PAHs.

Groundwater samples collected from the upper aquifer beneath the Former Process Area were not included in the human health risk assessment during the RI for the Soil and Groundwater OUs (CH2M HILL, 1997) because the aquifer is classified as non-potable. In the upper-aquifer groundwater south and west of the Former Process Area, the excess lifetime cancer risk from ingestion of groundwater by future residents ranges from $5x10^{-6}$ to $4x10^{-4}$, with the higher values found on the southern end of the Former Process Area (EPA's acceptable risk range is from 1 in 10,000 [$1x10^{-4}$] to 1 in 1,000,000 [$1x10^{-6}$]). In general, the primary contributors to cancer risk in groundwater are benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and benzo(b)anthracene.

In lower-aquifer groundwater, two of the four wells that were included in the risk assessment displayed an excess lifetime cancer risk of greater than 10^{-5} but lower than 10^{-4}. However, subsequent field investigations revealed that one of those two wells (CW12) was not screened in the lower aquifer. As a result, data from this well may be representative of either the upper aquifer or contaminant levels penetrating high-permeability zones of the aquitard, but may not be representative of the lower aquifer.

3.4.3 West Harbor OU

A number of metals (copper, lead, zinc, cadmium, and arsenic) in intertidal sediment samples collected during the RI for Eagle Harbor were found to exceed the maximum concentrations measured at background locations. The greatest number and the highest concentrations of metals were detected near the former shipyard on the north shore of the West Harbor. Subtidal mercury concentrations exceeded maximum background values by between two and 20 times throughout the harbor and were particularly high near the former shipyard.

PAH concentrations were extremely high in intertidal sediments adjacent to the Wyckoff facility. PAH concentrations in sediments adjacent to the former shipyard in the West Harbor were lower, but were still higher than at intertidal background stations. Estimated average concentrations of HPAHs were highest north of the Wyckoff Site and in the central harbor, and were significantly higher than background values. Concentrations of total PAHs and low-molecular-weight PAHs (LPAHs) followed the same general pattern. Contamination by PCP was not widespread.

The following risk-related information applies to all of Eagle Harbor. Human populations potentially exposed to contamination include children and adults who consume contaminated fish and/or shellfish, and individuals, particularly children, who might be exposed to contaminated intertidal sediments through dermal exposure (skin contact) or incidental ingestion. Risks from four exposure routes have been calculated, including ingestion of contaminated clams and crabs, ingestion of contaminated fish, ingestion of contaminated intertidal sediments, and dermal contact with contaminated intertidal sediments. Marine organisms potentially exposed to contaminated sediments include sediment-dwelling organisms in three major taxonomic groups: mollusca (e.g., clams), polychaeta (e.g., worms), and crustacea (e.g., amphipods).

Human health risks for Eagle Harbor are primarily associated with the consumption of shellfish. The human health risk assessment during the RI for Eagle Harbor used a high (95th percentile) fish and shellfish ingestion rate computed from the 1988 Puget Sound Estuary Program (PSEP) study of seafood consumption in Puget Sound. The high rate for shellfish consumption was estimated to be 21.5 grams per day, equivalent to a 1/3-pound serving a week. The fish consumption rate was 95.1 grams/day, which corresponds to 230 servings of 1/3-pound of fish over the course of a year. (The study estimated that an average consumer eats at most three such servings of shellfish and 30 such servings of fish per year.) The high rates were used for the reasonable maximum exposure (RME) assumption for adults. These assumptions were modified to develop ingestion rates for children, based on body weight ratios.

3.4.4 East Harbor OU

During the RI, chemical concentrations in Eagle Harbor sediments and seafood were elevated with respect to background locations. However, human health risk estimates for exposure to sediment contaminants through dermal contact and sediment ingestion are within or below EPA's range of acceptable risks (1×10^{-4} to 1×10^{-6}). For seafood ingestion, calculated cancer risks are generally between 10^{-4} and 10^{-6} at both Eagle Harbor and background locations. Consumption of shellfish from specific areas (such as near the Wyckoff Site) results in excess lifetime cancer risks above 10^{-4}. Institutional controls (advisories and tribal regulations) are currently in place to restrict shellfish harvesting.

Bioassays for acute toxicity and comparison to Apparent Effects Threshold-derived sediment values have indicated that sediments at many sampled locations in the East Harbor are toxic to amphipods, oyster larvae, or both. The bioassay responses were most severe in areas of high PAH contamination, such as areas of the East Harbor north of the Wyckoff Site. Additional evidence of biological effects in Eagle Harbor has included the prevalence of liver lesions and tumors in English sole, as documented by NOAA. Research citing the effects of PAHs and other sediment contaminants on marine organisms indicates potential damage to Eagle Harbor marine life.

4. Remedial Action

4.1 Soil and Groundwater OUs

4.1.1 Remedy Selection

The following are the major components of the selected remedy, thermal remediation, that were identified in the 2000 ROD:

- Construct a sheet pile wall around the highly contaminated area of the Former Process Area to prevent potential flow of contaminants to Eagle Harbor during remediation;
- Conduct a pilot study to test the applicability and effectiveness of thermal remediation. The pilot study will be designed and implemented with the ability to expand to the full-scale system. The pilot study will test steam injection and electrical resistance heating (as a supplemental technology to steam injection).

  If the pilot study is successful (Scenario 1) at meeting performance expectations, then:

  - Consolidate contaminated hot spots from the Former Log Storage/Peeler Area and the Well CW01 Area (approximately 60,000 cubic yards) within the Former Process Area.
  - Remediate the soil and groundwater within the Former Process Area by full-scale thermal treatment.
  - Construct a vapor cover over the treatment area (the Former Process Area) to enhance recovery of contaminated vapors, minimize emissions to the atmosphere, and reduce odors.
  - Monitor biodegradation, oxidation, and other thermally-enhanced attenuation processes in soil and groundwater during and after active thermal treatment is completed to confirm whether further reductions in contaminant concentrations are being achieved.
- If the pilot study is not successful (Scenario 2), then implement the contingency remedy, Containment with a Sheet Pile Wall. This remedy would include:
  - A sheet pile wall system for shoreline stabilization to isolate upland contamination from the marine environment;
  - Upper-aquifer groundwater extraction and treatment to maintain hydraulic containment;
  - Capping of upland soil to address human health risks and to reduce infiltration of water into the site; and

  - Groundwater monitoring and institutional controls.

- Common elements of Scenarios 1 and 2 were as follows:
  - Monitor the upper-aquifer and lower-aquifer groundwater.
  - Establish institutional controls to:
    - Ensure that the upper-aquifer groundwater outside the Former Process Area and the lower aquifer remain unused until protective levels are reached.
    - Ensure that the upper-aquifer groundwater within the Former Process Area remains unused due to contaminants that may remain after thermal treatment or will remain as part of the contingency remedy. This portion of the upper aquifer is also not potable due to high salinity levels.
    - Restrict site use to reduce the risk of direct exposure to surface soil, if necessary.

Remedial Action Objectives (RAO) for the Groundwater OU were as follows:

- Reduce the NAPL source and the quantity of NAPL leaving the upper aquifer beneath the Former Process Area sufficiently to protect marine water quality, surface water, and sediments (e.g., ensure that the quantity of NAPL leaving the site will not adversely affect aquatic life and sediments). Site-specific groundwater contaminant concentration limits will be met at the mudline.
- Ensure that contaminant concentrations in the upper-aquifer groundwater leaving the Former Process Area will not adversely affect marine water quality, and aquatic life in surface water and sediments.
- Protect humans from exposure to groundwater containing contaminant concentrations above MCLs.
- Protect groundwater outside the Former Process Area and the lower aquifers, which are potential drinking water sources.

Specific groundwater cleanup levels are listed in Table 1. (Tables referenced in this report are provided together following the figures, before Appendix A.)

Remedial action objectives for the Soil OU, as identified in the February 2000 ROD, were:

- Prevent human exposure through direct contact (ingestion, inhalation, or dermal contact) with contaminated soil.
- Prevent stormwater runoff containing contaminated soil from reaching Eagle Harbor.

The Washington State Model Toxics Control Act (MTCA) requirements have been identified as a key Applicable of Relevant and Appropriate Requirement (ARAR) for the Soil OU actions. Specific soil cleanup levels are listed in Table 2.

4.1.2 Remedy Implementation

4.1.2.1 Thermal Remediation Pilot Study

As identified in the 2000 ROD, EPA conducted a thermal remediation pilot study to determine the applicability and effectiveness of thermal remediation in achieving the RAOs and ARARs established in the ROD. A contingency remedy of Containment with a Sheet Pile Wall was to be implemented if results from the pilot study established that thermal treatment would not meet the necessary performance standards.

The pilot study was conducted from November 2002 through April 2003. The history of the pilot study is documented in the *Thermal Remediation Pilot Study Summary Report, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington* (USEPA, 2006) and summarized below.

In theory, delivery of a heat source via injection wells enhances recovery of contaminants by: (1) reducing the viscosity of contaminants, (2) increasing the contaminant vapor pressures, (3) increasing contaminant solubility, and (4) increasing microbial degradation and enhancing hydrous pyrolysis oxidation (contaminants mix with oxygen and, in the presence of heat, oxidize into carbon dioxide and water). Heat was delivered through 16 injection wells located within a 1-acre area within the Former Process Area. Mobilized contaminants, in the form of water, vapor, and oily product, were removed by seven extraction wells placed within and surrounding the contaminated zone. Vapor was also removed through vacuum conveyance lines in the vapor cap.

Operations were restricted by budget constraints and equipment problems, and the pilot study was terminated in April 2003. Technical problems with the pilot study included issues with the liquid and vapor extraction and conveyance systems and the treatment plant.

The equivalent of approximately 2,940 gallons of NAPL was recovered during the pilot study: 340 gallons as NAPL and 9,800 kg (equivalent to 2,600 gallons) in the dissolved phase.

Although the pilot study demonstrated that thermal remediation achieves contaminant mass removal, this technology has never been demonstrated to meet the environmental cleanup standards required for the Wyckoff Site. Thermal treatment will not achieve the RAOs or ARARs specified in the ROD for soil (Washington State MTCA, Washington Administrative Code [WAC] 173-340-740), sediments (State of Washington Sediment Management Standards [SMS], WAC 173-204), or groundwater (State of Washington Groundwater Cleanup Standards, WAC 173-340-720, and Surface Water Cleanup Standards, WAC 173-340-730).

Implementation of the containment remedy (capping, shoreline stabilization, and hydraulic containment) would be required to protect human health and the environment and achieve ARARs. Additional source removal would not significantly increase the effectiveness of the containment remedy.

4.1.2.2 Contingency Containment Remedy

The contingency containment remedy is described in Section 7 of the *Engineering Evaluation of Groundwater and Soil Remediation Scenarios, Wyckoff/Eagle Harbor Superfund Site, Soil and Groundwater Operable Units* (CH2M HILL, 2005) and consists of the following components:

- **Groundwater Extraction System –** The groundwater extraction system consists of seven recovery wells screened in the upper aquifer. Pumps installed in these wells draw groundwater and NAPL away from the site perimeter and in toward the extraction wells. Pumping in the upper aquifer also maintains an upward vertical gradient between the lower and upper aquifers. The inward flow direction in the upper aquifer combined with the upward flow direction from the lower aquifer are the primary means of hydraulic containment in the Former Process Area. The groundwater and NAPL recovered from the extraction wells are treated at the onsite groundwater treatment plant.

- **Upgradient Groundwater Cutoff –** The purpose of the upgradient cutoff is to reduce the amount of groundwater entering the upper aquifer beneath the Former Process Area and thus reduce the amount of water that needs to be extracted and treated. An upgradient cutoff along the entire southern boundary of the Former Process Area was originally conceptualized. Subsequent investigations have shown that the aquitard actually is present at or near the surface in the center portion of the Former Process Area southern boundary and prevents this from occurring. However, the aquitard appears to be discontinuous at the southwest and southeast portions of the site. Additional studies (e.g., the installation of monitoring wells and soil borings) will be conducted in the winter of 2007/2008 to further characterize the aquitard in these areas and to determine the need for modifications to the sheet pile wall.

- **Site Cap –** A low-permeability site cap will be constructed over contaminated areas within the Former Process Area. The purpose of the cap is to prevent contact with contaminated soil and provide a clean surface, facilitating access by the public. The cap will also be designed to limit the infiltration of precipitation and reduce the hydraulic loading to the groundwater treatment plant.

- **Shoreline Protection/Sheet Pile Wall –** A shoreline protection system constructed around the existing shoreline will be used to prevent the erosion of contaminated soil and isolate the contaminated soil and upper-aquifer groundwater from contact with the surrounding surface waters. This system would be designed to protect or replace the existing sheet pile wall that is exposed above the mudline.

- **Long-Term Monitoring** – A monitoring program will provide data on water levels in both the upper and lower aquifers beneath the Former Process Area (for confirming hydraulic containment), and on contaminant distribution and movement in the subsurface beneath the Wyckoff Site.

4.1.3 System Operations/O&M

4.1.3.1 Containment – Sheet Pile Wall

There are no ongoing O&M activities for the sheet pile wall. A study was conducted in 2004 (CH2M HILL, 2004a) to evaluate the corrosion rates of the sheet pile wall. Corrosion rates vary for different portions of the sheet pile wall. The sheet pile in the upper splash and tidal zones has an average corrosion rate of 8 to 12 mils per year and a time-to-penetration of approximately 20 years. The buried wall below the mudline has an average corrosion rate of 2 mils/year and a time-to-penetration in excess of 100 years. EPA is evaluating additional actions that may be warranted to increase the design life of the sheet pile wall in the upper splash and tidal zone areas with the highest corrosion rates.

4.1.3.2 Containment – Groundwater Treatment Plant and Extraction System

The existing groundwater treatment plant and extraction system continue to be operational. System O&M activities are summarized in the *Remedial Action Management Plan* (Operations and Maintenance International [OMI], 2005).

Primary O&M activities for the treatment plant and extraction system include the following:

- Extract groundwater to maintain hydraulic control by adjusting rates to compensate for seasonal water levels.
- Manually remove NAPL from each extraction well as needed.
- Operate and maintain treatment plant equipment.
- Monitor treatment plant operational efficiency.
- Monitor effluent concentrations.

Annual system O&M costs for the Soil and Groundwater OUs are presented in Table 3.

The existing groundwater treatment plant has been in operation for approximately 15 years and is nearing the end of its service life. Consequently, a contract was awarded for construction of a replacement groundwater treatment plant. Primary treatment processes include oil separation, hydromation filtration, and dissolved-phase adsorption on granular activated carbon (GAC). Construction began in June 2007, and the plant should be fully operational in July 2008.

4.2 West Harbor OU

4.2.1 Remedy Selection

The ROD for the West Harbor OU was signed in September 1992 and amended in December 1995. The primary RAOs for the sediments in the West Harbor are achievement of the Washington State SMS Minimum Cleanup Levels (MCULs; WAC 173-204-520), and reduction of contaminants in fish and shellfish to levels protective of human health and the environment.

In order to define areas requiring specific types of remedial action, the RAOs above were supplemented by three EPA objectives:

- Address sediments containing 5 mg/kg (dry weight) or more of mercury, as a means of source control;
- Address intertidal sediments containing 1,200 micrograms per kilogram (µg/kg) (dry weight) or more of HPAHs, as shellfish in such areas contained carcinogenic HPAHs above EPA's acceptable levels for the protection of human health;
- Address predicted biological impacts, minimize potential sediment resuspension, and limit biological uptake in areas where sediment concentrations of mercury exceed 2.1 mg/kg (dry weight).

Thus, the selected remedy required the removal of sediments containing 5 mg/kg or more of mercury from the marine environment.

The major components of the selected remedy for the West Harbor OU, as identified in the 1992 ROD and shown in Figure 3, include:

- Further evaluation and control of potential upland sources of contamination to West Harbor sediments;
- Excavation, solidification/stabilization (if necessary), and upland disposal of sediments exceeding 5 mg/kg mercury (dry weight);
- Placement of a cap of clean sediments over areas of high concern for adverse biological effects and potential contaminant re-suspension and bioaccumulation;
- Thin-layer placement of clean sediments to enhance sediment recovery in areas of moderate concern;

- Natural recovery and monitoring in areas predicted to achieve the long-term sediment cleanup objective without sediment remedial action;
- Continued institutional controls to protect human health from exposure to contaminated fish and shellfish; and
- Long-term environmental monitoring to evaluate the effectiveness of the remedy.

In the December 1995 amendment to the September 1992 ROD for the West Harbor OU, EPA incorporated the following changes:

- Construction of nearshore fill and a Confined Disposal Facility (CDF) in intertidal areas adjacent to the former shipyard property. Hotspot sediments were to be placed inside the CDF and capped with clean material and asphalt. This fill would create 0.9 acres of additional land so that WSDOT could reserve one acre of the property for private boatyard or other water-dependent operations. To compensate for habitat lost as a result of the nearshore CDF, WSDOT would:
  - Enhance the outer wall of the nearshore CDF with a layer of gravel and/or small pebble to provide favorable habitat (about 0.19 acre) for barnacles and mussels. The habitat would resemble habitat lost at the fill site.
  - Restore 0.6 acre of eelgrass immediately west of the nearshore fill. Eelgrass provides high-quality habitat for juvenile fish and other marine life.
  - Construct a 2-acre estuarine salt marsh habitat at the South Bainbridge Estuarine Wetland and Stream Restoration Site (ultimately named the Schel-chélb Estuary), near Lynnwood Center.
  - Furnish the Suquamish Tribe with materials for a 1.5-acre Manila clam enhancement project.
  - Transfer 6 to 8 acres of tideland from WSDOT to the Suquamish Tribe.
  - Implement contaminant source control measures at the former shipyard property acquired by WSDOT, to prevent soil contaminants from entering Eagle Harbor through groundwater seeps or surface water runoff. These measures would include: the treatment of heavily contaminated soil in two areas; capping of site soil with asphalt; diversion of surface water and groundwater; construction of a shoreline barrier to minimize seawater movement through contaminated soil; implementation of pollution prevention practices; and access restrictions. These measures were required to meet State of Washington soil cleanup standards for industrial land use.

4.2.2 Remedy Implementation

Construction of the initial remedy for the West Harbor OU was completed in the summer of 1997. The only portion of the remedy constructed in the last five years has been the intertidal barrier system, completed in 2006 (see Figure 4) and located adjacent to the original tidal barrier system constructed in 1997. The total remedy consisted of completion of the following activities, which provides the basis for final remedy implementation at the West Harbor OU:

- Source control through soil stabilization of two upland “hotspot” areas
- Installation of a tidal barrier system adjacent to the landfill located in the northwest corner of the upland area to minimize the potential for seeps that could impact capped sediments
- Installation of a drainage system along the northern boundary of the site to intercept and cut off surface and shallow subsurface water run-on
- Installation of an asphalt-concrete cap across the former Bainbridge Marine Services upland area to minimize the potential for soil to run off to capped sediments
- Construction of a CDF for contaminated sediments removed from the OU
- Sediment capping
- Mitigation for 0.9 acres of lost aquatic habitat
- Construction of an additional intertidal barrier system

WSDOT completed construction of the CDF and initial intertidal barrier in December 1997. Intermittent seeps from the intertidal barrier, resulting from the flooding and saturation of the barrier material at high tide and the subsequent draining of the water at low tide, were identified shortly after its placement. Quarterly monitoring of these seeps was conducted in accordance with the EPA-approved plan. This sampling determined that the concentrations of copper and zinc in the seep water exceeded the applicable state standards. Based on these data, EPA required WSDOT to propose options for addressing the seepage. The monitoring data initially indicated that the seep volume and metals concentrations may be decreasing over time. Subsequent monitoring indicated that the seepage was not decreasing to acceptable levels, Therefore, EPA required WSDOT to construct an additional tidal barrier along approximately 600 feet of shoreline, extending from the footbridge located near the northern boundary of the site to the southern extent of the rockery. WSDOT completed construction of this additional barrier in 2006 (WSDOT, 2007). WSDOT conducts quarterly monitoring of the remedy to ensure continued compliance with regulatory standards.

4.2.3 System Operations/O&M

WSDOT is conducting long-term monitoring of the subtidal and intertidal areas of the West Harbor according to the *Operation, Maintenance, and Monitoring Plan,* [OMMP], *Wyckoff/Eagle Harbor Superfund Site, West Harbor Operable Unit* (USACE, 1997**)** (Tables 4 and 5). The most recent Year 9 monitoring results (2006) are used to determine remedy success. The primary activities associated with the OMMP include the following:

- Upland containment and BMP inspections;
- Intertidal seep and groundwater monitoring;
- Stormwater treatment system inspection; and
- Schel-chélb Estuary monitoring, completed during the fourth quarter of 2006.

All site access controls, including health advisories, deed restrictions, and fencing, are operating as constructed.

4.3 East Harbor OU

4.3.1 Remedy Selection

The ROD for the East Harbor OU was signed in September 1994. The primary RAOs for the sediments in the East Harbor are achievement of the Washington State SMS MCULs (WAC 173-204-520) and reduction of contaminants in fish and shellfish to levels protective of human health and the environment (Tables 6 and 7). In subtidal areas, active remediation is required if the top 10 centimeters of sediments contain contaminant concentrations above the MCULs at the completion of upland source control. For intertidal sediments, the surface 10 centimeters must achieve the MCUL within 10 years from control of significant sources to these areas. This is supplemented by an intertidal objective of concentrations of 1,200 µg/kg (dry weight) for HPAHs, developed by EPA to address human health risks from consumption of contaminated shellfish in intertidal areas. The major component of the remedy includes sediment capping in subtidal areas, with monitoring in intertidal areas to confirm the predicted recovery of intertidal sediments through natural processes.

4.3.2 Remedy Implementation

The East Harbor Subtidal Sediment Cap was completed in three phases over nine years (1993-2002) (Figure 5). Completion of the cap and intertidal activities described below provide the basis for the final remedy implementation for the East Harbor OU. The major components of each phase were as follows:

4.3.2.1 Phase I

EPA issued an Action Memorandum for a non-time-critical removal action in June 1993. Sediment placement activities began in September 1993 and concluded in March 1994.

Approximately 275,000 CY of dredged material, covering more than 54 acres, was placed in the East Harbor to complete the removal action.

4.3.2.2 Phase II

In 2000-2001, EPA extended the original sediment cap by an additional 15 acres in a nearshore area adjacent to the Wyckoff Site known as the log-rafting area. This area had not been remediated during Phase I because of a lack of upland source control at the time. The cap extended from the 1994 cap's approximate 3-foot thickness contour (located approximately 900 feet offshore) to the northern shoreline of the Wyckoff Site.

4.3.2.3 Phase III

In early 2002, EPA placed an additional 50,000 cubic yards of clean borrow material in 15 acres of the shallow subtidal area to create intertidal habitat and to form a continuous intertidal beach along the Eagle Harbor shoreline.

4.3.2.4 Habitat Mitigation Beach/West Beach

To offset habitat loss associated with construction of the sheet pile wall and to enhance existing shoreline functions of Eagle Harbor and the adjacent Puget Sound shoreline, EPA created a total of 1,154 feet (approximately 2 acres) of intertidal beach along the western portions of the Wyckoff Site, in the northern portion of the Former Log Storage/Peeler Area. Construction was completed in February 2002. Beach construction involved excavation of soil (both contaminated and uncontaminated) and removal of deteriorated bulkhead. The surface of the habitat mitigation beach consisted of imported sediments (referred to as habitat fill) with a grain size preferred by endangered species and smelt.

Since 2005, the habitat mitigation beach has been renamed the West Beach and is considered part of the East Harbor OU based on its elevation and intertidal and subtidal nature. Creation of this beach increased the area of available forage fish-spawning habitat; provided feeding, resting, and habitat for migrating salmonids; and established a connecting corridor between existing habitats within Eagle Harbor and Puget Sound.

In the summer of 2005, Bainbridge Island residents reported observations of creosote odors and orange staining on the West Beach, which was being accessed by the public for recreational use (Figure 6). EPA responded to these reports by investigating the nature and extent of the contamination in beach sediments and water. Having confirmed the contamination, EPA initiated the design of an Exposure Barrier System (EBS) to isolate the contamination from the marine environment and to address potential human health hazards (Figure 7). The EBS encompasses approximately 2.5 acres of intertidal sediments and 2.3 acres of subtidal sediments.

Construction of the EBS will begin in the fall of 2007 and will consist of three layers, as follows:

- **Geotextile.** A porous geotextile placed on the original beach will minimize the potential for contaminated sediments to move into the environment. The geotextile will also provide an additional deterrent for digging and a visual barrier to anyone who may have been able to dig down that deep into the beach.

- **Cobble Layer.** A 1-foot-thick layer of 3- to 5-inch cobbles placed on top of the geotextile will provide an armor layer to resist wave energy, a highly permeable drainage layer to convey groundwater to the bottom of the beach, a deterrent to digging a deep hole in the beach, and a visual marker that will show if the habitat layer above has eroded to the point of exposing the armor, indicating that beach maintenance is needed to replace or to redistribute the habitat fill above.

- **Habitat Fill Layer.** A 2-foot-thick layer of habitat fill placed on top of the cobble layer will provide fish habitat and complete the total 3-foot-thick separation provided by the entire beach cover system.

The remedy for the intertidal West Beach portion of the East Harbor OU is currently being revised in an Explanation of Significant Differences (ESD). The construction of the EBS at the West Beach constitutes a significant difference to the ROD for the East Harbor OU because the beach cover system, which replaces the mitigation beach portion of the remedy, includes additional subsurface components intended to isolate contaminated sediment from human and ecological contact.

4.3.3 System Operations/O&M

EPA is conducting long-term monitoring of the subtidal and intertidal areas of the East Harbor OU according to the OMMP for the OU that was approved by EPA in 1995 and amended in 2002 (USACE, 2002a) The most recent Year 8 monitoring results (2002-2003) are used to determine remedy success. The primary activities associated with the OMMP include the following:

- Subtidal cap monitoring to determine the physical stability of the cap, assess the effectiveness of containing underlying contaminated sediments, and enable comparison with state standards

- Intertidal area monitoring to determine stability in areas where cap material was placed, assess the effectiveness of containing underlying contaminated sediments, and enable comparison to state standards

- East Beach monitoring for natural attenuation

- West Beach monitoring for buffer zone success and habitat use

The monitoring requirements are summarized in Table 8. Annual system O&M costs for the East Harbor OU are presented in Table 9.

5. Progress Since Last Five-Year Review

5.1 Protectiveness Statements from 2002 Five-Year Review

The following protectiveness statement was provided for the overall Wyckoff/Eagle Harbor Superfund Site in the 2002 Five-Year Review Report:

> “The remedies for all four operable units are expected to be protective of human health and the environment. All immediate threats at the site have been addressed through containment of contaminated soil and groundwater with a pump-and-treat system and sheet pile wall, removal and consolidation of contaminated soil, removal and capping of sediments, and the installation of fencing and warning/fish advisory signs. Long-term protectiveness of the remedial actions will be verified by additional monitoring and data collection.”

5.1.1 Soil and Groundwater OUs

The protectiveness statement for the Soil and Groundwater OUs in the 2002 Five-Year Review Report was as follows:

> “With the exception of the soil and upper aquifer groundwater within the Former Process Area, in which a final remedy will be designed and constructed once results from the steam injection pilot project have been evaluated, the remedies that are in place have met, or are expected to meet the cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled. Site controls are preventing exposure to contaminated soil and groundwater. The final soil and groundwater remedy for the Former Process Area is expected to be in-place by 2005.”

5.1.2 West Harbor OU

The protectiveness statement for the West Harbor OU in the 2002 Five-Year Review Report was as follows:

> “The remedies have met, and with the implementation of additional actions to address the seeps in the area of the old landfill, are expected to meet the cleanup goals. Institutional controls are effective in controlling access to the upland areas and fish advisories are in place.”

5.1.3 East Harbor OU

The protectiveness statement for the East Harbor OU in the 2002 Five-Year Review Report was as follows:

> "The remedies are expected to meet the cleanup goals. Exposure pathways that could result in unacceptable risks are being controlled. Institutional controls are preventing exposure to contaminated East Beach intertidal sediments and the ingestion of contaminated fish and shellfish."

5.2 Recommendations from the 2002 Five-Year Review

The recommendations in the 2002 Five-Year Review Report suggested three actions for the Soil and Groundwater OUs, two actions for the West Harbor OU, and three actions for the East Harbor OU (Table 10). In addition, four recommendations based on community involvement were provided (Table 11).

5.3 Status and Results of Recommendations and Follow-up Actions from the 2002 Five-Year Review

5.3.1 Soil and Groundwater OUs

Recommendations resulting from the 2002 Five-Year Review that have been implemented or are in the process of being addressed are described below.

- Concerns about the service life for the existing treatment plant and extraction system will be resolved by construction of the replacement groundwater treatment plant scheduled for completion in the spring of 2008. The replacement plant is designed to remove free oil/product , PAHs, and PCP from groundwater pumped to the plant from the existing groundwater extraction wells. The replacement plant will also treat stormwater that falls on containment pads associated with the existing and replacement treatment plants.

- The ability of the aquitard to restrict vertical migration of contaminants is being evaluated through ongoing monitoring of groundwater levels and contaminant concentrations in the lower aquifer. A subsurface investigation is planned for the winter of 2007 for portions of the Soil and Groundwater OUs where aquitard information is incomplete. In addition, EPA is planning the installation of additional lower-aquifer monitoring wells to better understand possible interactions between the upper and lower aquifers.

- EPA is continuing to coordinate with City of Bainbridge Island and other local officials to ensure that the remedy is implemented and is protective of current and future site uses.

5.3.2 West Harbor OU

The 2002 Five-Year Review revealed that seeps in the area of the old landfill contained copper and zinc concentrations above marine water quality criteria. Based on these exceedances, EPA tasked WSDOT (in accordance with the contingency strategy outlined in the site OMMP), to investigate options for mitigating the seep water discharge. The 2002 Five-Year Review Report noted that seepage did not call into question the protectiveness of the remedy as a whole and concluded that the remedy, as designed and implemented, was functioning well. The contaminated seep water discharge is the result of tidal outflow in areas beyond the extent of the tidal barrier or berm.

As noted in Section 4.2.2, recommendations resulting from the 2002 Five-Year Review have been implemented. WSDOT has completed construction and monitoring of an intertidal seep barrier and eelgrass plantings. The intertidal seep barrier is operating effectively, as described in quarterly and annual reports. Eelgrass beds were planted twice, in accordance with the OMMP contingency strategy. Neither planting was successful because of excessive microalgal growth; therefore, no further work is recommended to restore eelgrass. Tables 4 and 5 summarize monitoring requirements already met and future monitoring requirements.

5.3.3 East Harbor OU

All recommendations resulting from the 2002 Five-Year Review have been implemented. Monitoring of the East Beach, North Shoal, and subtidal sediment cap will continue as defined in the OMMP. Institutional controls are preventing exposure to residual contamination on the West Beach until construction of the Exposure Barrier System occurs during the fall of 2007. The West Beach will be monitored and maintained under the OMMP, which will be updated in the fall/winter of 2007.

No other issues were identified in the 2002 Five-Year Review.

6. Five-Year Review Process

6.1 Administrative Components, Community Notification, and Document Review

Appendix A contains the notification to the public of the preparation and availability of this Second Five-Year Review Report.

6.1.1 Administrative Components of the Five-Year Review Process

Development of the second Five-Year Review process for the Wyckoff/Eagle Harbor Superfund Site, identification of the review team, and establishment of the review schedule was completed in mid-2007. The Five-Year Review team was led by Mary Jane Nearman, EPA Remedial Project Manager (RPM) for all the OUs at the Wyckoff Site; Jeanne O'Dell, EPA Community Involvement Coordinator (CIC); and team members from the USACE with expertise in biology, hydrogeology, and risk assessment. Chung Yee of Ecology assisted in the review as the representative for the support agency.

The review schedule included the following components that are described in this section:

- Community notification and involvement
- Document review
- Data review
- Site inspections
- Development and review of this Second Five-Year Review Report

6.1.2 Community Notification and Involvement

The major components of community notification and involvement during the past five years are described below.

6.1.2.1 Fact Sheets

Fact sheets were made available to the public in May 2003, May 2004, November 2005, and July 2007. These fact sheets covered the following topics:

- May 2003 – The thermal remediation pilot study; new information about the lower aquifer; and an update on other activities at the Wyckoff Site
- May 2004 – Reasons why the thermal remediation pilot study had been discontinued; replacement of the groundwater treatment plant
- November 2005 – West Beach, East Beach, and North Shoal cleanup update

- July 2007 – Update on conditions in the Former Process Area; replacement of the groundwater treatment plant
- July 2007 – West Beach cleanup update
- July 2007 – West Harbor cleanup update

Copies of the fact sheets are included in Appendix A. The fact sheets were also made available on EPA's web page for the Wyckoff/Eagle Harbor Superfund Site.

6.1.2.2 Five-Year Review

A newspaper display advertisement announcing that EPA was conducting the Five-Year Review and welcoming public participation was published in two local newspapers in June 2007 (see Appendix A). Another display advertisement will announce the availability of the final report and EPA will be issuing a fact sheet describing the results of the review. In addition, the final report will be placed in the local information repository and on the EPA's web page for the Wyckoff Site at http://yosemite.epa.gov/r10/cleanup.nsf/sites/wyckoff.

6.1.2.3 Availability Sessions and Public Meeting

Public availability sessions were held on the Bainbridge Island-Seattle ferry on August 2 and August 9 to provide information to individuals interested in the Wyckoff/Eagle Harbor Superfund Site. In addition, a public meeting was held on August 16, 2007, to provide information and answer questions about the Five-Year Review process. A copy of the presentation materials is included in Appendix A.

Approximately 45 people attended the public meeting. Most questions centered on the creosote contamination in the Former Process Area. The City of Bainbridge Island submitted a memorandum regarding the *Wyckoff Site ROD and Contaminant Source Removal*, dated August 16, 2007, for inclusion in the record for the site.

6.1.2.4 Agency for Toxic Substances and Disease Registry (ATSDR) Review

ATSDR, a federal public health agency, is part of the Public Health Service in the U.S. Department of Health and Human Services. ATSDR provides public health advice and recommendations to EPA regarding health concerns around hazardous waste sites. Earlier this year, EPA requested an ATSDR health consultation for the Wyckoff/Eagle Harbor Superfund Site. The initial ATSDR evaluation for the site was completed in 1990; EPA requested this new consultation seeking ATSDR's advice on potential public health issues related to real or possible human exposure to toxic material based on the most recent information available for the site. In part, EPA requested the health consultation to facilitate future Pritchard Park development plans of the City of Bainbridge Island and the Park District. ATSDR will be looking at all areas of the

Wyckoff/Eagle Harbor Site including the former Wyckoff wood-treating facility (currently Pritchard Park) and the West Harbor area (currently the WSDOT ferry maintenance facility).

6.1.2.5 Project Library and Information Repository

The EPA Region 10 Office maintains a project library containing relevant site documents. In addition, EPA's web page for the Wyckoff Site, at http://yosemite.epa.gov/r10/cleanup.nsf/sites/wyckoff, contains the most up-to-date information on activities at the site, and the Bainbridge Island Library located at 1270 Madison Ave North (www.krl.org) also contains site information.

6.2 Document Review

Numerous documents were reviewed during preparation of this Second Five-Year Review Report. The specific documents are listed in Appendix B.

6.3 Data Review

Data collected as part of investigation activities supporting selection and/or implementation of the remedies for the four OUs at the Wyckoff Site were reviewed for this Five-Year Review Report. Data were reviewed for relevant trends, to identify needed changes to the existing monitoring programs, and to assess opportunities to optimize the existing systems.

6.3.1 Relevant Trends

6.3.1.1 Soil and Groundwater OUs

Treatment Plant Performance and Compliance Monitoring

The existing groundwater treatment plant at the Wyckoff Site processes groundwater contaminated with elevated levels of PAHs and PCP. The groundwater is obtained from extraction wells located within the Wyckoff Site boundary. In addition to recovering groundwater, the extraction well recovery system is designed to recover NAPL composed of both LNAPL and DNAPL in almost pure product form. The existing treatment plant has been in operation for approximately 15 years and is nearing the end of its service life.

The treatment system was originally installed in 1990 by the Wyckoff Company. EPA took over responsibility for O&M in 1993 and made upgrades in 1995. A replacement treatment system was designed in 1998, but that system was never installed because of uncertainty regarding the future use of thermal treatment to enhance recovery. The existing treatment system includes a dissolved air flotation (DAF) unit (which replaced a nonfunctioning depurator in 2002), an activated sludge system, a clarifier, multimedia filters, and three 8,000-pound GAC vessels. Water is discharged to the harbor under the substantive requirements of a National Pollutant Discharge Elimination System (NPDES) permit. A replacement groundwater treatment plant is under construction and is expected to be completed in the spring of 2008.

Samples are collected from the groundwater treatment plant to meet three primary objectives:

- Performance monitoring to evaluate system efficiency and performance through measurement of specific parameters of influent and effluent of selected process units
- Chemical compliance monitoring to determine whether the discharge limitations required by the 2000 ROD for the Wyckoff Soil and Groundwater OUs are being met through the quality of effluent being discharged to Puget Sound
- Biological compliance monitoring to demonstrate compliance with Washington State Whole Effluent Toxicity Testing and Limits (WAC 173-205) through measurement of acute and chronic toxicity affects of effluent on selected aquatic organisms

Treatment plant performance monitoring is conducted weekly at 11 sampling locations within the groundwater treatment plant (Table 12). The results are used for daily operations decisions and are provided to EPA and Ecology in monthly reports. The most critical samples collected in the performance monitoring program are used to evaluate contaminant concentrations across the three carbon vessels in the treatment system. These samples provide early warning that carbon loading is approaching the breakthrough threshold. The carbon in the tanks is replaced in accordance with standard operating procedures to ensure compliance with the effluent limits.

Compliance monitoring requirements for the GWTP are detailed in the 2000 ROD and the substantive NPDES permit requirements. Effluent discharge limits to Puget Sound have never been exceeded. Effluent discharge limits are listed in Table 13.

In addition to chemical samples, effluent toxicity samples are collected both quarterly and annually. The results of both the annual and the quarterly biomonitoring tests have consistently demonstrated compliance with Washington State discharge limits for toxicity as described in WAC 173-205-020. A recent system operations report (from May 2007) is included as Appendix C.

Groundwater Monitoring

Groundwater monitoring to demonstrate hydraulic containment and to monitor changes in contaminant levels in the upper and lower aquifers was initiated in 2004. Between 2001 (when the sheet pile containment wall was installed) and 2004, the monitoring program focused on hydraulic containment and consisted of monthly water-level measurements from upper- and lower-aquifer wells.

The current hydraulic containment monitoring program involves continuous water-level monitoring using data loggers installed in 17 upper-aquifer wells and eight lower-aquifer wells. The effectiveness of hydraulic containment is evaluated on a semi-annual basis. The most recent semi-annual report (Evaluation of Groundwater Elevation Data [CH2M HILL 2006a]) indicated that hydraulic containment has been maintained and that monitoring results were consistent with those of the past monitoring periods. These data indicate that pumping from the existing extraction system is sufficient to induce an inward gradient (i.e., toward the extraction wells) within the contaminated upper aquifer, and an upward gradient from the lower aquifer to the upper aquifer. The level of hydraulic control is further supported by the presence of the sheet pile containment wall, which provides a physical barrier to NAPL and dissolved-phase contaminant migration from the Former Process Area to Puget Sound and Eagle Harbor. In general, the groundwater extraction systems are performing as intended in maintaining hydraulic control of the Former Process Area.

Contaminant concentrations in the upper and lower aquifers are also monitored on an annual basis. The current sampling program includes 11 monitoring wells and 7 piezometers. Contaminant concentrations in groundwater are monitored primarily in the lower aquifer which, aside from sporadic detections in a limited number of wells, has not been impacted by site contaminants. Conversely, the upper aquifer is known to be contaminated with significant volumes of NAPL. Therefore, an analysis of trends in contaminant concentrations in either aquifer has not been conducted on a regular basis. However, a simple comparison of 2004 analytical data with 2006 analytical data for selected wells was reported in the *September 2006 Groundwater Sampling Results for Wyckoff/Eagle Harbor Superfund Site Report* (CH2M HILL, 2007a). This report concluded that, for the most part, the 2006 upper- and lower-aquifer results did not differ significantly from the 2004 results.

Sheet Pile Containment Wall

Two sheet pile walls are in place at the Wyckoff Site. The containment wall is placed around the outer, shore-side perimeter of the site. This wall is approximately 1,870 feet long, extends approximately 20 to 90 feet below grade, and is embedded into the aquitard layer. The thickness of this sheet pile wall varies from 11.9 mm (0.47 inches) to 17.1 mm (0.67 inches). A second sheet pile wall is installed within the containment wall. This second wall was installed to isolate a section of the site for the purposes of the thermal remediation pilot study. The construction of both walls was completed in February 2001.

The sheet pile containment wall is an integral component of the remediation process at the Wyckoff Site, and an evaluation of the corrosion potential for the wall was conducted in 2004. The results of the evaluation were documented in a technical memorandum, *Sheet Pile Wall Corrosion Issues* (CH2M HILL, 2004a). Although performance of the sheet pile wall is not monitored on a regular basis, the exterior of the containment wall was examined during low tide as part of the May 2007 site inspection conducted by USACE. Corrosion was observed on portions of the wall exposed to wave/tidal actions. The 2004 corrosion memorandum predicted the highest rates of corrosion for this part of the wall, with an overall average of 12 mils (0.012

inches) per year and localized corrosion or pitting at 25 mils (0.025 inch) per year. The depth of pitting observed along the wall during the May 2007 inspection (i.e., 1/8th inch, or 0.125 inches) is consistent with the predicted localized corrosion rate for the portion of the wall in the upper splash zone. The final remedy will include additional shoreline protection to extend the design life of the sheet pile wall system.

6.3.1.2 West Harbor OU

Intertidal Seeps

WSDOT completed construction of the CDF and the initial tidal barrier in December 1997. Intermittent seeps from the intertidal barrier, which resulted from the flooding and saturation of the tidal barrier material at high tide and the subsequent draining of the water at low tide, were identified shortly after its placement. Quarterly monitoring of the seeps was conducted in accordance with the EPA-approved plan. This sampling determined that the concentrations of copper and zinc in the seep water exceeded the applicable state standards. Based on these data, EPA required WSDOT to propose options for addressing the seepage.

The monitoring data initially indicated that the seep volume and metals concentrations may be decreasing over time. Also, sampling of the adjacent estuary indicated that there were no environmental risks to fish. For these reasons, it was decided to continue monitoring the seeps for a limited time to assess whether the seep volume and metals concentrations would decrease to acceptable levels. When subsequent monitoring indicated that the seepage was not decreasing to acceptable levels, EPA required WSDOT to construct an additional tidal barrier along approximately 600 feet of shoreline extending from the footbridge located near the northern boundary of the site to the southern extent of the rockery. WSDOT completed construction of this additional barrier in 2006 (WSDOT, 2007). A post-construction inspection was conducted in October 2006, approximately six weeks after the completion of construction, and again in December 2006 following a record rainfall. Monitoring of the active seeps now indicates that the barrier is effectively isolating the upland contamination sources from Eagle Harbor. Monitoring is continuing on a regular basis.

Water quality results for the intertidal seeps during the fourth quarter of Year 9 (2006) were compared with marine water quality criteria as required by the OMMP for the West Harbor OU (Hart Crowser, 1997). The report prepared by WSDOT (2007) noted that marine criteria for dissolved copper (3.1 micrograms per liter [μg/L] chronic and 4.8 μg/L acute) were slightly exceeded in one of three seep samples (5.05 μg/L at SP-16), and that no samples exceeded marine criteria for dissolved zinc. Dissolved copper and zinc concentrations observed at these new seeps were well below the concentrations observed from 2000 to 2005. The report concluded that the seep remediation cap has greatly reduced the dissolved metals concentrations in the seeps and suggests that the number of seeps and the seep discharge rates should decrease as the cap material settles and porosity decreases, in part due to reduced admixture of oxygenated marine waters into the waste materials underlying the cap.

Surface Water Management

In 1994, WSDOT's Washington State Ferries (WSF) prepared a Storm Water Pollution Prevention Plan (SWPPP) that was updated in 1996, 2003, 2005, and 2006 (WSDOT, 2007), and is being updated again in 2007 to reflect the requirements of the 2004 modified Ecology permit . In accordance with the SWPPP, personnel inspect the site during both dry and wet weather to ensure that operational, source control, erosion and sediment control, and treatment Best Management Practices (BMPs) are in place and being used effectively at the Wyckoff Site. In 2003, WSF began a stormwater quality monitoring program for its ferry maintenance facility in Eagle Harbor. Stormwater samples were collected on a quarterly basis at Outfall 2 and a catch basin near the maintenance building. During the first two years of storm water monitoring at the facility, only the benchmark for zinc (117 µg/L) was exceeded. However, zinc concentrations declined to levels below the benchmark in 2005 and 2006 because of improved "housekeeping" procedures, which include sweeping the parking lot weekly and modifying the practices of storing uncovered galvanized piping or scrap metal onsite.

Based on available information, Year 10 (2007) OMMP monitoring activities will only include the following:

- Annual site and stormwater inspections will continue through Year 10 (2007) in accordance with the OMMP and the NPDES permit.
- Annual water quality monitoring will be conducted during the second quarter of Year 10 at monitoring well MW-01.

No sediment quality monitoring activities are planned for Year 10 (2007) in accordance with the OMMP for the West Harbor OU. No monitoring of the Schel-chélb Estuary and Harper Estuary (a reference site) is planned beyond 2006 (Year 10 of estuary monitoring). Future maintenance and noxious weed control will be conducted at the site as needed by WSDOT's Maintenance Office. Based on OMMP guidance and monitoring results, low-tide habitat surveys and underwater video surveys of the 1997 sediment cap area are not required and are not proposed for the future.

Eelgrass transplanting and monitoring are not planned to occur in the future because it has been determined that contingency action requirements for failure of the eelgrass transplant site have been met. The 0.6-acre eelgrass transplant site, located in the ravine stream delta immediately west of the 1997 cap boundary, was originally planted with 10,000 eelgrass shoots in 1998 (Herrera, 2001). Only 59 eelgrass shoots were observed in the deep portion of the site during the 1999 surveys, and no eelgrass shoots were present at the site during the survey in April 2000. EPA-approved contingency actions for failure of the transplant site include a second eelgrass planting as specified in the amended ROD for the West Harbor OU (EPA, 1995), the OMMP (Hart Crowser, 1997), and the transplant site mitigation plan (Thom and Antrim, 1998). A second planting of 220 eelgrass shoots was conducted in the deep portion of the site in April 2000, but none of those plants were present during the following survey in August 2000. Excessive macroalgal growth was identified as the primary cause for the transplant site failure (Herrera, 2001). In a letter from WSDOT to EPA dated July 16, 2003, WSDOT identified the rationale for no further action regarding eelgrass restoration. The rationale includes: initial low probability of eelgrass survival at this site, and additional mitigation actions completed for which environmental benefits were realized but credit was not provided under the ROD, such as additional estuarine acreage at the Schel-chélb site, habitat enhancement of the intertidal seep barrier, habitat protection by removal of barges and restriction of boat anchorage within intertidal and subtidal portions of the West Harbor, and volunteer assistance with construction of a fish ladder at the Schel-chélb Estuary location.

6.3.1.3 East Harbor OU

The East Harbor OU is conceptually separated into subtidal and intertidal areas. Although the subtidal area was capped in multiple events, it is considered one complete area during monitoring. The intertidal areas shown in Figure 8 are considered as separate areas during monitoring based on historical knowledge and investigation results. Data trends for each area are discussed below.

Subtidal Cap

The 2002 Five-Year Review noted that subsurface PAH concentrations as of 1999 had increased at three locations (T7-10, T8-4, and T9-2) of a total of eight locations sampled, and the subsurface contamination increased with increasing depth within the cap. Monitoring reflected conditions on the Phase I cap. It was noted that the monitoring for that period occurred when source control had not yet been achieved; therefore, direct contamination could have occurred. Other possible explanations included upward vertical migration of contaminants from the native sediment into the cap, mixing of the contaminated material with cap sediments during cap construction, or physical mixing of the contaminated native sediments with cap sediments due to intrusive activities such as anchor drags and boat moorings. The report noted that these observations did not reflect the entire cap area, over which most sampling locations show little or no change in surface and subsurface PAH concentrations.

In 2002 and 2003 (Integral Consulting, 2004), Year 8 environmental monitoring of the East Harbor OU cap occurred. In the intervening period since 1999, both the Phase II and Phase III caps had been placed to cover previously uncapped areas, and the Phase I cap had been augmented. In addition, a sheet-pile wall had been installed around the Former Process Area to aid in source control.

The Phases I and II/III subtidal caps were determined by bathymetry and through-cap coring to be physically stable. The caps are physically isolating the underlying contaminated sediments with the exception of one station, J-10, near the former West Dock. However, PAHs were detected in subsurface cap sediments. All stations but one had surface sediment concentrations below Washington State SQS (Table 6), with the exception of Station J-9, also near the former West Dock, where dibenzo(a,h)anthracene exceeded the MCUL and fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene exceeded the SQS. This station also had visual sheen and had a concentration of 23,300 µg/kg total petroleum hydrocarbons in the diesel range (TPH/DRO). Because a distinct 1-6 cm layer of recently deposited, fine-grained material occurred in this location, it is believed that this was a release from an uncontrolled upland soil or sediment source. Analytical results indicated that the contamination differed from the contamination associated with the Wyckoff Site. For this reason, it is concluded that the subtidal cap is functioning as intended. As noted, fish surveys are currently being carried out by the City of Bainbridge Island, the Suquamish Tribe, and Washington Department of Fish and Wildlife (DFW).

Intertidal Cap

Bathymetry surveys accomplished by Integral (2004) indicated that the intertidal cap was depositional and physically stable; chemical analyses suggest that it is providing clean habitat (with no exceedances of SQS, MCUL or Lowest Apparent Effects Thresholds [LAET]).

The West Beach (the former Habitat Mitigation Beach) remains physically stable, and buffer zone planting has been successful. Mammal usage has been noted, but was sporadic and may not have included forage. Benthic assemblages suitable for supporting desirable fish communities have been observed, as have sand lance. Fish surveys are currently being carried out by the City of Bainbridge Island, the Suquamish Tribe, and DFW. As noted previously, contaminated sediments have appeared at the lower margin of the intertidal area along a portion of the West Beach. The EBS described in Section 4.3.2 will be constructed in 2007 to mitigate possible human and ecological exposure to the contaminants.

North Shoal

No direct remedial action has occurred on the North Shoal except for the removal of the West Dock. Although no visible seeps were detected during inspection and collection activities, one station (K9-D3) located near the former West Dock exceeded SQS and MCUL criteria. It has been noted (Integral, 2004) that this station is highly heterogeneous and repeated samples have yielded widely varying results. It is speculated that this area remains a possible source, which may be related to a flow path that would include cap stations J-9 and J-10.

The need for additional response actions, if appropriate, will be evaluated based on these results and continued monitoring. Institutional controls (e.g., signage) currently restrict public access to this area.

East Beach

No direct remedial action other than placing the containment wall has occurred at this location. NAPL seeps continue to be observed along the beach. Integral (2004) refined information on the nature and extent of contamination on the East Beach previously provided by USACE (2001), and developed a three-dimensional conceptual model of the distributions of NAPL and PAHs in the area in order to establish baseline conditions and assess the potential for natural attenuation. The study suggested that natural attenuation may occur in non-seep areas with relatively low concentrations of PAHs (i.e., less than 3 times the LAET).

Issues being addressed by others within Eagle Harbor include the following:

- The National Marine Fisheries Service (NMFS) Northwest Fisheries Science Center continues to conduct studies to determine whether there has been a reduction in PAH exposure and associated effects on English sole from Eagle Harbor following the placement of a clean sediment cap over the most PAH-contaminated region, and associated onshore source controls. A number of recently published papers also reveal the mechanisms for PAH toxicity for fish, and these may merit consideration in the next Five-Year Review. See Section 7.3 for further information.

- The City of Bainbridge Island initiated a beach-seining project in 2002 in partnership with the Suquamish Tribe and DFW to provide a baseline inventory of species in nearshore waters around Bainbridge Island, including the area of the intertidal cap. The beach-seining results included the capture and identification of Chinook, chum, cutthroat, steelhead, and pink salmon along with sand lance, surf smelt, and herring on the West Beach. The various species were identified from April through December. These results suggest that the beach is being used as habitat as intended.

6.3.2 Recommended Changes to Monitoring Programs

6.3.2.1 Soil and Groundwater OUs

The current configuration of the long-term groundwater monitoring system for the Soil and Groundwater OUs may not be sufficient for containment remedy monitoring. Additional monitoring wells are needed as follows:

- Lower-aquifer wells to monitor the potential offsite migration of lower-aquifer groundwater at the sheet pile wall.

- Additional vertical hydraulic containment well pairs to supplement and enhance the areal coverage of the four current well pairs. The lower-aquifer well of each well pair would also serve as an additional "early warning" water quality monitoring location.

The rationale, location, and construction details for the additional wells are described in the *Engineering Evaluation of Groundwater and Soil Remediation Scenarios, Wyckoff/Eagle Harbor Superfund Site, Soil and Groundwater Operable Units* (CH2M HILL, 2005). Once installed, the wells will be added to the hydraulic containment and groundwater quality monitoring programs described in Section 6.2.1.1. EPA is planning phased implementation of the proposed well installation and monitoring program beginning in the fall of 2007.

6.3.2.2 West Harbor OU

There are no recommended changes to the monitoring program for the West Harbor OU, and monitoring will continue as defined in the current OMMP.

6.3.2.3 East Harbor OU

Monitoring for the East Harbor OU will continue as defined in the current OMMP, with revisions to occur in the fall/winter of 2007.

6.4 Site Inspections

A site inspection was conducted by USACE at the Soil, Groundwater, and East Harbor OUs on May 31, 2007. USACE also performed a site inspection at the West Harbor OU on June 13, 2007. The Site Inspection Checklists and photographic documentation are included in Appendices D and E, respectively. The purpose of the inspections was to assess the protectiveness of the remedy for each OU. Summaries of the inspections are presented in Sections 6.4.1 through 6.4.3.

6.4.1 Soil and Groundwater OUs

USACE's site inspection activities included visual inspection of all portions of the OUs that are accessible, including onsite trailers and buildings, areas inside and outside the fence line, the intertidal area around the sheet pile wall (the East and West Beaches), monitoring wells, and the western portion of the Wyckoff Site containing the Nikkei Memorial currently under construction by the City of Bainbridge. The existing groundwater treatment plant was not inspected because construction of the replacement plant had just begun. The findings of the site inspection were as follows:

- Access to the site is via Creosote Place Northeast. The eastern slope adjacent to this road has sloughed off onto the intertidal area below making it susceptible to a slide, especially in heavy rains.

- Daily site visitation records were up to date. All other on-site documents and records were readily available and up-to-date.
- Access and institutional controls were readily available for examination and were operating as expected. Examination of the fencing and signage revealed no significant issues. The corner post at the southeast corner of the fencing near the parking lot was loosened by winter wind and wave action and will require repair; however, it does not affect public access. There was one area along the southern area of the fence where the ground was low enough that a person could slide beneath the fencing. A trail used by the public runs along the outside of the fence along its southern boundary and allows the public access to the West Beach and hillside. One new gate has been added to the site for treatment plant construction. All gate locks were intact and keys were available from the site manager upon request. The outside of the sheet pile had some graffiti on it. The site maintenance crew regularly removes graffiti in this location. There is new vegetative growth in the Former Process Area which facilitates surface water removal, reduces mud during rain events, and reduces dust generation during dry weather.
- The general site conditions were adequate. The sheet pile wall was examined during low tide. Inspection of the sheet pile wall showed corrosion on areas exposed to wave/tidal actions. Seepage was seen at joints and in areas that had a blistered appearance. The surfaces of some sections of the wall appeared to have rusted and pitted to a depth of approximately 1/8 inch.
- Examination of the habitat mitigation area revealed no significant issues. Many of the restored plants were dead, but other vegetation is growing throughout the entire area.
- A house had been built adjacent to the site on the southeast corner of the property.
- Potential remedy problems observed or discussed during this site inspection were corrosion of the sheet pile wall. Potential opportunities for optimization included well performance monitoring and hydraulic control optimization.
- Current operation and maintenance of the site appeared adequate.

6.4.2 West Harbor OU

USACE's site inspection activities included visual inspection of site access controls, the asphalt-concrete cap and stormwater treatment structures, under the dock to observe seeps, along the intertidal seep barrier area, and the northern cutoff drainage system. The site is maintained by WSF and remedial monitoring is completed by WSDOT consultants. Quarterly monitoring was occurring on the date of the site inspection. The findings of the site inspection were as follows:

- Daily site visitation records were up to date. All other on-site documents and records were readily available and up-to-date.
- Access and institutional controls were observed. All fences were intact with no damage. The WSF Maintenance Facility security appeared intact.
- The CDF cap appeared intact and in good condition, with oil-water separators clearly marked. Some settling appeared to have occurred in an approximately 3-by-5-foot area on the CDF cap in the northwest corner of the parking lot. The area is being observed by the Maintenance Facility and is targeted for observation during quarterly monitoring. No significant changes have occurred recently, and it was surmised that the pavement had settled due to substrate compaction only in this area. The settling has had no effect on the remedy.
- The recently constructed intertidal barrier system appeared to be intact and functioning. WSDOT contractors were performing seep sampling during the site visit and provided information regarding the design of the remedy.
- No major land use changes have occurred in the West Harbor OU in the past five years.
- General site conditions were adequate, and no indicators of potential remedy problems were observed with the exception of the potential settling of the CDF cap. No opportunities for optimization were identified. O&M of the site appeared adequate.

6.4.3 East Harbor OU

The results of USACE's site inspection of the East Harbor OU were as follows:

- Site records are up-to-date and can be found at the EPA document repository.
- The major land use change that has occurred in the East Harbor OU is that the West Beach and indeed the entire intertidal area around the site formally became public access when the property was sold to the City of Bainbridge in February 2006. The major parts of the East Harbor OU that are visible for inspection at low tide include the intertidal area around the site. The East Beach and West Beach in particular were observed for seeps. In general, it appears that the sediments that were placed during the Phase II and III capping efforts have remained in place and are stable. As discussed previously, areas of the West Beach are currently roped off to avoid exposure to seeps from residual contamination. No significant odors or sheens were noted during the site visit.
- One sign at the top of the beach requires replacement.
- Examination of the buffer area found a number of dead plants; however, survival of the remaining plants appeared relatively strong with the exception that some appeared to have

stunted growth, suggesting that the plants require watering if they are to continue to survive. In addition, a number of 'volunteer' species such as alder appeared to be thriving and may need to be trimmed for beach access during West Beach construction.

- Potential remedy problems discussed during this site inspection mainly included those already identified in previous monitoring reports, and included recontamination of the surface of the subtidal cap from offsite sources.
- Monitoring data indicate that O&M is adequate. The OMMP for the East Harbor OU will be updated in the fall/winter of 2007/2008 and will include intertidal monitoring to ensure the adequacy of the EBS on the West Beach and seep monitoring on the East Beach.

6.5 Development and Review of this Second Five-Year Report

This Second Five-Year Report was prepared for EPA Region 10 by USACE, Seattle District. Independent technical review was provided by the USACE Center for Expertise in Omaha, Nebraska. EPA Region 10 and Ecology provided review comments prior to review by EPA Headquarters.

7. Technical Assessment

7.1 Question A: Is the remedy functioning as intended by the decision documents?

7.1.1 Soil and Groundwater OUs

Ongoing operation and maintenance of the groundwater extraction and treatment system and institutional controls are addressing immediate threats. Contamination within the Former Process Area is currently stable, and conditions are protective of human health and the environment. EPA plans to issue an ESD for the contingency containment remedy pending the outcome of discussions with regulatory and governmental stakeholders.

7.1.1.1. Remedial Action Performance and Operations

Extraction and Treatment

The existing groundwater treatment plant and extraction system are functioning as intended. The extraction system of nine active wells provides approximately 40 to 56 gallons per minute (gpm), 24 hours per day, seven days per week. Extraction rates are adjusted to compensate for seasonal increases in water levels, with lower rates in the summer and higher rates in the winter. Based on data provided in annual groundwater-level monitoring reports, hydraulic containment has been maintained consistently over this Five-Year Review period. Approximately 2 million gallons per month of contaminated groundwater continue to be removed and treated by the treatment plant and extraction system. In addition, 125 gallons of DNAPL per month are removed. NAPL removal has decreased approximately 50 percent since the First Five-Year Review was completed in 2002, and LNAPL is no longer being removed. To date, the extraction system has recovered approximately 100,000 gallons of NAPL, and the treatment plant has treated over 475 million gallons of extracted contaminated groundwater.

In combination with the sheet pile containment wall, the existing groundwater treatment and extraction system ensures that NAPL and contaminated groundwater in the upper aquifer are not leaving the Former Process Area. Continuous water-level monitoring indicates that current pumping rates are maintaining hydraulic control across the Wyckoff Site by producing an inward hydraulic gradient within the contaminated upper aquifer and an upward gradient from the lower aquifer to the upper aquifer. Containment of the contaminated groundwater eliminates adverse impacts to marine water quality, aquatic life, and the lower aquifer. While the upper aquifer is contaminated, it is not used for human consumption or industrial purposes, which eliminates human contact with contaminated groundwater with the exception of potential exposure to site workers.

The existing treatment and extraction system also addresses the remedial objective for reduction of the NAPL source and the quantity of NAPL leaving the upper aquifer beneath the Former Process Area. Combined with the sheet pile wall, the upland source of NAPL migration to the marine environment surrounding the site has been effectively controlled. However, because NAPL migrated offsite prior to the installation of the sheet pile wall, NAPL seepage from the shoreline areas outside the wall (e.g., the East Beach) continues.

Groundwater extracted at the Former Process Area is treated to meet the standards of the February 2000 ROD for the Soil and Groundwater OUs, which describes the discharge limits for the existing treatment system.

Sheet Pile Wall

The sheet pile wall is functioning as intended and is meeting the goal of limiting the lateral migration of contaminants into Eagle Harbor and Puget Sound. The potential for sheet pile wall leakage was evaluated in April 2001 using pumping tests at observation wells installed every 200 feet in the outer joints of the containment wall and the second sheet pile wall installed for the purposes of the thermal treatment pilot study (USACE, 2001). Results indicate that the overall hydraulic conductivity of the sheet pile walls is consistent with design expectations.

7.1.1.2 Opportunities for Optimization

Groundwater Treatment Plant Improvements

While the existing groundwater treatment plant and extraction system are currently operational, both continue to require extensive preventative and corrective maintenance. In many cases, pumps in the treatment plant and extraction system have reached the end of their service lives and require rebuilding. Corrosion and chemical incompatibility between the original materials of construction and site contaminants and conditions contribute to ongoing maintenance issues. Despite these maintenance challenges, the treatment system continues to operate at a high rate of efficiency and online operational time. The monthly costs for the treatment plant have stabilized, and monitoring reports (available onsite) confirm that process controls are operating as designed.

The replacement groundwater treatment plant system is scheduled to be completed in 2008. The replacement plant is designed to remove free oil/product and dissolved concentrations of PAHs, and PCP from groundwater pumped to the treatment plant from the existing groundwater extraction wells. The new plant will also treat stormwater that falls on containment pads associated with the existing and replacement treatment plants. The replacement plant process units are similar to those at the existing plant except that there is no biological treatment unit. The biological treatment unit was omitted in order to reduce the long-term O&M costs and to make the treatment process simpler and more automated. The new plant will contain the following components:

- An equalization tank with a skimmer for LNAPL recovery and DNAPL recovery from the tank bottom
- A DAF system to remove NAPL entrained in the groundwater
- Walnut shell oil filters
- Carbon filters
- An effluent tank
- A waste product tank
- A filter backwash treatment system

Another potential opportunity for optimization would involve verifying that the groundwater extraction pumps are not contributing to entrainment/emulsification of NAPL. Some types of pumps (e.g., progressive cavity pumps) are better than others for withdrawing groundwater from creosote NAPL sites, because they pump out the water without creating as much turbulence in the water as it is being withdrawn. The greater the turbulence, the greater the extent to which the NAPL gets entrained/emulsified into the water. Once entrainment/emulsification occurs, it can be very difficult to separate the NAPL from the water. The less entrainment/emulsification that occurs, the easier it is to separate out the NAPL from the water.

Infiltration Control

Water that flows into the Former Process Area, either by infiltration or by groundwater movement, quickly becomes contaminated as it comes into contact with contaminated groundwater and/or NAPL. This water must then be extracted and treated, which increases the demand on the groundwater treatment plant. Two projects are being considered to reduce the volume of uncontaminated water that is entering the contaminated zone—an upgradient groundwater cutoff, if warranted, and a cover system.

The benefits of reduced infiltration include the following:

- Lower operating costs proportional to the amount of water being treated, such as the cost of activated carbon
- Operational flexibility provided by a reduced flow rate, including the option to turn the treatment plant off during weekends to decrease labor costs
- Implementation of both the upgradient groundwater cutoff and the cover system would result in an estimated 35-gpm reduction in the amount of groundwater needing to be extracted from the site (CH2M HILL, 2005).

Shoreline Stabilization and Perimeter Attenuation Zone

The shoreline stabilization component of the containment remedy will protect the exposed portions of the sheet pile wall.

Groundwater Monitoring System

Additional monitoring wells are planned to supplement existing wells in the Soil and Groundwater OUs (CH2M HILL, 2005).

7.1.1.3 Implementation of Institutional Controls

As described above, contaminated groundwater in the upper aquifer is not used for human consumption or for any industrial purpose. The sheet pile wall and fencing around the Former Process Area restrict access to the most contaminated portion of the site. All access points to this portion of the property are secured with locking gates and signs. A "Notice of Agreement and Covenants Affecting Real Property", dated December 16, 2004, and an associated Prospective Purchaser Agreement with the City of Bainbridge Island document the institutional controls in place for land use restrictions necessary to protect the remedy.

7.1.1.4 Early Indicators of Potential Issues

Monitoring wells in the lower aquifer are monitored as an early indicator of potential contaminant migration for the groundwater-to-surface-water pathway.

7.1.2 West Harbor OU

7.1.2.1 Remedial Action Performance and Operations

The West Harbor upland containment, intertidal cap, and subtidal sediment cap appear to be operating effectively. As noted in Section 4.2.2, in an effort to reduce stormwater zinc concentrations, three oil/water separators were cleaned in April 2004. Performance standards are currently being met as described in the quarterly and annual monitoring reports. All actions necessary to ensure that there are no exposure pathways that could result in unacceptable risks have been implemented. Maintenance activities as defined in the OMMP, and as implemented, will maintain the effectiveness of response actions.

7.1.2.2 Opportunities for Optimization

There were no opportunities for optimization identified during this review. The OMMP provides sufficient data to assess the effectiveness of the remedial actions.

7.1.2.3 Implementation of Institutional Controls

Site access controls implemented as part of site remediation include health advisories, deed restrictions, and fencing.

The sign located at the entrance to Eagle Harbor Condominiums had been damaged and was replaced in 2004 by the Bremerton-Kitsap County Health Department. The most recent inspection outside of this review was conducted on November 22, 2006 (Ultican, 2006). All signs were found to be in good condition with the following exception (first observed in December 2002): the sign located at the Queen City Yacht Club had faded and was difficult to read. Kitsap County has not determined when it will be replaced.

WSF has determined land use restrictions for excavation actions. Environmental requirements during construction activities are also addressed. The deed restrictions will be reiterated in any lease agreements administered by WSF. WSF has not entered into any lease agreements on the Eagle Harbor property since remediation of the site.

A chain link fence surrounds the site. The fence was repaired at one location in December 2003.

7.1.2.4 Early Indicators of Potential Issues

Investigation findings suggest that the asphalt-concrete cap subsidence was caused by the collapse of a small underlying void. The void may have developed from tidal action that washed fines from the fill materials, possibly due to a lack of compaction at the edge of the pier, although such a scenario was not noted during construction. A more likely cause of the void's formation is differential settlement of the berm materials (a natural response to placement of fill soil on a site such as this) and the adjacent pier structure (which would not be expected to settle because it is founded on piles). The rate of subsidence is expected to slow or stop in the future at this and other locations in the berm. There is no indication that any future subsidence would be significant enough to threaten the integrity of the CDF or the disposition of equipment stored on the asphalt pavement. This area will continue to be monitored by the Ferry Maintenance Facility.

7.1.3 East Harbor OU

7.1.3.1 Remedial Action Performance and Operations

The East Harbor subtidal sediment cap appears to be operating effectively. Although a small percentage of subtidal cap samples show signs of contamination, these areas are near the former West Dock area and statistical analysis has not identified areas of concern on the subtidal cap that require monitoring in addition to that described in the existing OMMP. Areas of the West Beach intertidal area, constructed only as mitigation for other actions on the site, have not met overall RAOs. Therefore, remediation is ongoing for this area. Effective implementation of institutional controls has prevented exposure to, or ingestion of, contaminated sediments.

7.1.3.2 Opportunities for Optimization

Multiple opportunities for monitoring optimization have occurred since the original OMMP for the East Harbor OU (1995) and were identified in the OMMP Addendum (USACE, 2002). Major changes to the 1995 OMMP long-term monitoring (LTM) sampling program have included the following:

- All references to zones (areas of specific interest) have been removed based on past monitoring results and final remedial construction actions.

- A grid system rather than replicate point sampling has been instituted to identify sampling locations for subtidal areas.
- The portion of the subtidal cap without past sediment quality criteria exceedances will not be intensively monitored in all future events. Only the samples needed to confirm that this section of the cap remains uncontaminated will be collected.
- Sediment vertical profiling system (SVPS) and benthic collections will no longer be used based on results from previous monitoring events.
- Site Condition Indices (SCIs) are no longer relevant and will no longer be used to describe cap areas.
- Monitoring for movement of contaminants through the sheet pile wall will occur under the Soil and Groundwater OUs based on achievement of upland source control.
- Off-cap subtidal areas have been verified as uncontaminated (EPA, 1995a, 1997, 2000a) and will no longer be monitored.
- If SMS criteria are exceeded on the sediment cap, PAH fingerprinting (via measuring the full nonalkylated and alkylated PAH list) may be used for surface sediments to identify PAH sources.

No opportunities for optimization were identified in this review period.

7.1.3.3 Implementation of Institutional Controls

The institutional controls in place include prohibitions on anchoring on the sediment cap, harvesting shellfish from the intertidal areas around the site, and walking on contaminated East and West Beach intertidal areas. Observed human activities that violate the institutional controls include people walking on the East Beach during low tide. Areas of known contamination on the West Beach have been roped off, and the EBS will be constructed over the contaminated sediments. No other human activities in violation of institutional controls in the East Harbor OU have been observed. In 2004 a whale was observed to be bottom-feeding on the subtidal cap; however, no significant damage was identified using bathymetric surveys.

7.1.3.4 Early Indicators of Potential Issues

As noted above, PAH fingerprinting may be used for subtidal capped surface sediments. It may become necessary to identify the source of PAHs on the cap surface due to known increasing concentrations of PAHs throughout the harbor, likely due to non-point sources. Fingerprinting data evaluation will only occur if criteria exceedances are identified during regular monitoring events.

New remediation efforts on the West Beach are ongoing as described in Section 4.3.2. These efforts will continue to be monitored under the East Harbor OMMP.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?

7.2.1 Exposure Assessment

The following is a review of pertinent information to determine whether exposure assumptions have been substantially altered over the Five-Year Review period.

7.2.1.1 East Harbor OU Exposure of Fish to PAHs from Eagle Harbor Sediments and Surface Water

Although exposure to fish is not a new pathway, it has been assumed since the time of the East Harbor ROD development that sediment cleanup levels or groundwater cleanup levels protective of benthic organisms would be fully protective of fish. Scientific information that became available during this Five-Year Review period and which may prompt re-evaluation of this assumption is presented in Appendix F.

7.2.1.2 East Harbor OU West Beach Recreational Use — Direct Contact

The discovery of contamination along a portion of the East Harbor OU that is accessed by the public necessitated an evaluation of potential risks associated with direct contact with the contaminated sediments. Washington State MTCA Method B soil cleanup levels were used to evaluate this pathway (Table 6) and will be added as RAOs for this portion of the OU via the ESD. For the most part, the locations where the MTCA Method B soil cleanup levels were exceeded coincide with locations where the SQS standards have been exceeded. The EBS scheduled for construction in the fall of 2007 will cover sediments contaminated in excess of both the SQS and the MTCA Method B soil cleanup levels, and will cut off the direct exposure pathway for recreational users at the West Beach.

7.2.1.3 East Harbor OU West Beach Recreational Use — Surface Water

Surface water was sampled during this Five-Year Review period in order to evaluate potential risks for recreational swimmers at the West Beach, East Beach, Inner Harbor (area background), and Murden Cove (area background) to determine whether the exposure pathway via swimming is significant. Surface water sampling results are presented in Table 14.

For the non-cancer screening values, no samples exceeded the conservatively-set screening levels or cancer screening values. For PAHs, no results exceeded the screening levels for acenaphthylene, anthracene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, or phenanthrene. However, despite the low-level analytical methods used (selected ion monitoring [SIM]; EPA, 2004), the laboratory's detection limits were greater than the risk-based screening levels for the cancer screening values. Hence, although it is believed that human health is protected, analytical limitations regarding these compounds dictate that protectiveness remains indeterminate for all compounds tested except benzo(a)anthracene.

Three PAHs (benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene) and PCP were reported in some samples as estimated concentrations less than the laboratory reporting limits and slightly above the detection limits. Of the environmental samples, only benzo(b)fluoranthene exceeded the screening level, and ranged from risks of 8.8E-05 to 1.1E-04 excess lifetime cancer risk as an upper limit. However, based upon the presence of these four PAHs in the method blank and the potential for carryover during analysis of the deuterated surrogate standards for these same compounds, USACE (2005b) concluded that the estimated detections of these four compounds near the detection limit may have been artifacts of the low-level analysis methods used. Hence, it is believed that their presence may not have been representative of environmental conditions. It is expected that ATSDR will further evaluate recreational exposure to surface water as part of the health consultation.

7.2.1.4 Tribal Subsistence Seafood Consumption Rates

The Risk Assessment documented in the RI Report for the Wyckoff Soil and Groundwater OUs (CH2M HILL, 1997) used a recreational exposure scenario for fish and shellfish. New information will be evaluated to determine the potential risks associated with tribal consumption of fish and shellfish in accordance with the 2000 Suquamish Tribe fish consumption survey and EPA's *Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia*, (EPA, 2007b).

Eagle Harbor is in the Usual and Accustomed area for harvesting of fish and shellfish by the Suquamish Tribe. The Suquamish Tribe's current fishing regulations prohibit the harvesting of bottomfish west of a line projected from Wing Point to the entrance light of Eagle Harbor. The Suquamish Tribe also uses the Washington State Department of Health (DOH) commercial shellfish growing area classification for regulating the subsistence, ceremonial, and commercial harvesting of shellfish. The Suquamish Tribe does not open areas for shellfish harvesting that have an Unclassified or a Prohibited classification. The DOH commercial shellfish growing area classification for Eagle Harbor is currently Unclassified.

7.2.1.5 Health District Shellfish Closure Advisories

The Bremerton-Kitsap County Health Department maintains fishing health advisories[2] and provides public hazard education regarding the harvesting of fish, crab, and shellfish in Eagle Harbor.

7.2.2 Toxicity Assessment

The First Five-Year Review concluded that all toxicity values remained valid and protective. The following is a review of toxicological information to determine whether toxicity or other characteristics of site-related contaminants have substantially altered over the Second Five-Year Review period.

7.2.2.1 PAHs and PCP — Human Health

A review of COC toxicity values was accomplished by consulting EPA sources: the Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), EPA Provisional Peer-Reviewed Toxicity Values, the U.S. Department of Energy's Risk Assessment Information System (RAIS), and other sources of toxicity information. Individual PAH toxicity values have not been updated in IRIS since 1994, with the exception of naphthalene which had a toxicological reassessment on IRIS in 1998. PAH toxicity equivalence factors (TEFs; EPA, 1993 and California EPA [Cal EPA], 1994) relative to benzo(a)pyrene are used by Ecology in the MTCA guidance, which is the basis for the soil and groundwater cleanup levels. These have not changed since the First Five-Year Review was completed. PCP toxicity was last revisited by EPA in 1998, and has also not changed in the last five years.

(It should be noted that Cal EPA has determined that naphthalene is a carcinogen, and this determination is being used for remediation of a former-wood-treater NPL site located in that state. However, EPA still regards naphthalene as a Class C carcinogen for which insufficient evidence exists to assign a carcinogenic slope factor. Therefore, the recent Cal EPA slope factor for naphthalene is not considered to indicate lack of protectiveness.)

In summary, no significant changes to human-health-related toxicity values for PAH compounds or PCP have occurred during this Second Five-Year Review period.

The ROD for the East Harbor OU (EPA, 1994) selected the Washington State SMS MCULs for protection of benthos and human health, and for organic compounds the MCULs are organic-carbon-normalized. The values have not been updated since the First Five-Year Review was

---

[2] Eagle Harbor west of Wing Point is currently closed to the harvesting of all species of shellfish, crab, bottomfish, and rockfish. Shellfish closure advisories for Eagle Harbor and other areas of Kitsap County are posted on the County's hotline (1-800-223-9355) and the following web site: *http://www.kitsapcountyhealth.com/environmenta_health/water_quality/shellfish_closures.htm*

completed, and there are no sediment-based human health standards promulgated in the State of Washington.

7.2.2.2 PAHs and PCP — Ecological Health

The groundwater cleanup levels are shown in Table 1. LPAHs include 2- and 3-ring forms; HPAHs include 4- or higher-ring forms. The lowest groundwater cleanup levels are for the 4- and 5-ring carcinogenic PAHs (0.0296 µg/L) and HPAHs (0.254 µg/L). For LPAHs, the cleanup levels are considerably higher, up to 83 µg/L for naphthalene and 3.9 µg/L for 3-ring PAHs (e.g., fluorene and phenanthrene).

No definitive information has come to EPA's attention during this Five-Year Review period that suggests that these values would not also protect ecological receptors. However, some developing scientific information (see Section 7.3) is recommended for review for relevance to ecological protectiveness during the next Five-Year Review period.

7.2.2.3 Dioxins and Furans — Human Health

According to IRIS (see Section 7.2.2.1), the 2,3,7,8-tetrachloro-p-dibenzodioxin (TCDD) carcinogenic slope value has not been altered within the past five years. Dioxin/furan TEFs have altered slightly. Both the 1998 and 2005 World Health Organization updates (Van den Berg et al., 1998, 2005) have generally increased the apparent toxicity of the dioxin mixtures over the initial risk assessment, which was based upon the EPA (1987) mammalian TEFs. Soil cleanup levels in the ROD for the Wyckoff Soil and Groundwater OUs (EPA, 2000) used MTCA B toxicity equivalent (TEQ) calculation methods with the Van den Berg et al. (1998) TEFs. The changes from Van den Berg et al. (1998) to Van den Berg et al. (2005) are minor, as shown in Table 15. These changes are not believed to significantly affect the protectiveness of the remedy. Fish and avian TEFs have not been altered since Van den Berg et al. (1998).

7.2.2.4 Mercury and Methyl Mercury — Human Health

The IRIS values for mercury have not changed since 1995.

7.2.3 Risk Characterization/Uncertainty Analysis

Human health effects in the beach areas will be addressed in part though an ATSDR Human Health consultation in 2007/2008. The existing fish and shellfish advisory is believed to be adequate to manage health effects from seafood consumption

No new regulatory values have suggested that ecological risk estimates have altered. Recommendations advanced in the paragraphs above mainly relate to ecological health centered on effects on fish.

7.2.4 Potential New ARARs and TBCs

With the exception of MTCA Method B cleanup levels for the West Beach, which will be documented in an ESD, no newly-promulgated standards or changes in standards or To Be Considered criteria (TBCs) have been identified during this Five-Year Review.

7.2.5 Progress Towards Meeting RAOs

7.2.5.1 Soil and Groundwater OUs

In combination with the sheet pile containment wall, the existing groundwater treatment and extraction system ensures that NAPL and contaminated groundwater in the upper aquifer are not leaving the Former Process Area. Evidence to support this conclusion is provided by continuous water-level monitoring conducted across the Former Process Area. This monitoring indicates that the current pumping rates are maintaining hydraulic control across the site by producing an inward hydraulic gradient within the contaminated upper aquifer and an upward gradient from the lower aquifer to the upper aquifer.

7.2.5.2 West Harbor OU

As indicated in Section 4.2.3, West Harbor OU goals have been met and continued monitoring will provide information for the next Five-Year Review.

7.2.5.3 East Harbor OU

The subtidal cap is achieving RAOs at this time. However, developing information suggests the potential for future PAH penetration of the cap. The East Beach does not meet RAOs, nor do limited areas on the North Shoal.

7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

7.3.1 Soil and Groundwater OUs

There is some uncertainty about the location and depth of the aquitard beneath the southeastern corner of the Former Process Area. A series of exploratory borings will be advanced in the southeastern portion of the site to reduce the uncertainty about the aquitard. The containment remedy design will be adjusted as necessary (e.g., through the installation of an additional sheet pile or containment wall) to reflect the findings of the investigation.

7.3.2 West Harbor OU

No information has been identified that could call into question the protectiveness of the remedy.

7.3.3 East Harbor OU

Based on the exposure and toxicity assessment provided above, ecological risks are adequately addressed at the site based on information known at the time of remedy implementation. There have been no changes in the regulatory standards for surface water and sediments.

7.4 Technical Assessment Summary

Multiple opportunities for optimization have been identified for the Soil and Groundwater OUs. The majority of these opportunities are currently being addressed by EPA. Appropriate institutional controls have been implemented for all OUs. Early indicators of potential issues have been identified for the East Harbor OU and are currently expected to be addressed by the long-term monitoring.

8. Issues, Recommendations, and Follow-Up Actions

This Five-Year Review found that where the remedial actions have been implemented for each OU, the work was done in accordance with the requirements of the RODs. Immediate threats have been addressed. EPA will continue to monitor the remedies that are in place to confirm continued protectiveness. Outstanding issues and follow-up actions to be addressed to ensure ongoing protectiveness of human health and the environment are summarized below and listed in Table 16.

8.1 Soil and Groundwater OUs

While soil and groundwater contamination remain in the Former Process Area, ongoing O&M of the groundwater extraction and treatment system and institutional controls are addressing immediate threats. Contamination within the Former Process Area is currently stable and conditions are protective of human health and the environment. EPA expects to issue an ESD for the contingency containment remedy and proceed with implementation of the remedy pending the outcome of discussions with the regulatory stakeholders.

8.2 East Harbor OU

Construction of an EBS in the fall/winter of 2007 will address residual contamination in the West Beach intertidal area. Residual contamination in the North Shoal and East Beach areas will continue to be monitored and additional potential response actions will be evaluated, as appropriate, based on the results of the continued monitoring. Existing ROD criteria will be re-evaluated as necessary for: (1) new information relating to potential risks of tribal consumption of fish and shellfish in accordance with the EPA Framework (2007b); and (2) effects of sediment contamination on juvenile fish and fish eggs based on recent and expected scientific information.

8.3 Overall Human Health Issues

At the request of EPA, the ASTDR is conducting a health consultation for all four OUs at the Wyckoff/Eagle Harbor Superfund Site to evaluate any potential public health issues related to real or possible human exposure to toxic material at any of the OUs at the Site.

9. Protectiveness Summary

All immediate threats at the site have been addressed through containment of contaminated soil and groundwater with a pump-and-treat system and sheet pile wall, removal and consolidation of contaminated soil, removal and capping of sediments, and the installation of fencing and warning/fish advisory signs. The long-term protectiveness of the remedial actions will be verified by additional monitoring and data collection as outlined in Table 16.

9.1 West Harbor OU

The remedies have been implemented and are achieving the ROD objectives and ARARs. Institutional controls are effective in controlling access to the upland areas, and fish advisories are in place.

9.2 East Harbor OU

Phases 1-3 of the subtidal and intertidal cap have been implemented and are protective of human health and the environment. The remedy for residual contamination in the West Beach intertidal area is expected to be protective of human health and the environment upon completion and, in the interim, institutional controls are in place to limit exposure. Areas of residual contamination in the North Shoal and East Beach areas are posted to restrict public access. Fish advisories are in place to prevent the ingestion of contaminated fish and shellfish.

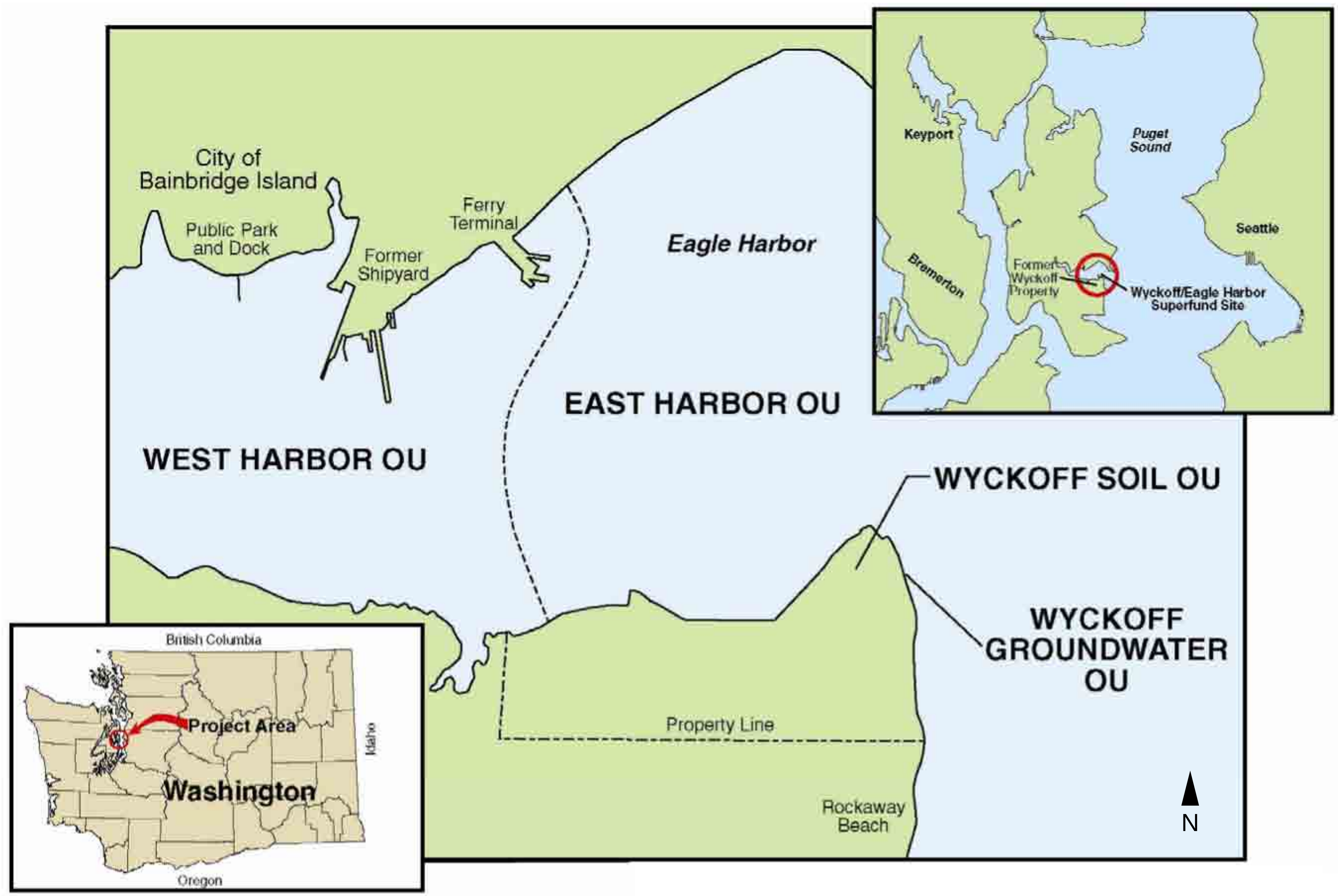
9.3 Soil and Groundwater OUs

The final soil and groundwater remedy for the Former Process Area is expected to be documented in 2008. The remedy is expected to be protective of human health and the environment and to comply with ARARs upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through operation of the groundwater extraction and treatment system and institutional controls to prevent exposure to contaminated soil and groundwater.

10. Next Five-Year Review

The Third Five-Year Review for the Wyckoff/Eagle Harbor Superfund Site is required to be completed by September 26, 2012, five years from the completion date of this Second Five-Year Review.

FIGURES



OU - Operable Unit

Figure 1
Wyckoff Site and Vicinity

SECOND FIVE-YEAR REVIEW REPORT
WYCKOFF/EAGLE HARBOR SUPERFUND SITE

316783.ds.07_ES092007001SEA WEHSS_01_SiteVicinity_v2.ai 091907_rd

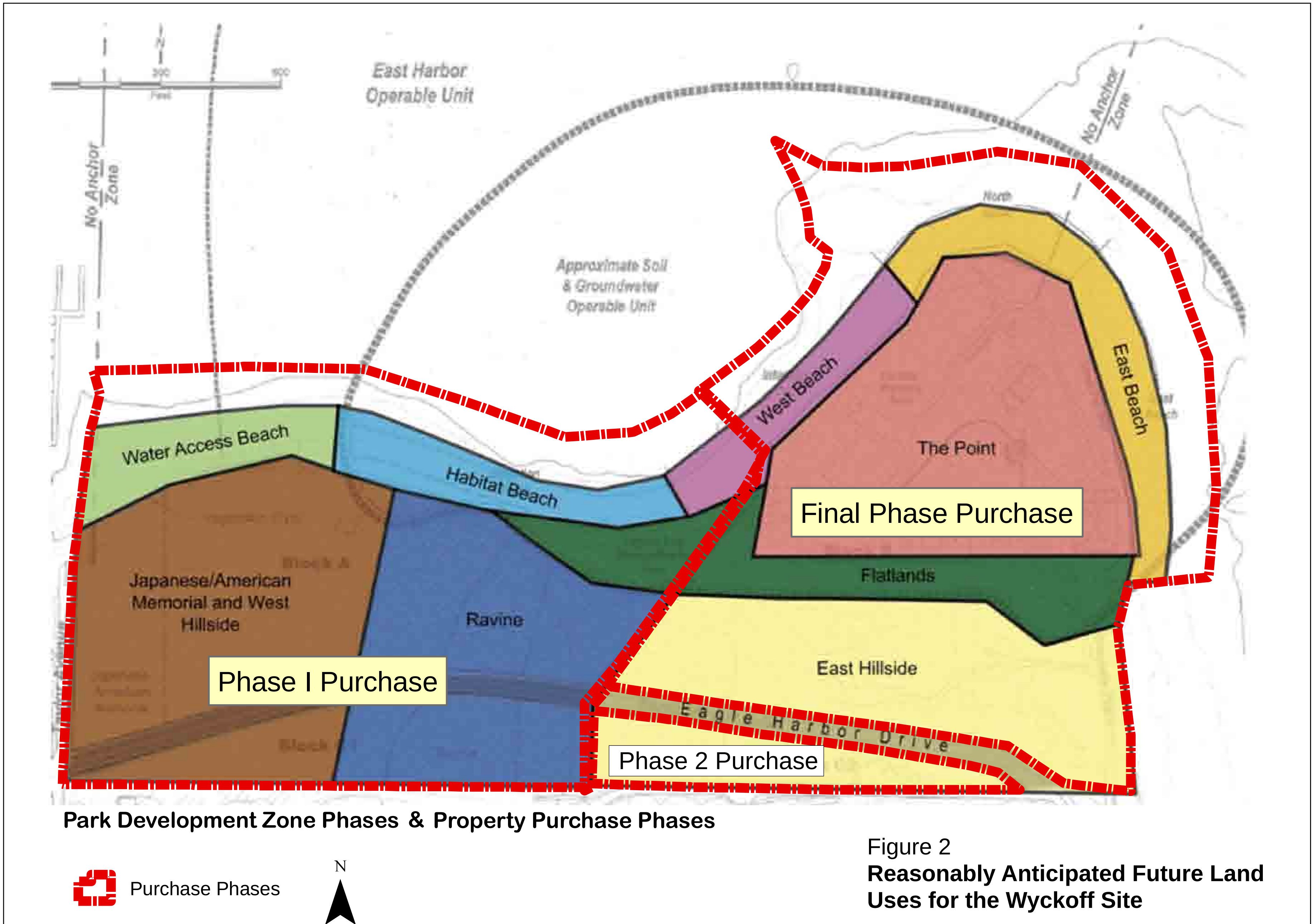
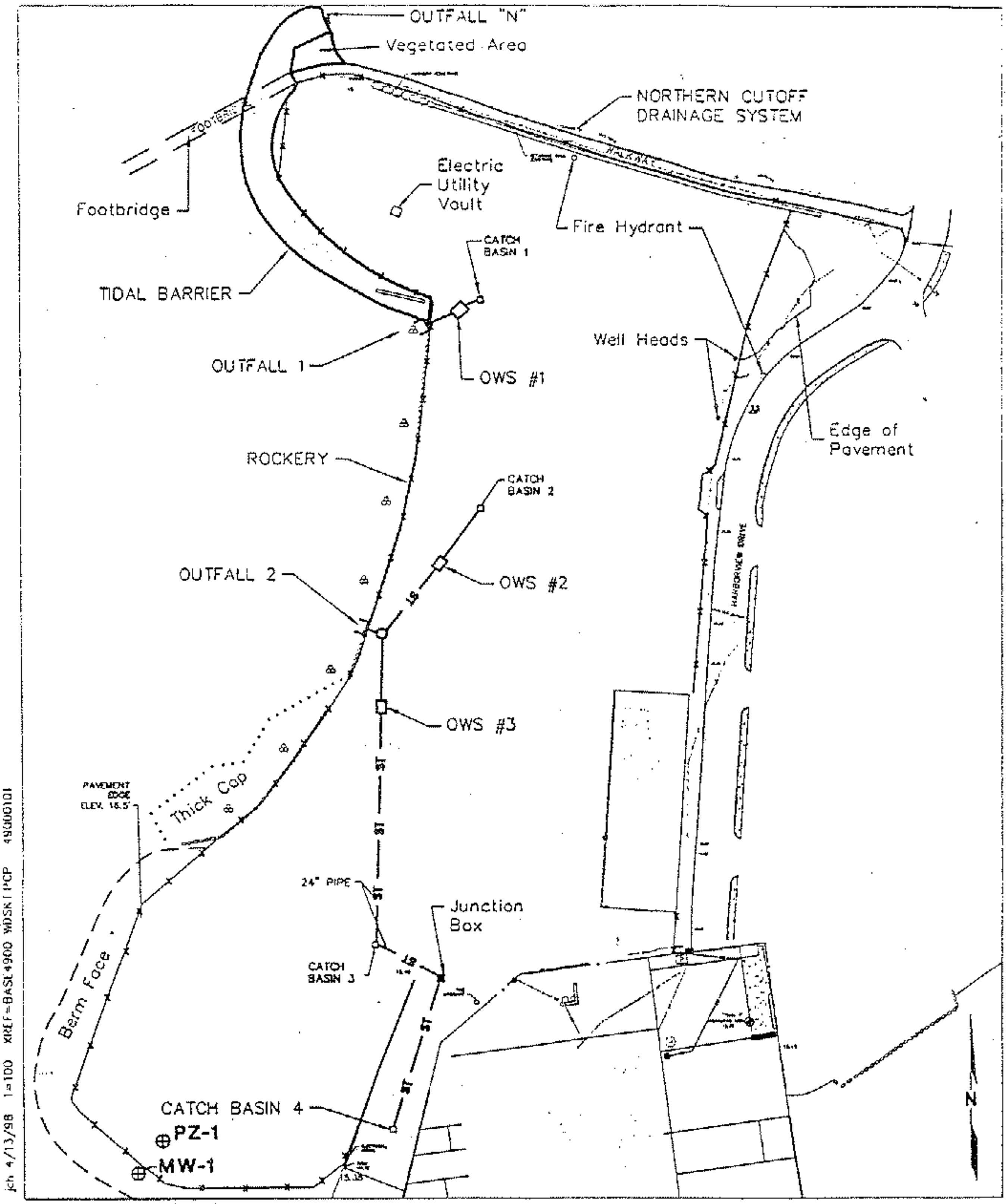


Figure 2
Reasonably Anticipated Future Land Uses for the Wyckoff Site

SECOND FIVE-YEAR REVIEW REPORT
WYCKOFF/EAGLE HARBOR SUPERFUND SITE

316783.ds.07_ES092007001SEA WEHSS_02_ReasonFutureLandUses_v1.ai 092007_rd



.	Area of New Asphalt Concrete Pavement
▫	Catch Basin
O	Manhole
✖	Junction Box
— ST —	Storm Drainage Line
—x—	Type 3 Chain Link Fence
▢	Oil Water Separator
⊕ MW-1	Monitoring Well (MW) or Piezometer (PZ) Location and Number

0 100 200
Scale in Feet

HARTCROWSER

Figure 3
West Harbor OU Remediation Components
SECOND FIVE-YEAR REVIEW REPORT
WYCKOFF/EAGLE HARBOR SUPERFUND SITE

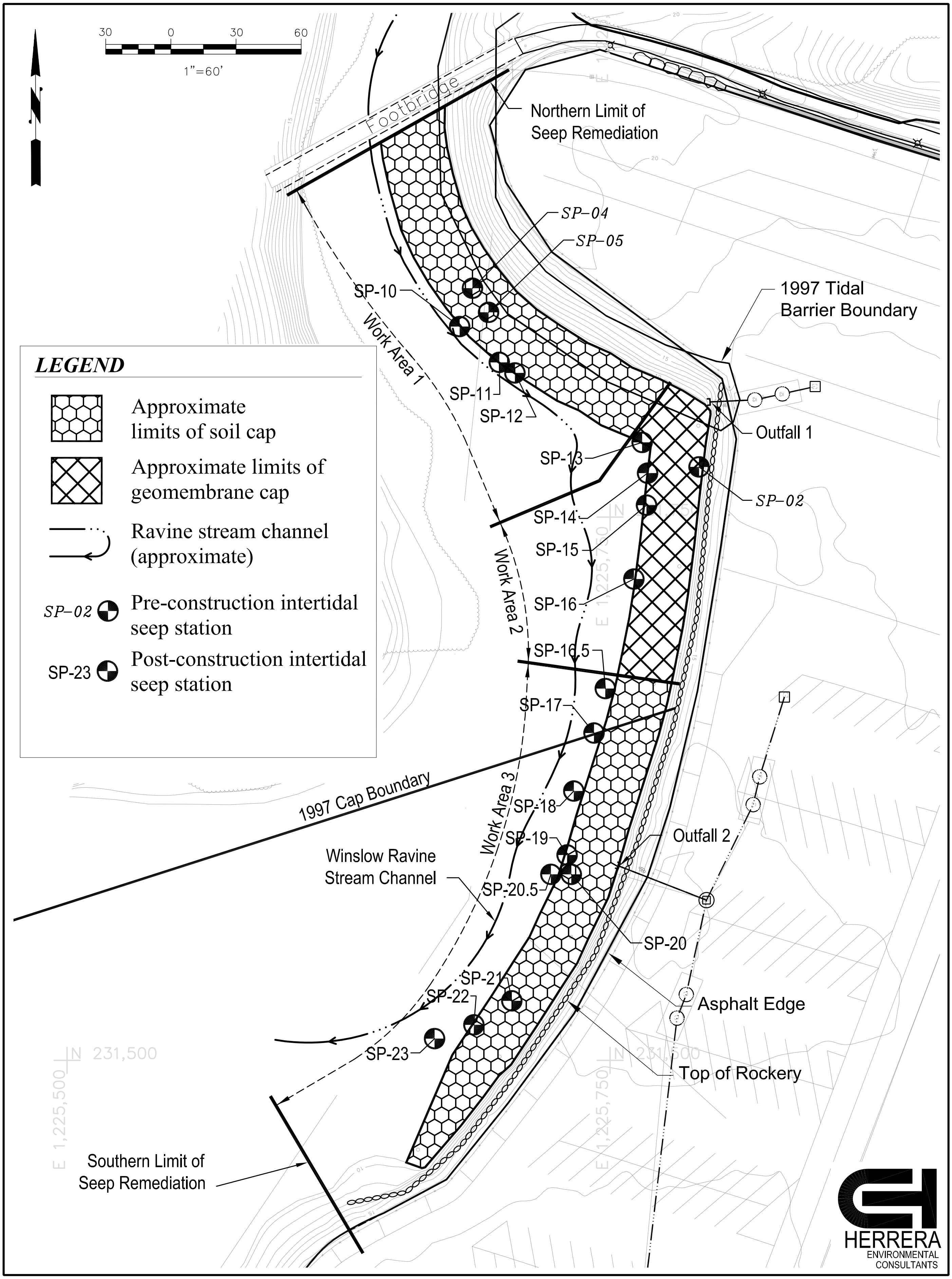
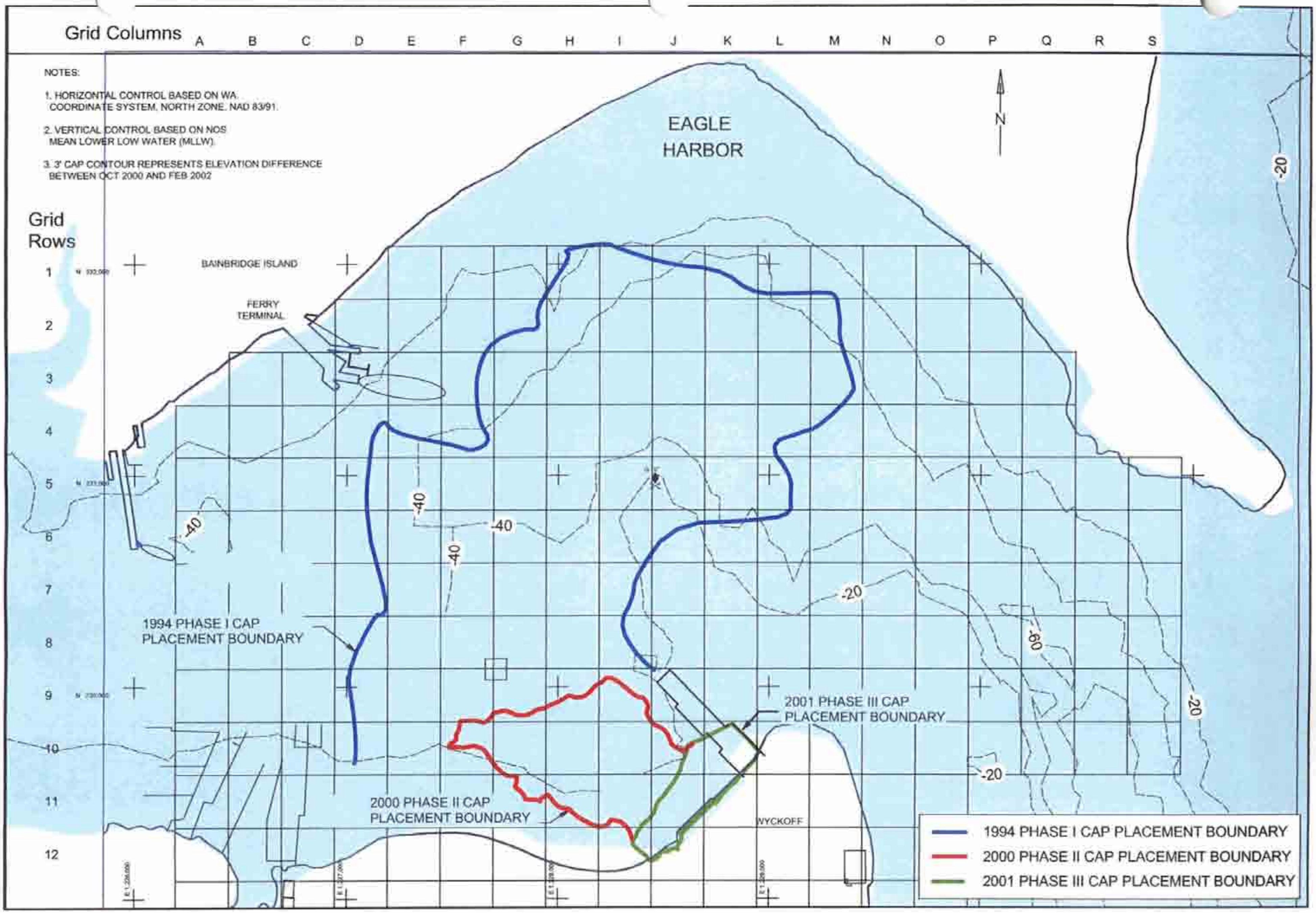


Figure 4. West Harbor OU Intertidal Seep Remediation Area

SECOND FIVE-YEAR REVIEW REPORT

WYCKOFF/EAGLE HARBOR SUPERFUND SITE



integral consulting inc.

Map Document: (C:\GIS\Projects\Eagle_Harbor\Monitoring MXD\Final_MXDs_20040412\1-2_Location_of_Caps_20040412.mxd)
Plot Date: 05/12/2004

Basemap from USACE 2002

N

0 200 400 800 Feet

Figure 5

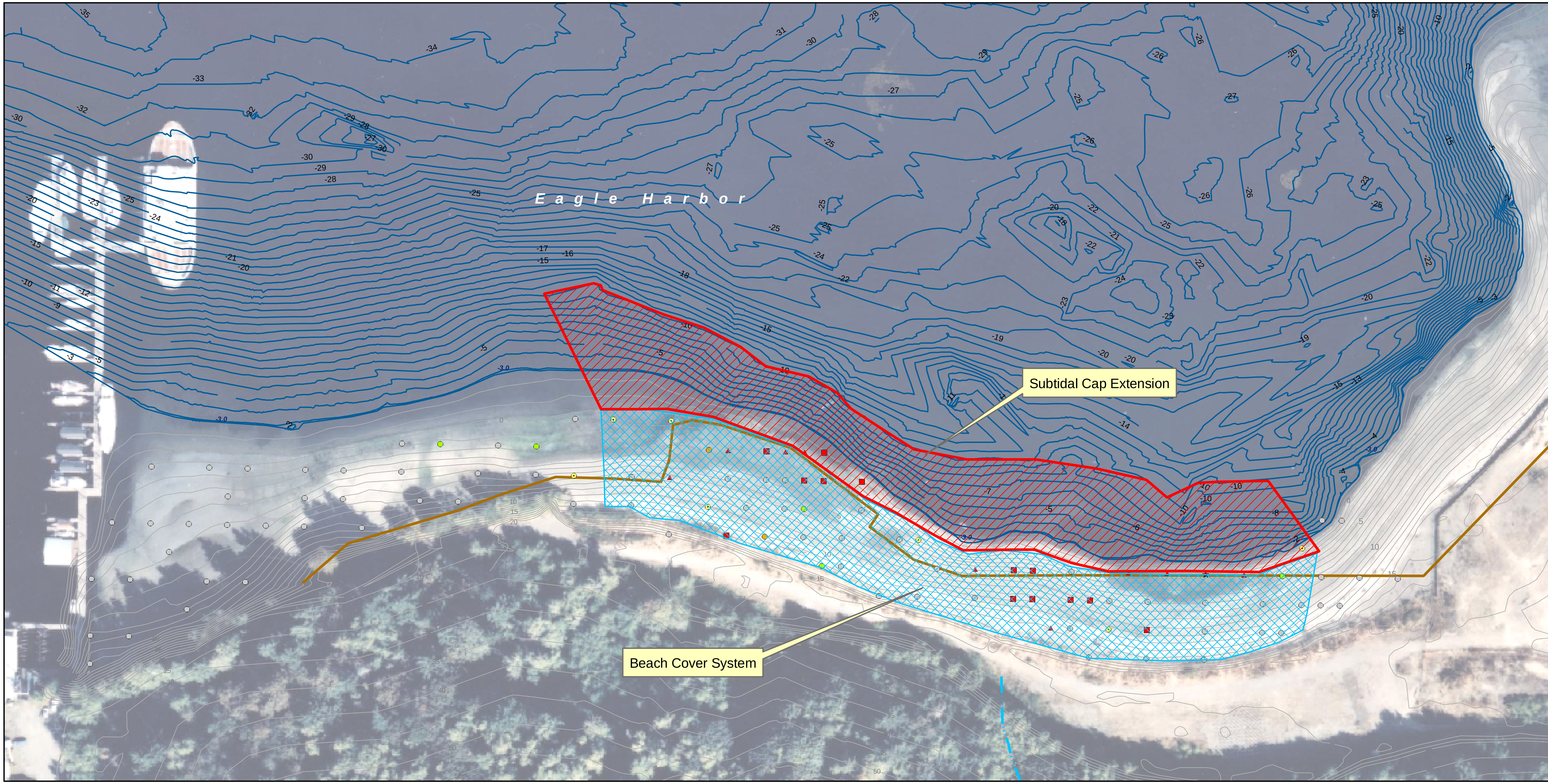
East Harbor OU Sediment Cap Phases

SECOND FIVE-YEAR REVIEW REPORT

WYCKOFF/EAGLE HARBOR SUPERFUND SITE

Figure 6
East Harbor OU: West Beach Historical Features and Current Beach Configuration
SECOND FIVE-YEAR REVIEW REPORT
WYCKOFF/EAGLE HARBOR SUPERFUND SITE

File Path: P:\URSGreiner\180776\GIS\Layouts\Beach\West_Beach_HistFeartures.mxd, Date: April 10, 2006 2PM



Subtidal Cap Extension

Beach Cover System Area

Exceedance Magnitude

- >100X cleanup level
- 10 - 100X cleanup level
- Visual contamination, no samples
- 5 - 10X cleanup level
- 2 - 5X cleanup level
- < 2X cleanup level (MTCA only)
- No exceedances, no visual contamination

N

0 50 100 200 Feet

Figure 7
East Harbor OU: West Beach Cover System and Subtidal Cap Extension Areas

SECOND FIVE-YEAR REVIEW REPORT
WYCKOFF/EAGLE HARBOR SUPERFUND SITE

File Path: P:\URSGreiner\180776\GIS\Layouts

Integral Consulting, Inc.
Eagle Harbor EHOU 2004 Year 8 Monitoring
Draft Final Report
May 12, 2004

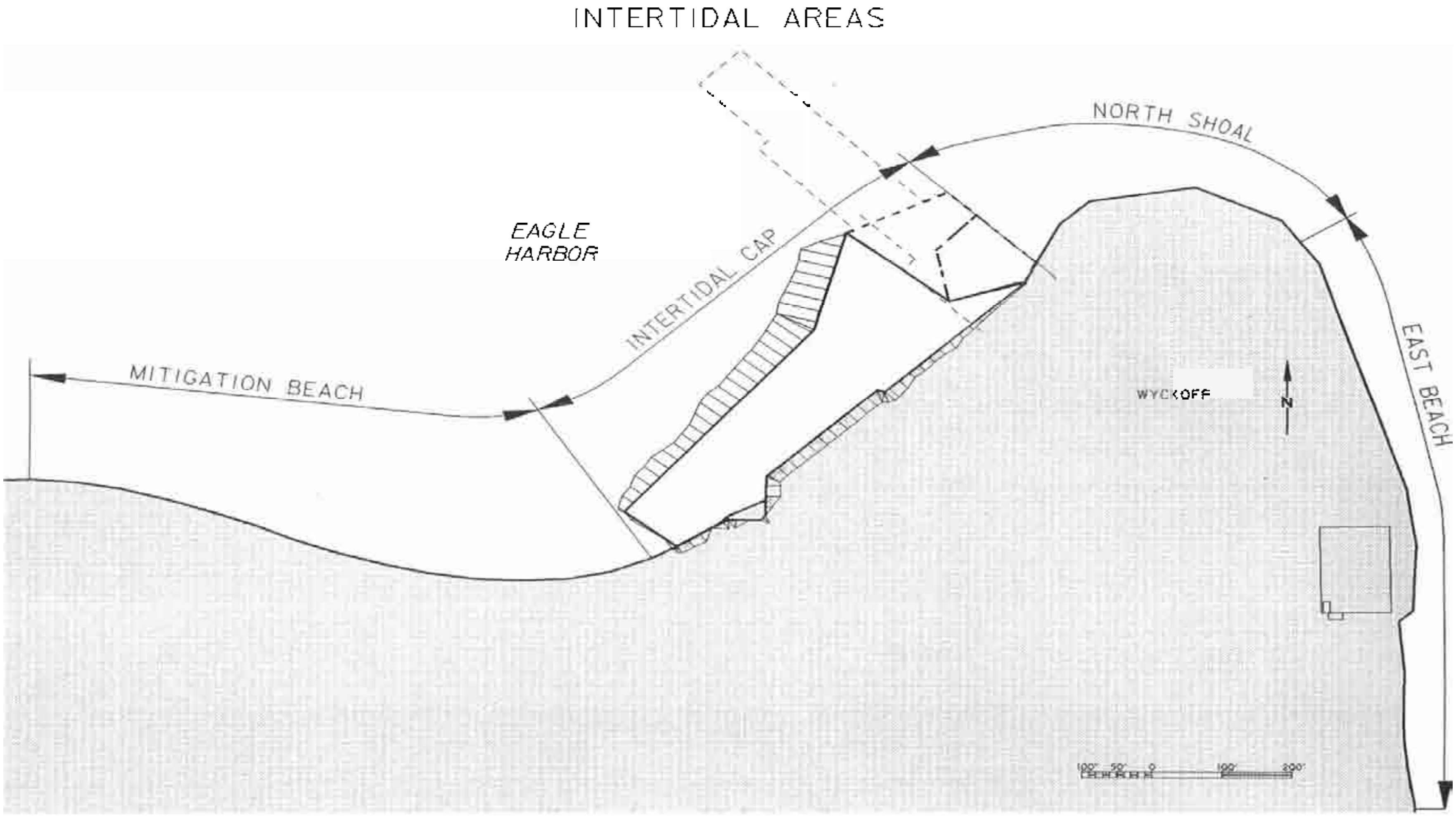


Figure 8
East Harbor OU Intertidal Area Designations
SECOND FIVE-YEAR REVIEW REPORT
WYCKOFF/EAGLE HARBOR SUPERFUND SITE

TABLES

TABLE 1
Groundwater Cleanup Levels for the Groundwater OU (µg/L)
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Chemical of Concern	WA SW Quality Stds. (173-201A WAC)	MTCA Method B SW for Human Consumption of Organisms (173-340 WAC)[b]	Federal WQ Standards/NTR (40 CFR 131)		Federal WQ Criteria		Calculated Pore-Water Concentrations Based on SMS or HH	Groundwater Cleanup Level[c]
			Marine Chronic	Human Cons. of Orgs.	Marine Chronic	Human Cons. of Orgs.		
Naphthalene		9880					83	83
Acenaphthylene								
Acenaphthene		643				2,700	3	3
Fluorene		3,460		14,000		14,000	3	3
Phenanthrene								
Anthracene		25,900		110,000		110,000	9	9
Fluoranthene		90		370		370	3	3
Pyrene		2,590		11,000		11,000	15	15
Benzo(a)anthracene		0.0296		0.031		0.049	0.308	0.0296
Chrysene		0.0296		0.031		0.049	0.262	0.0296
Benzo(b)fluoranthene		0.0296		0.031		0.049	0.079	0.0296
Benzo(k)fluoranthene		0.0296		0.031		0.049	0.079	0.0296
Benzo(a)pyrene		0.0296		0.031		0.049	0.102	0.0296
Dibenzo(a,h)anthracene		0.0296		0.031		0.049	0.007	0.007
Benzo(g,h,i)perylene								
Indeno(1,2,3-cd)pyrene		0.0296		0.031		0.049		0.0296
HPAHs							0.254	0.254
Pentachlorophenol	7.9[a]	4.9	143	8.2	7.9	8.2	880	4.9

Notes:

[a] Chronic criteria
[b] Values obtained from MTCA Cleanup Levels and Risk Calculations (CLARC II) Update (February 1996).
[c] Where there is no cleanup level specified for a certain chemical, benzo(a)pyrene will be used as an indicator chemical during remediation. Groundwater cleanup levels will be measured at the point of compliance.

Reference: *Wyckoff/Eagle Harbor Superfund Site, Soil and Groundwater Operable Units, Bainbridge Island, Washington: Record of Decision* (U.S. Environmental Protection Agency, February 2000).

TABLE 1
Groundwater Cleanup Levels for the Groundwater OU (µg/L)
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Chemical of Concern	WA SW Quality Stds. (173-201A WAC)	MTCA Method B SW for Human Consumption of Organisms (173-340 WAC)[b]	Federal WQ Standards/NTR (40 CFR 131)		Federal WQ Criteria		Calculated Pore-Water Concentrations Based on SMS or HH	Groundwater Cleanup Level[c]
			Marine Chronic	Human Cons. of Orgs.	Marine Chronic	Human Cons. of Orgs.		

Cons. of Orgs. = Consumption of organisms
HH = human health
HPAHs = high-molecular-weight polycyclic aromatic hydrocarbons
MTCA = Model Toxics Control Act
NTR = National Toxics Rule
SMS = Sediment Management Standards
WA = Washington State
WAC = Washington Administrative Code
WQ = Water Quality
µg/L = micrograms per liter

TABLE 2
Soil Cleanup Levels for the Soil OU
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Chemical of Concern	Soil Cleanup Level (µg/kg)[a, b]
Naphthalene	3.20E+06
Acenaphthylene	NA
Acenaphthene	4.80E+06
Fluorene	3.20E+06
Phenanthrene	NA
Anthracene	2.40E+07
Fluoranthene	3.20E+06
Pyrene	2.40E+06
Benzo(a)anthracene	1.37E+02
Chrysene	1.37E+02
Benzo(b)fluoranthene	1.37E+02
Benzo(k)fluoranthene	1.37E+02
Benzo(a)pyrene	1.37E+02
Dibenzo(a,h)anthracene	1.37E+02
Benzo(g,h,i)perylene	NA
Indeno(1,2,3-c,d)pyrene	1.37E+02
Dioxin (2,3,7,8-TCDD)/TEF [c]	6.67E-03
Pentachlorophenol	8.33E+03

Notes:

[a] For surface soil to 15 feet bgs, the most stringent of Method B levels will need to be met. If the levels cannot be practically met, then a point of compliance will be established in the soils for direct contact at the ground surface. µg/kg = micrograms per kilogram.

[b] Model Toxics Control Act (MTCA) Cleanup Levels and Risk Calculation (CLARCII) Update, February 1996. Where both cancer and non-cancer values are provided, the most stringent are used.

Concentrations of individual hazardous substances shall be adjusted downward to take into account exposure to multiple hazardous substances and/or exposure resulting from more than one pathway of exposure. In making these adjustments, the hazard index shall not exceed 1 and the total excess cancer risk shall not exceed one in one hundred thousand (MTCA Chapter 173-340 WAC).

[c] Chlorinated Dioxin/Furan Toxicity Equivalence Factor (expressed as 2,3,7,8 TCDD toxicity equivalent [TEQ])

NA = There were no values available for these chemicals in CLARCII. For purposes of cleanup, assume they are co-located with other polycyclic aromatic hydrocarbons (PAHs).

Reference: *Wyckoff/Eagle Harbor Superfund Site, Soil and Groundwater Operable Units, Bainbridge Island, Washington: Record of Decision* (U.S. Environmental Protection Agency, February 2000).

TABLE 3
Annual System Operation and Maintenance Costs for the Soil and Groundwater OUs
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Dates	Total Costs Rounded to Nearest $1,000
October 2002 through September 2003	$2,192,000
October 2003 through September 2004	$1,492,000
October 2004 through September 2005	$1,010,000
October 2005 through September 2006	$593,000
October 2006 through May 2007	$448,000

TABLE 4
Summary of Post-Remediation Monitoring Activities Occurring from Year 1 (1998) through Year 10 (2007) at the West Harbor OU
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Monitoring Component	Location	Period	Frequency	Analytes (EPA Method)	Notes
Inspection					
Site	West Harbor OU	1998 - 2007	Annual (winter)	Site inspection form	As per OMMP.
Stormwater	West Harbor OU	1998 - 2001	3 per year (winter)	Stormwater inspection form	As per OMMP.
	West Harbor OU	2001 - 2007	Annual (winter)	Stormwater inspection form	Reduced frequency approved by EPA.
Water Quality					
Piezometers	PZ-02, PZ-03	8/6-11/1998	5 days continuous	Water surface elevation in CDF	As per OMMP.
	PZ-02, PZ-03	12/1998 - 1999	Quarterly (6 events)	Water surface elevation in CDF	Supplemental data.
	PZ-02, PZ-03	2000 - 2007	Semiannual (14 events)	Water surface elevation in CDF	Supplemental data.
Groundwater	MW-01, WP-01, WP-02	2/1998 - 7/1998	Quarterly (3 events)	Field parameters; Hg (1631); Cu, Pb, Zn (6020)	As per OMMP and SAP/QAPP for minimum of 2 years.
	MW-01, WP-01, WP-02	12/1998 - 6/1999	Quarterly (3 events)	Field parameters; Hg (1631); Cu, Pb, Zn (200.9)	Revised method for Cu, Pb, and Zn due to salt interference.
	MW-01, WP-01, WP-02	8/1999 - 11/1999	Quarterly (2 events)	Field parameters; Hg (1631); Cu, Pb, Zn (1640)	Revised method for Cu, Pb, and Zn due to salt interference.
	MW-01	2000 - 2007	Annually (7 events)	Field parameters; Hg (1631); Cu, Zn (1640/1638)	Reduced frequency and terminated Pb due to low levels.
	WP-01, WP-02	2000 - 2001	Semiannual (4 events)	Field parameters; Hg (1631); Cu, Zn (1640)	Well point monitoring terminated due to low metals.

TABLE 4
Summary of Post-Remediation Monitoring Activities Occurring from Year 1 (1998) through Year 10 (2007) at the West Harbor OU
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Monitoring Component	Location	Period	Frequency	Analytes (EPA Method)	Notes
	MW-01	11/2005	Additional event	Field parameters; Hg (1631); Cu, Zn (1640)	Added event due to overestimated Cu at MW-01 by Method 1638.
	WP-01, WP-02	5/2005, 11/2005	Additional events	Field parameters; Hg (1631); Cu, Pb, Zn (1638, 1640)	Added events due to overestimated Cu at MW-01 by Method 1638.
Surface Water	PS-01 (access by boat)	1998	Quarterly (4 events)	Field parameters; Hg (1631); Cu, Pb, Zn (6020)	As per OMMP and SAP/QAPP for minimum of 2 years.
	PS-02 (moved to shore)	1999	Quarterly (4 events)	Field parameters; Hg (1631); Cu, Pb, Zn (200.9/1640)	Moved station and revised metals methods.
	RS-02, RS-03, (RS-01 once)	2003 - 2004	Semiannual (4 events)	Field parameters; Cu, Zn (1640/1638)	Added stream stations for seep impact analysis.
Intertidal Seeps	SP-01	2/1998 - 6/1999	Quarterly (6 events)	Field parameters; Hg (1631); Cu, Pb, Zn (6020/200.9)	OMMP specified seep monitoring in 1999 and 2001 only.
	SP-02	6/2000 - 5/2005	Quarterly/annually (12 events)	Field parameters; Hg (1631); Cu, Pb, Zn (1640/1638)	Terminated Pb in 2002 due to low levels.
	SP-04, (SP-05 once)	12/2001 - 12/2004	Semiannually (7 events)	Field parameters; Hg (1631); Cu, Zn (1640/1638)	Consistently high Cu and Zn led to seep remediation.
	SP-11, SP-16, SP-23	10/2006 - 2007	Semiannually (3 events)	Field parameters; Cu, Zn (1640)	Initiated 6 weeks after seep remediation.
Sediment Quality					
Surface Sediments	10 cap, 2 off-cap stations	1999, 2001, 2005	3 sampling events	Hg (1631/7471A)	As per OMMP.
Sediment Trap	EH-03 (duplicates)	1999, 2001, 2005	3 sampling events	Hg (1631); Cu, Pb, Zn (200.9/1638)	As per OMMP and SAP.
Bathymetric Survey	Cap area	1999, 2001, 2005	3 surveys	Sediment surface elevation, erosion analysis	As per OMMP.

TABLE 4
Summary of Post-Remediation Monitoring Activities Occurring from Year 1 (1998) through Year 10 (2007) at the West Harbor OU
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Monitoring Component	Location	Period	Frequency	Analytes (EPA Method)	Notes
Tissue Quality					
Fish Tissue	Maintenance facility pier	2001	1 sampling event	Hg (1631)	As per OMMP.
Intertidal HPAH Area					
Surface Sediments	6 stations at ferry terminal	2005	1 sampling event	PAHs (8270C)	As per OMMP.
Shellfish Tissue	10 stations at ferry terminal	2005	1 sampling event	PAHs (8270C)	As per OMMP.
Habitat Performance					
Low Tide Survey	Intertidal area transects 1-14	1999, 2001	2 sampling events	Invertebrate species, macroalgae cover, substrate type	As per OMMP and SAP.
Underwater Video Survey	Subtidal area transects 1-12	1999, 2001	2 sampling events	Fish/invertebrate/macroalgae presence, substrate type	As per OMMP and SAP.
Eelgrass Monitoring	Transplant site transects 0-8	1998 - 2000	Quarterly/annually (6 events)	Eelgrass health and survival by divers	As per OMMP; eelgrass planted in 9/1998 and 4/2000.
Schel-chelb Monitoring	Schel-chelb/Harper estuaries	1997 - 2006	Annual (5 quantitative surveys)	Vegetation cover, bird counts, invertebrate families	As per OMMP and SAP.

Notes:

CDF = confined disposal facility; EPA =U.S. Environmental Protection Agency; HPAH = high-molecular-weight PAH; OMMP = Operation, Maintenance, and Monitoring Plan; OU = Operable Unit; PAH = polycyclic aromatic hydrocarbon; SAP =Sampling and Analysis Plan

Analytes/Parameters: Cu = copper; Hg = mercury; Pb =lead; Zn = zinc

TABLE 5
Summary of Post-Remediation OMMP Performance Standards, Performance in Years 1 through 10, and Future Monitoring Planned for the West Harbor OU
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Monitoring Component	1997 OMMP Performance Standard	10-Year Performance	Future Monitoring
Inspection			
Site	Inspect and report to ensure health advisory updates, no breaching of fencing, unobstructed northern cutoff drainage system, no cracks in asphalt, and upland excavation and piling restrictions.	Performed as required, including repaired fencing and asphalt subsidence.	Continue annual site inspections during a summer low tide.
Stormwater	Inspect and report to ensure stormwater treatment system maintenance, research, upgrade, and permit compliance.	Performed as required, including maintenance of oil-water separators.	Conduct according to SWPPP and NPDES permit.
Water Quality			
Piezometers	CDF water levels remain above 10 feet MLLW, which was lowered to 8.7 feet MLLW in 1999 based on elevation of hotspot sediments.	Performed as required.	Monitor water levels in piezometers PZ-02 and PZ-03 once every 5 years.
Groundwater	Well and well point samples shall meet Washington State marine water criteria for Hg, Cu, Pb, and Zn.	Performed as required except for overestimated Cu due to analytical interference, and elevated total Hg due to suspended sediment.	Monitor well MW-01 every 5 years for routine field parameters and metals. No well point monitoring is necessary.
Surface Water	Use as background for comparison to ground water.	Performed as required.	No surface water monitoring is necessary.
Intertidal Seeps	Seep samples shall meet Washington State marine water quality criteria for Hg, Cu, Pb, and Zn.	Seep under Pier A (SP-01) met all criteria. Seeps at tidal barrier (SP-02 and SP-04/5) exceeded Cu and Zn criteria until capped in 2006; slight exceedance of Cu criteria in one seep since capping.	Inspect the seep remediation cap on an annual basis during a summer low tide, and sample if discharge exceeds 1 gpm and sediments exhibit a rust color.
Sediment Quality			
Surface Sediments	Surface sediment samples (0-10 cm) from 10 cap stations shall meet the minimum cleanup level (MCUL) criteria for Hg.	Performed as required except for 2 cap stations in 2005 due to contamination by off-site suspended sediments and bioturbation.	No surface sediment monitoring is necessary.

TABLE 5
Summary of Post-Remediation OMMP Performance Standards, Performance in Years 1 through 10, and Future Monitoring Planned for the West Harbor OU
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Monitoring Component	1997 OMMP Performance Standard	10-Year Performance	Future Monitoring
Sediment Trap	Sediment trap samples shall meet the SQS for mercury.	Performed as required.	No sediment trap monitoring is necessary.
Bathymetric Survey	Berm and cap areas shall not erode more than 0.5 feet.	Performed as required except for several small areas that may have eroded but did not compromise the integrity of the berm or cap.	No bathymetric surveys are necessary.
Tissue Quality			
Fish Tissue	Fish tissue mercury concentrations shall be less than 0.22 mg/kg.	Performed as required.	No fish tissue monitoring is necessary.
Intertidal HPAH Area			
Surface Sediments	The 95th percent UCL of sediment PAH concentrations at 10 stations shall not exceed the MCUL for individual and cumulative PAHs.	Performed as required.	No sediment PAH monitoring is necessary.
Shellfish Tissue	The 95th percent UCL of the average carcinogenic PAH TEF concentrations shall be less than 60 µg/kg wet weight.	Performed as required.	No shellfish tissue PAH monitoring is necessary.
Habitat Performance			
Low Tide Survey	Verify that habitat and armor materials have not eroded in the berm, cap, and tidal barrier areas, and that the habitat layer is colonized by macroinvertebrates and macroalgae.	Performed as required.	No low tide surveys are necessary.
Underwater Video Survey	Verify that that the habitat layer is colonized by macroinvertebrates and macroalgae.	Performed as required.	No underwater video surveys are required.
Eelgrass Monitoring	Plant and monitor eelgrass meadow in a 0.6-acre plot located immediately west of the cap.	Initial planting failed and a second planting conducted as a contingency action also failed due to excessive macroalgae growth.	No eelgrass planting or monitoring is necessary.
Schel-chelb Monitoring	Estuary monitoring data shall meet requirements for minimum size, soil texture, slope, conductivity, native plant cover, tree cover, invasive species	Performed as required.	No additional estuary monitoring is necessary, but WSDOT will continue to provide maintenance as needed.

TABLE 5
Summary of Post-Remediation OMMP Performance Standards, Performance in Years 1 through 10, and Future Monitoring Planned for the West Harbor OU
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Monitoring Component	1997 OMMP Performance Standard	10-Year Performance	Future Monitoring
	cover, bird species richness and diversity, benthic invertebrate species richness, and culvert fish passage.		

Notes:

CDF = confined disposal facility
cm = centimeter(s)
EPA =U.S. Environmental Protection Agency
HPAH = high-molecular-weight PAH
MCUL = Minimum Cleanup Level
mg/kg = milligrams per kilogram
MLLW = mean lower low water
NPDES = National Pollutant Discharge Elimination System
OMMP = Operation, Maintenance, and Monitoring Plan
OU = Operable Unit
PAH = polycyclic aromatic hydrocarbon
SAP =Sampling and Analysis Plan
SQS = Sediment Quality Standard
SWPPP = Surface Water Pollution Prevention Plan
TEF = toxicity equivalency factor
UCL = upper confidence limit
WSDOT = Washington State Department of Transportation
µg/kg = micrograms per kilogram

Analytes/Parameters:

Cu = copper
Hg = mercury
Pb =lead
Zn = zinc

TABLE 6
East Harbor OU Sediment Cleanup Levels – Chemical Criteria
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Chemical of Concern	Sediment Standards Chemical Criteria[1] SQS[2]	Sediment Standards Chemical Criteria[1] MCUL[3]	MTCA Method B Soil CUL[8] (mg/kg)
Mercury	0.41 mg/kg (dry weight)	0.59 mg/kg (dry weight)	NA
Individual PAHs and PAH Groups	units of mg/kg organic carbon[4]	units of mg/kg organic carbon[4]	
LPAHs[5]	370	780	--
Naphthalene	99	170	3,200
Acenaphthylene	66	66	--
Acenaphthene	16	57	4,800
Fluorene	23	79	3,200
Phenanthrene	100	480	--
Anthracene	220	1,200	24,000
2-Methylnaphthalene	38	64	320
HPAHs[6]	960	5,300	--
Fluoranthene	160	1,200	200
Pyrene	1,000	1,400	2400
Benzo(a)anthracene	110	270	0.14
Chrysene	110	460	0.14
Benzo(b)fluoranthene	--	--	0.14
Benzo(k)fluoranthene	--	--	0.14
Total Benzofluoranthenes[7]	230	450	--
Benzo(a)pyrene	99	210	0.14
Indeno(1,2,3-c,d)pyrene	34	88	0.14
Dibenzo(a,h)anthracene	12	33	0.14
Benzo(g,h,i)perylene	31	78	--
Pentachlorophenol	--	--	8.3

Notes:

[1] Where laboratory analysis indicates a chemical is not detected in a sediment sample, the detection limit shall be reported and shall be at or below the criteria value shown in this table. Where chemical criteria in this table represent the sum of individual compounds or isomers, and a chemical analysis identifies an undetected value for one or more individual compounds or isomers, the detection limit shall be used for calculating the sum of the respective compounds or isomers. Mg/kg = milligrams per kilogram.

[2] Sediment Quality Standards

[3] Minimum Cleanup Level

[4] The listed chemical parameter criteria represent concentrations in parts per million, “normalized,” or expressed, on a total organic carbon basis. To normalize to total organic carbon, the dry weight concentration for each parameter is divided by the decimal fraction representing the percent total organic carbon content of the sediment.

[5] The low-molecular-weight polycyclic aromatic hydrocarbon (LPAH) criterion represents the sum of the following “low molecular weight polycyclic aromatic hydrocarbon” compounds: Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene. The LPAH criterion is not the sum of the criteria values for the individual LPAHs listed.

[6] The high-molecular-weight PAH (HPAH) criterion represents the sum of the following “high molecular weight polycyclic aromatic hydrocarbon” compounds: Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Total Benzofluoranthene, Benzo(a)pyrene, Indeno(1,2,3-c,d)pyrene, Dibenzo(a,h)anthracene, and Benzo(g,h,i)perylene. The HPAH criterion is not the sum of the criteria values for the individual HPAHs listed.

[7] The Total Benzofluoranthenes criterion represents the sum of the concentrations of the “B”, “J”, and “K” isomers.

[8] Model Toxics Control Act Cleanup Levels and Risk Calculations (CLARC) database, soil, Method B direct contact

TABLE 7
East Harbor OU Sediment Cleanup Levels – Biological Criteria
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

SQS Biological Criteria[a]	MCUL Biological Criteria[b]
Sediments are determined to have adverse effects on biological resources when any of the confirmatory marine sediment biological tests of WAC 173-204-315(1) demonstrate the following results:	The MCUL is exceeded when any two of the biological tests exceed the SQS biological criteria; or one of the following test determinations is made:
(a) Amphipod: the test sediment has a higher[c] mean mortality than the reference sediment and the test sediment mean mortality exceeds 25%, on an absolute basis.	(i) Amphipod: the test sediment has a higher[c] mean mortality than the reference sediment and the test sediment mean mortality is more than 30% higher than the reference sediment mean mortality, on an absolute basis.
(b) Larval: the test sediment has a mean survivorship of normal larvae that is less[c] than the mean normal survivorship in the reference sediment and the test sediment mean normal survivorship is less than 85% of the mean normal survivorship in the reference sediment (i.e., the test sediment has a mean combined abnormality and mortality that is greater than 15% relative to time-final in the reference sediment).	(ii) Larval: the test sediment has a mean survivorship of normal larvae that is less[c] than the mean normal survivorship in the reference sediment and the test sediment mean normal survivorship is less than 70% of the mean normal survivorship in the reference sediment (i.e., the test sediment has a mean combined abnormality and mortality that is greater[c] than 30% relative to time-final in the reference sediment).
c) Benthic abundance: The test sediment has less than 50% of the reference sediment mean abundance of any one of the following major taxa: Crustacea, Mollusca, or Polychaeta, and the test sediment abundance is statistically different[c] from the reference sediment abundance.	(iii) Benthic abundance: The test sediment has less than 50% of the reference sediment mean abundance of any two of the following major taxa: Crustacea, Mollusca, or Polychaeta, and the test sediment abundances are different[c] from the reference abundances.
d) Juvenile polychaete: The test sediment has a mean biomass of less than 70% of the reference sediment mean biomass and the test sediment biomass is statistically different[c] from the reference sediment biomass.	(iv) Juvenile polychaete: The test sediment has a mean biomass of less than 50% of the reference sediment mean biomass and the test sediment biomass is statistically different[c] from the reference sediment biomass.
e) Microtox: The mean light output of the highest concentrations of the test sediment is less than 80% of the reference sediment, and the two means are statistically different.	

Notes:

[a] SQS = Sediment Quality Standard

[b] MCUL = Minimum Cleanup Level

[c] Statistical Significance is defined with a test, p less than or equal to 0.05.

Test results from at least two acute effects tests and one chronic effects tests shall be evaluated. The biological tests shall not be considered valid unless test results for the appropriate control and reference sediment samples meet the performance standards described in WAC 173-204-315(2).

TABLE 8

East Harbor OU Monitoring Requirements as per the 2002 Operations, Maintenance, and Monitoring Plan (OMMP) Addendum

Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Calendar Year[1]	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010***	**2011**
Monitoring	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Bathymetry[1]	C	C		C		C			●				●				●	
Sub-bottom Profiling	C	C																
SVPS[2]	C	C		C		C												
Video/Plan View Surveys	C	C		C		C												
Subtidal Cap Subsurface Sediments (0-3 ft)				C		C			●				●				●	
Subtidal Cap Surface Sediments (0-10 cm)		C		C		C			●				●				●	
PAH Fingerprinting Analysis*									●				●				●	
Intertidal Seeps[3]			C	C	C		C											
East Beach Surface Sediments(0-10 cm)									●				●[4]				●	
East Beach Subsurface Sediments (0-3 ft)									●									
East Beach Clam Tissue Analysis									●				●				●	
Intertidal Elevation Surveys[5]									●	●	●	●	●					
Intertidal Visual Surveys[5]									●	●	●	●	●				●	
Sediment Traps	C	C		C														
Sediments (0-2 cm)		C		C														
Benthic Infauna		C		C		C												

Notes:

C = Completed; ● = To be accomplished.

* Anticipated sampling scheme. This scheme may change (e.g., polycyclic aromatic hydrocarbon [PAH] fingerprinting analysis will only occur upon on-cap Sediment Management Standard [SMS] exceedances in primary samples).

[1] Bathymetry data were collected by the National Oceanic and Atmospheric Administration (NOAA) in the spring of 1995. Sub-bottom sonar profiling in 1995 was conducted by the U.S. Geological Survey (USGS) under an interagency agreement with the U.S. Environmental Protection Agency (EPA). 1997 Bathymetry data were collected by the U.S. Army Corps of Engineers (USACE) in August and October. 1999 Bathymetry data were collected by USACE in July. USACE is expected to continue to collect bathymetric data to ensure comparisons between years.

[2] In 1997 and 1999, video surveys were replaced with plan-view, still, and video photography at all sediment vertical profiling system (SVPS) station locations. No further SVPS or video collections are proposed.

[3] Intertidal Seep Monitoring (East Beach Area) as established in the 1995 OMMP used visual inspection and tiered subsurface coring with subsequent analysis. Monitored natural attenuation on the East Beach has been redefined as the goal for this area and will be accomplished with visual inspection and surface cores (0-10cm).

[4] East beach monitoring in 2006 was associated with the Thermal Effects Study being conducted under the remediation of the Soil and Groundwater Operable Units.

[5] Elevation and visual surveys will occur twice yearly through year 12 and in Year 16.

TABLE 9
Annual System Operation and Maintenance Costs for the East Harbor OU
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Dates	Total Costs Rounded to Nearest $1,000
October 2002 through September 2003	$158,000
October 2003 through September 2004	$112,000
October 2004 through September 2005	$19,000
October 2005 through September 2006	$40,000
October 2006 through May 2007	Not available

TABLE 10
Recommendations from the First Five-Year Review
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Issue	Recommendations/Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date
Soil and Groundwater Operable Units (OUs)				
Existing treatment and extraction system is nearing the end of its service life	Monitor the systems closely and perform repair and maintenance activities	EPA	EPA/Ecology	Ongoing
	Replace the systems for either full-scale thermal remediation or containment	EPA	EPA/Ecology	2005
Competence of the aquitard is uncertain in isolated locations	Monitor lower aquifer on a regular basis	EPA	EPA/Ecology	Monthly/Quarterly
	Conduct a thorough evaluation of the aquitard to ensure ongoing protection of the lower aquitard	EPA	EPA/Ecology	2004
Future land use (proposed and actual zoning changes	Continue to coordinate with local officials to ensure that the remedy is protective of future site uses	EPA	EPA	Ongoing
West Harbor OU				
Seeps in intertidal area surrounding the CDF	Seep discharge mitigation alternatives are being developed. One alternative under consideration is the addition of capping material in seep areas.	DOT	EPA	Spring 2003
Eelgrass site did not survive	Alternative contingency actions are being evaluated	DOT	EPA	Spring 2003
East Harbor OU				
Significant contamination still exists on the East Beach	Continue to monitor contaminant concentrations to determine if natural recovery, aided by source control and potential upland thermal remediation, can achieve cleanup goals established in the ROD	EPA	EPA/Ecology	Fall 2002 and yearly
Need to confirm the North Shoal does not contain contaminants in the top 10 cm	Monitor in the upcoming sampling event	EPA	EPA/Ecology	Fall 2002
Localized surface and subsurface PAH concentrations on the subtidal sediment cap have been measured	Locations will be sampled and evaluated in the fall 2002 monitoring event and will be monitored closely in subsequent years	EPA	EPA/Ecology	Fall 2002

TABLE 11
Recommendations Based on Community Involvement
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Recommendations	Party Responsible	Oversight Agency	Milestone Date
Coordinate with Bremerton-Kitsap County Health District regarding the harbor harvest restrictions. Provide an update to the community	EPA	EPA	Winter 2002
Continue to share information with nearby community and the City about the on-site and local well water testing	EPA	EPA	Ongoing
Share results of the pilot study with the community as they become available, including information such as noise and air quality	EPA	EPA	During Pilot Project
Consider placing an information sign/billboard outside the site explaining cleanup activities	EPA	EPA	Winter 2002

TABLE 12
Existing Groundwater Treatment Plant Monitoring — Descriptions of Sampling Locations
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Location	Location Number	EPA Sample ID No.	Sampling Location Description
Treatment Plant Influent	SP-0	2113	Downstream of valve manifold; ½-inch PVC pipe with brass ball valve
Equalization Tank (T-401) Effluent	SP-1	2100	Downstream of Pumps 401A/B; ¾-inch bronze ball valve
DAF Effluent	SP-3	2102	Downstream of DAF-104
T-402 Effluent.	SP-4	2103	West of Tank 402; ½-inch galvanized pipe with ball valve, taken on north side of the clarifier
Clarifier Effluent (T-204)	SP-6	2104	West end of clarification tank; ¾-inch galvanized pipe with ball valve
Biofilter Effluent	SP-7	2118	Grab sample
Multimedia Filter Effluent (T-206A, T-206B)	SP-8	2105	North end of multi-media filters; ½-inch galvanized pipe with ball valve
Lead Carbon Filter Effluent	SP-9	2106	West of carbon No. 1 tank; ½-inch galvanized pipe with ball valve
Middle Carbon Vessel Effluent	SP-12	2116	West of carbon No. 2 tank; ½-inch galvanized pipe with ball valve
Lag Carbon Filter Effluent	SP-10	2107	West of carbon No. 3 tank; ½-inch galvanized pipe with ball valve
T-303 Effluent	SP-11	2108	Effluent Discharge compliance point downstream of 303 Tank
T-303 Effluent	SP-11	2114	Grab sample from T-303 Effluent for TDS analysis
Performance Dup	FD-1	2109	Varies between SP-0, SP-4 to SP-10
Compliance Dup	FD-2	2110	From T-303 Effluent (SP-11)
Compliance Dup	FD-2	2115	Grab sample from T-303 Effluent (SP-11) for TDS analysis
Performance Blank	FB-1	2111	
Compliance Blank	FB-2	2112	
Varies	Varies	2119-2124	Sample numbers used for extra samples that may be collected

Notes:

DAF = dissolved air flotation
PVC = polyvinyl chloride
TDS = total dissolved solids

TABLE 13
Effluent Discharge Limits
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Parameter	Discharge Limit
Naphthalene	4 µg/L
Acenaphthylene	4 µg/L
Acenaphthene	4 µg/L
9H-Fluorene	2 µg/L
Phenanthrene	2 µg/L
Anthracene	2 µg/L
Fluoranthene	2 µg/L
Pyrene	2 µg/L
Benzo(a)anthracene	2 µg/L
Chrysene	2 µg/L
Benzo(b)fluoranthene	2 µg/L
Benzo(k)fluoranthene	2 µg/L
Benzo(a)pyrene	2 µg/L
Indeno(1,2,3-cd)pyrene	2 µg/L
Dibenzo[a,h]anthracene	2 µg/L
Benzo(g,h,I)perylene	2 µg/L
Total PAHs	20 µg/L
Pentachlorophenol	6 µg/L
pH	6.0-9.0

Notes:

PAHs = polycyclic aromatic hydrocarbons
µg/L = micrograms per liter

TABLE 14
Surface Water Results from the U.S. Army Corps of Engineers
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Chemical of Concern	Cancer Screening Level[1] (µg/L)	Reporting Limit (µg/L)	Maximum Risk at Detection Limit (ELCR)[2]
Benzo(a)anthracene	0.000114	0.0005	4.39E-06
Benzo(a)pyrene	0.00000691	0.0091	1.32E-03
Benzo(b)fluoranthene	0.0000681	0.0091[3]	1.34E-04
Dibenzo(a,h)anthracene	0.00000460	0.0091	1.98E-03
Indeno (1,2,3cd) pyrene	0.0000658	0.0091	1.38E-04
Pentachlorophenol	0.00237	0.15	6.33E-05

Notes:

Source: U.S. Army Corps of Engineers (USACE), December 2005, *Surface Water Sampling Report – Surface Water Exposure Assessment, Wyckoff Facility and Groundwater Operable Units, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington*.

[1] Calculations performed by EPA to establish the screening levels can be found in USACE, August 2005, *Quality Assurance Project Plan: Surface Water Exposure Assessment, Wyckoff Facility and Groundwater Operable Units, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington*, Appendix A.

[2] ELCR = Excess Lifetime Cancer Risk**.** This column does not say that such risks exist; it says that if the compound were present at the detection limit, the risk could be as high as, but would likely be below this value.

[3] As described in the text, there were estimated detections slightly above this reporting limit. Chemical analysis was performed by Liberty Analytical of Cary, North Carolina, using Contract Laboratory Program modified methods OLCO3.2 and OLCO3.2 (Selected Ion Monitoring) for PAHs and PCP.

EPA = U.S. Environmental Protection Agency
PAHs = polycyclic aromatic hydrocarbons
PCP = pentachlorophenol
USACE = U.S. Army Corps of Engineers

µg/L = micrograms per liter

TABLE 15
Dioxin Toxicity Equivalence Factors
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

	Toxicity Equivalence Factors		
		Van den Berg et al.:	
Reference Compound	**EPA 1987**	**1998**	**2005**
2,3,7,8-TCDD	1	1	1
1,2,3,7,8-PeCDD	0.5	1	1
1,2,3,4,7,8-HxCDD	0.04	0.1	0.1
1,2,3,6,7,8-HxCDD	0.04	0.1	0.1
1,2,3,7,8,9-HxCDD	0.04	0.1	0.1
1,2,3,4,6,7,8-HpCDD	0.001	0.01	0.01
OCDD	0	0.0001	0.0003
2,3,7,8-TCDF	0.1	0.1	0.1
1,2,3,7,8-PeCDF	0.1	0.05	0.03
2,3,4,7,8-PeCDF	0.1	0.5	0.3
1,2,3,4,7,8-HxCDF	0.01	0.1	0.1
1,2,3,6,7,8-HxCDF	0.01	0.1	0.1
1,2,3,7,8,9-HxCDF	0.01	0.1	0.1
2,3,4,6,7,8-HxCDF	0.01	0.1	0.1
1,2,3,4,6,7,8-HpCDF	0.001	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.001	0.01	0.01
OCDF	0	0.0001	0.0003

References:

U.S. Environmental Protection Agency (EPA). 1987. *Interim procedures for estimating risks associated with exposures to mixtures of chlorinated dibenzo-p-dioxins and -dibenzofurans (CDDs and CDFs).* EPA/625/3-87/012.

Van den Berg et al. 1998. "Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife." *Environmental Health Persp*ectives Vol. 106, No. 12, pp. 775-792.

Van den Berg et al. 2005. *Project for the re-evaluation of human and mammalian toxic equivalency factors (TEFs) of dioxins and dioxin-like compounds.* http://www.who.int/ipcs/assessment/tef_update/en/ay

TABLE 16
Summary of Recommendations and Follow-up Actions
Second Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington

Recommendations/Follow-Up Actions	Party Responsible	Milestone Date	Follow-Up Actions: Affects Protectiveness (Y/N)	
			Current	**Future**
A. Overall Site (All Operable Units [OUs])				
Evaluate any potential public health issues related to real or possible human exposure to toxic materials at the site.	Agency for Toxic Substances and Disease Registry (ASTDR)	Spring 2008	ATSDR determinations will be reviewed to determine need for additional actions, if warranted.	ATSDR determinations will be reviewed to determine need for additional actions, if warranted.
B. Soil and Groundwater OUs				
Advance additional soil borings in the southeastern portion of the Former Process Area to characterize aquitard conditions.	EPA	Fall/Winter 2008	N	N
Install additional groundwater monitoring wells in the Former Process Area.	EPA	Fall/Winter 2008	N	N
Document final remedy selection and proceed with implementation.	EPA	2008	N	N
C. East Harbor OU				
Construct an exposure barrier system at the West Beach.	EPA	Winter 2008	Y	Y
Evaluate additional potential response actions in the North Shoal and East Beach areas as appropriate based on continued monitoring.	EPA	OMMP due Spring 2008/ sampling Summer 2008	Y	Y
Continue to track developments in tribal shellfish consumption and the effects of sediment contamination on fish.	EPA	Tribal and OMMP sampling 2008	Y	Y

APPENDIX A

Fact Sheets and Public Notification Documents, 2003-2007

SUPERFUND
Fact Sheet
WYCKOFF/EAGLE HARBOR SUPERFUND SITE
Bainbridge Island, Washington

EPA U.S. ENVIRONMENTAL PROTECTION AGENCY May 2003

Steam Cleaning at Wyckoff: Schedule Delayed

EPA plans design changes in Wyckoff's cleanup plant.

EPA began the steam injection cleanup pilot project in October 2002. The good news: the technology began successfully removing wood-treating contaminants from the groundwater. The not-so-good news: the concentration and chemical make-up of the contaminants caused several mechanical and chemical problems. EPA is evaluating these problems and plans to make changes to both the steam injection system and the water treatment system.

Chemical incompatibility and clogging are two of the issues encountered. Tests show large amounts of a chemical in the groundwater called naphthalene. As the naphthalene is pumped out, it causes problems with the seals and gaskets and it clogs in the equipment.

"These early results give us important information," says the new EPA Project Manager Mary Jane Nearman. "These pilot tests for developing new technologies help us optimize the system and make any changes to deal with site-specific conditions at Wyckoff." EPA remains committed to making the pilot as successful as possible for the Wyckoff site, as well as to advancing our understanding of this technology nationally. The early testing has provided valuable information as EPA moves forward to make necessary design changes and system modifications.

Initially, EPA had been hopeful that the existing treatment plant would be capable of treating the extracted groundwater contamination. Now it has become clear that the treatment plant likely will need significant modifications to handle the large increase in contamination coming through the system. EPA is now evaluating necessary design changes to treat the groundwater to meet regulatory requirements before it is released into Eagle Harbor.

(continued on page 2)

In This Issue...

Schedule Delayed

(continued from page 1)

In light of these challenges, the pilot test schedule will be delayed. EPA will spend the next six months evaluating the early test results and retrofitting both the steam injection and water treatment plants. Steam injection would likely restart in fall 2003 and continue for six to eight months or until contaminant extraction volumes are small and no longer cost-effective to pump out. After EPA evaluates the data, proposals can be made about moving forward with a larger cleanup effort.

There have been no reported problems with odors or vapors. There has been some minor increased noise. Because there are more contaminants being treated by the cleanup system, a pump to press solids has been operating more often. EPA is committed to minimizing noise and other nuisances.

New Information About Lower Aquifer

The main area of contamination targeted for soil and water cleanup is immediately under the old Wyckoff process area. That area is called the **upper aquifer**. Below that area is another aquifer, called the lower aquifer. (*An aquifer is an area of underground water.*) A layer of clay forms a barrier between the two aquifers. However, there appear to be areas where the barrier is made up of mostly sand instead of clay. In those areas, water can seep between the two aquifers.

Because of concerns about contamination seeping from the upper contaminated aquifer into the lower aquifer, EPA has been monitoring the aquifers. EPA has known for some time that some contamination has existed in the lower aquifer. (The lower aquifer is not used as a water source.) Recently, however, additional contamination was discovered in the lower aquifer. EPA will continue to monitor the upper and lower aquifers and conduct more hydrogeologic studies to determine the potential for contaminant movement.

Site Background

EPA listed Wyckoff/Eagle Harbor as a Superfund site in 1987. The former Wyckoff wood treating facility, located at the mouth of Eagle Harbor on Bainbridge Island, operated from the very early 1900s to 1988. Soils at the facility, and groundwater beneath the facility, are severely contaminated. Contaminants include creosote and other wood treatment compounds. About 1 million gallons of creosote product remain in the site's soil and groundwater. These contaminants pose a risk to public health and the environment.

A groundwater extraction and treatment system has been operated on site since 1990. However, contaminants were still moving into the marine environment until a sheet pile wall was installed in 2001. EPA is testing thermal treatment technologies to clean up remaining soil and groundwater contamination.

In Eagle Harbor, bottom sediments were severely contaminated with chemicals from wood-treating and shipyard operations. A public health advisory recommends against eating fish and shellfish from the harbor. From 1993 to 2002, contaminated sediments in various locations were capped with clean material.

Update on Other Site Activities

Mitigation Beach Doing Well: The plantings on the new beach are largely thriving. The willows are now in bloom and the added organic material remains in place. The slope of the beach appears to be stable, with wood debris collecting at the high water mark. Clams and worms are recolonizing the beach, and many bird and animal species are visiting. Beach sediment sampling was conducted to confirm that regulatory contaminant levels have been achieved. Results are expected within a month or two.

Offshore Sediment Cap is Stable: The offshore sediment cap is monitored regularly. Monitoring results from 1999 indicate that the cap is physically stable. It continues to isolate underlying contaminated sediments while providing clean habitat. In fall 2002, EPA also monitored the new intertidal and subtidal areas constructed in 2000-2002. Early results show that the cap continues to remain an adequate and effective remedy. Final results are expected this summer.

Outfall Sediments Monitored: Treated water from the treatment plant is discharged into Puget Sound from a subtidal pipe on the east side of the Wyckoff site. The sediments around the outfall pipe were monitored before the start of steaming operations in fall 2002. The tests aimed to determine if there has been any impact from the discharge over the past five years. Results showed that the treatment plant discharges have not affected biological resources in the area of the discharge pipe. Sediments will be monitored again when the pilot project is finished.

Sheet Pile Wall Corrosion to be Studied: EPA will conduct a study of the rate of corrosion of the sheet pile wall and potential methods for reducing the corrosion rate. EPA will also sample the interlocks this summer to find out how much, if any, contaminated groundwater is leaking through the wall.

Hydraulic Containment Under Evaluation: EPA is continuing to evaluate our ability to maintain steady groundwater levels at the site. This evaluation will help us determine if there are ways to reduce the need for expensive groundwater treatment during cleanup activities.

For More Information

Mary Jane Nearman
EPA Project Manager
(206) 553-6642
E-mail: nearman.maryjane@epa.gov

Andrea Lindsay
EPA Community Involvement Coordinator
(206) 553-1896
E-mail: lindsay.andrea@epa.gov.

Toll-Free Telephone Number
1-800-424-4372

Please contact EPA with any mailing list changes.

EPA Web Site:
www.epa.gov/r10earth/
click on "Index"
click on "W" for Wyckoff

Documents: The Administrative Record is a file that contains all information used by EPA to make decisions on the cleanup actions. The Administrative Record can be reviewed at the

EPA Records Center
7th Floor, 1200 Sixth Avenue
Seattle.

Call 206/553-4494 to make an appointment.

Select documents can be viewed at the Information Repository located at the

Bainbridge Island Public Library
1270 Madison Avenue North.

If the library does not have the document you need, feel free to call Andrea Lindsay, EPA Community Involvement Coordinator, at (206) 553-1896.

To request reasonable accommodations:

For people with disabilities: call Andrea Lindsay at the number above.

For TTY users: call 1-800-877-8339 and give the operator Andrea Lindsay's phone number.

United States
Environmental Protection
Agency

Region 10 (ECO-081)
1200 Sixth Avenue
Seattle WA 98101

Pre-sorted Standard
Postage & Fees Paid
U.S. EPA
Permit No. G-35

RETURN SERVICE REQUESTED

SUPERFUND FACT SHEET
WYCKOFF/EAGLE HARBOR SUPERFUND SITE
May, 2003

STEAM CLEANING SCHEDULE DELAYED

EPA

Wyckoff / Eagle Harbor, **Bainbridge Island, Washington**

U.S.Environmental Protection Agency, Region 10 *May 2004*

Wyckoff Cleanup: EPA Looking at Data and Options

Reviewing Options for Moving Forward
New Groundwater Treatment Plant Being Designed

EPA HAS STOPPED THE STEAM-INJECTION CLEANUP TESTING at the Wyckoff Superfund site on Bainbridge Island. The steam pilot project encountered technical challenges some months ago, relating to the water and vapor-treatment systems. Since that time, EPA has been studying the results to determine the best path forward. Information gathered during the steaming operations will be considered in an ongoing engineering evaluation to explore all options for moving forward. The engineering evaluation will look at both a thermal cleanup option and a containment option. The evaluation is expected to be completed this summer. A report of findings will be made available to the public.

EPA remains committed to the long-standing cleanup goals for protection of human health and the environment. These goals are outlined in the 2000 Record of Decision (ROD). The ROD called for a thermal steam-injection cleanup test in one acre of the Former Processing Area, followed by an evaluation of the appropriateness of thermal treatment for the remaining cleanup area. We are now in that evaluation stage. As stated in the ROD, in the event that thermal treatment is found to be inappropriate for this site, a containment remedy of capping the site with a barrier of clean material would be put in place.

The thermal steam-injection project was an ambitious state-of-the-art pilot test, and EPA learned a great deal. Initial results from the pilot show that injection of steam may be an effective way to remove creosote contamination from the groundwater and soils. However, the pilot system was unable to handle the high volume of heavily contaminated groundwater and vapor.

EPA has not ruled out full-scale thermal treatment. Full-scale steaming would not be pursued unless a successful pilot had been completed. The Agency is now considering what changes to the treatment system would be required if more steam injection is found to be suitable. EPA, in coordination with the other agencies, is also looking at cleanup requirements for compliance with regulatory standards.

The proposal for the long-term approach at the site will be based on the engineering evaluation. EPA will ensure that future land-use plans are considered in the remaining cleanup efforts. Input from the City of Bainbridge and the local community will help shape EPA's decisions as work moves ahead on this site.

The aging groundwater treatment plant needs to be replaced.

So What Were the Problems?

EPA ENCOUNTERED SEVERAL PROBLEMS WITH THE CLEANUP TEST, WHICH BEGAN IN OCTOBER 2002. Injection of steam underground mobilized high concentrations of creosote and wood-treating chemicals. These contaminants were extracted in both vapor and liquid form.

Naphthalene

AN ISSUE COMMON TO BOTH THE VAPOR AND GROUND-water streams was the presence of naphthalene in the Wyckoff creosote. The chemical naphthalene is not compatible with rubber. Rubber seals and gaskets throughout the plant failed early in the steaming process. One critical piece of equipment that failed was the "vapor-phase heat exchanger," which was designed to condense highly contaminated vapors. Without this heat exchanger, the rate of injection of steam needed to be cut back dramatically. In the groundwater treatment plant, seal and gasket failures made it difficult to separate oil products from the rest of the contaminated water.

In addition, naphthalene solidifies at a relatively high temperature, which caused rapid clogging of equipment and transfer lines in both the vapor-collection system and groundwater-treatment system.

An Aging Groundwater Treatment Plant

THE AGING GROUNDWATER-TREATMENT PLANT, WHICH WAS built by the Wyckoff Company in the 1980's, was not able to handle the much higher levels of contaminants extracted during the thermal pilot. The treatment plant uses a biological system in which microscopic organisms (or "bugs") break down the contaminants. Biological systems can fail as a result of sudden changes, such as the much higher contaminant levels that came through the system during steaming. In the early stages of the pilot, the biological process did fail and the bugs had to be re-populated.

The treatment plant is experiencing many other mechanical and structural failures. No matter how the cleanup proceeds at this site, replacement of this aging plant is first priority.

The chemical naphthalene clogged the pipes. Note the crystals in the inner ring.

Ability to Treat Extracted Vapors

THE THERMAL PILOT DATA SHOW THAT A VERY HIGH volume and concentration of vapors would need to be collected and treated during steaming. An evaluation is underway to determine what changes to the vapor collection/treatment system would be required for future pilot or full-scale steaming operations. In addition, EPA also needs to make sure that the treatment of the pentachlorophenol that was mixed into the Wyckoff creosote does not produce contaminants that could be released to the atmosphere.

Steam-Injection Wells

THE PILOT STUDY INDICATED THAT ADDITIONAL WELLS WILL likely be needed to heat the area of contamination completely. Because the injected steam tends to move upward toward the surface, rather than outward, more injection wells may be required to heat the pilot area entirely. EPA is evaluating the option to heat the lower portions of the aquifer to reach the deepest contamination. The effect of additional wells on the capacity of the vapor and groundwater treatment system also needs to be considered.

Looking Ahead

THE WYCKOFF TEAM IS NOW TAKING STOCK OF THE CHALLENGES AHEAD. EPA's immediate priorities at this site are changing. Even as EPA carefully works to make decisions about cleanup through the engineering evaluation process, the Agency must deal with some more pressing questions. Some of those issues are outlined below.

1st Priority—Operating the Existing Groundwater Treatment Plant

EPA must continue to operate the existing groundwater treatment plant to prevent groundwater releases into the environment and to ensure compliance with surface-water discharge standards. This is a significant effort given the state of the aging treatment plant, requiring frequent repairs of failing equipment.

2nd Priority—Replacing the Groundwater Treatment Plant

No matter how the cleanup proceeds at this site, the treatment plant must be replaced. Its parts are aging, and its capacity is limited. EPA plans to propose a design of a new treatment plant by summer 2004. The new plant could be in place by summer 2005.

3rd Priority—Reducing Rates of Groundwater Pump and Treat

The need to replace the groundwater treatment plant raises the question, "How big should it be?" There are four major considerations: (1) clean groundwater flowing into the site from the hillside; (2) rainfall and surface water runoff infiltrating the site soils; (3) groundwater coming up from the lower aquifer into the upper aquifer; and (4) contaminated water coming from additional steaming operations. To reduce the cost of treating groundwater that is not from steaming operations, EPA is evaluating ways to reduce the capacity needs of a new groundwater treatment plant as follows:

A: Fully Enclosing the Site with Cutoff Wall

The site is surrounded on three sides by a sheet-pile wall. The wall extends deep underground along the harbor to hold in the contamination. On the fourth side to the south, against the hillside, groundwater flows into the site, mingling with the contamination underground. This extra groundwater must be processed through the treatment plant. EPA believes that it makes sense to extend this sheet-pile wall so that it fully encloses the site, thus reducing the need to treat this water.

B: Capping the Site

EPA is evaluating the possibility of placing a "cap," or barrier of material, over the site to reduce the amount of rain draining into the contaminated soil. This extra water becomes contaminated and must be processed through the treatment plant. Under the engineering evaluation, EPA is considering different types of caps that would reduce infiltration, including designs that could be consistent with any future thermal treatment efforts.

<> . <> . <>

Other Issues Under Evaluation

Sheet-Pile Wall Protection:

THE SHEET-PILE WALL IS EXPERIENCING CORROSION IN the intertidal zone. This corrosion likely will reduce the sheet pile's ability to control contaminant movement. The site team is considering ways to prevent contaminant movement, including a shallow interior sheet-pile wall, clay walls, or sealers or sand and riprap on the outside edge. An analysis of these options will be part of the engineering evaluation.

Compliance with Water Standards:

EPA IS REQUIRED TO MEET STATE CLEAN WATER standards at the edge of the sheet-pile wall, which is called a "point of compliance." Any water that potentially seeps through the wall must be clean enough to meet standards. No violations have been noted. However, since this is a very contaminated site, this requirement poses a challenge. EPA is working with the State of Washington Department of Ecology to determine the best approach for regulatory compliance. This understanding is critical to setting soil and groundwater cleanup standards at the Wyckoff site.

Community Information Meeting Coming Soon

EPA REMAINS COMMITTED TO DEALING WITH THIS SERIOUSLY CONTAMINATED SITE. Determining the appropriate path forward will require a careful evaluation of each option through the engineering evaluation.

EPA will host a Community Information Meeting sometime this spring or summer to discuss options developed during the evaluation process. The meeting will provide a chance to discuss the latest news about the Wyckoff cleanup project and to hear community views on moving forward. Stay tuned for more information.

Site Background

EPA LISTED WYCKOFF/EAGLE HARBOR AS A Superfund site in 1987. The former Wyckoff wood-treating facility, located at the mouth of Eagle Harbor on Bainbridge Island, operated from the very early 1900s to 1988. Soils at the facility, and groundwater beneath it, are severely contaminated. Contaminants include creosote and other wood-treatment compounds. About one million gallons of creosote product remain in the site's soil and groundwater. These contaminants pose a risk to public health and the environment.

A groundwater extraction-and-treatment system has been operated on site since 1990. However, contaminants were still moving into the marine environment until a sheet-pile wall was installed in 2001. EPA is testing thermal treatment technologies to clean up remaining soil and groundwater contamination.

In Eagle Harbor, bottom sediments were severely contaminated with chemicals from wood-treating and shipyard operations. A public health advisory recommends against eating fish and shellfish from the harbor. From 1993 to 2002, contaminated sediments in various locations were capped with clean material.

Wyckoff Team Welcomes New Member

Long-time EPA Superfund Project Manager **Wally Reid** recently joined the Wyckoff Team. Wally, an environmental engineer, has been with EPA ten years. He is excited to be joining the team.

For More Information

Wally Reid
EPA Project Manager
(206) 553-1728
E-mail: reid.wallace@epa.gov

Mary Jane Nearman
EPA Project Manager
(206) 553-6642
E-mail: nearman.maryjane@epa.gov

Andrea Lindsay
EPA Community Involvement Coordinator
(206) 553-1896
E-mail: lindsay.andrea@epa.gov

EPA Toll-free phone number:
1-800-424-4372

EPA Web Site:

www.epa.gov/r10earth/ Click on "Index," then click on "W" for Wyckoff.

Documents:

The Administrative Record is a file that contains all information used by EPA to make decisions about the cleanup. The Administrative Record can be reviewed at the EPA Records Center, 7th Floor, 1200 Sixth Avenue, Seattle. Call (206) 553-4494 to make an appointment.

Some documents can be viewed at the Information Repository located at the Bainbridge Island Public Library, 1270 Madison Avenue North. If the library does not have the document you need, feel free to call Andrea Lindsay, EPA Community Involvement Coordinator, at (206) 553-1896.

Alternative formats are available upon request. Call Andrea Lindsay at the number above to request reasonable accommodation. TTY users call 1-800-877-8339.

Please contact EPA with any mailing list changes.

United States Environmental Protection Agency
1200 Sixth Avenue, ECO-081
Seattle, Washington 98101-1128

Pre-Sorted Standard
Postage and Fees Paid
U.S. EPA
Permit No. G-35

RETURN SERVICE REQUESTED

WYCKOFF/EAGLE HARBOR CLEANUP
BAINBRIDGE ISLAND, WASHINGTON
MAY 2004

UNITED STATES • ENVIRONMENTAL PROTECTION AGENCY •

♦ *Working with you for a better environment* ♦

Wyckoff / Eagle Harbor, **Bainbridge Island, Washington**

U.S.Environmental Protection Agency, Region 10 *November 2005*

UPDATE ON WYCKOFF/EAGLE HARBOR SUPERFUND CLEANUP

If you have visited the newly acquired Pritchard Park beach lately, you may have noticed some roped-off areas near the shoreline. This fact sheet provides an update of U.S. Environmental Protection Agency (EPA) activities in these areas.

West Beach (Pritchard Park side)

Recently, EPA received reports from Bainbridge Islanders about odors on the west beach. Upon inspection, EPA found evidence of residual oily contamination and sheen on the beach in the area where the Wyckoff Company had built a series of bulkheads at the shoreline (see below). In 2000, EPA removed the bulkheads, as well as contaminated soils and sediments behind the bulkheads, to

Potentially contaminated beach areas and rope barriers.

create the current beach. It now appears that some of the contaminated sediments were not completely removed. EPA has conducted preliminary sediment sampling in this area and is awaiting the results. In early spring when lower tides allow more complete access to areas of the beach, EPA will conduct more extensive sediment sampling to determine the extent of this contamination and to evaluate options to address the residual oily contamination in the beach sediments. Further actions may include removal of contaminated sediments and/or placement of additional capping materials.

North Shoal and East Beach

Now that public use of the beach is increasing, EPA has placed signs and boundary barriers at the west end of the north shoal and the south end of the east beach (see below). Barriers alert the public to residual contamination on the beaches. The remaining contamination is relatively low level. It migrated onto beaches in the past when the Wyckoff Company operated wood-treating facilities in the former process area ("the Point"). In the Record of Decision for Eagle Harbor, the selected remedy for this area of low-level contamination was natural attenuation (allowing the contaminants to degrade naturally).

(continued on back page)

A beach rope barrier.

United States Environmental Protection Agency
1200 Sixth Avenue, ETPA-081
Seattle, WA 98101-1128

WYCKOFF/EAGLE HARBOR CLEANUP
BAINBRIDGE ISLAND, WASHINGTON
November 2005

North Shoal and East Beach *continued*

The current sheet-pile wall was installed to prevent movement of the oily wastes. The wall has effectively prevented additional former-process-area contamination from reaching the beaches. EPA is continuing to monitor sediments along the north shoal and east beach to track any changes in the contaminant levels over time. EPA will use this information to determine what, if any, additional action is warranted on these beaches.

EPA is advising members of the public to avoid these areas of the beach when visiting Pritchard Park.

For More Information

If you would like more information or if you have any questions, please contact:

Mary Jane Nearman

EPA Project Manager

(206) 553-6642

or

Jeanne O'Dell

EPA Community Involvement Coordinatoror

(206) 553-6919

Wyckoff / Eagle Harbor Superfund Site, Bainbridge Island, Washington

U.S. Environmental Protection Agency, Region 10 ***July 2007***

Former Process Area (The "Point") Update

This fact sheet is an update on the status of cleanup activities in the Former Process Area portion of the Wyckoff Site. The Former Process Area encompasses the former Wyckoff wood-treating facility, which occupied the "point" on the south side of Eagle Harbor. Soil and groundwater beneath the Former Process Area are heavily contaminated with creosote and other wood-treatment compounds. The EPA has constructed a sheet pile wall and operates a series of extraction wells to prevent migration of these contaminants from the Former Process Area to Eagle Harbor and Puget Sound.

Monitoring Results

The EPA uses monitoring wells installed in the upper and lower aquifers (water-bearing zones) to monitor conditions in the Former Process Area or the "point". The upper aquifer is heavily contaminated with creosote and other wood-treatment chemicals that were released during operations at the Wyckoff wood-treating facility. The upper aquifer is separated from the lower aquifer by an aquitard composed of layers of silt and clay. These fine-grained layers limit movement of water and contaminants between the two aquifers (Figure 1).

The groundwater monitoring program has two parts - groundwater level monitoring and contaminant concentration monitoring:

- Groundwater level monitoring consists of continuous groundwater level measurements from 17 upper aquifer wells and 8 lower aquifer wells and weekly water level measurements from the active extraction wells. Water level data from the wells are analyzed on a regular basis to ensure that flow in the upper aquifer is away from the sheet pile wall and toward the extraction wells and that an upward flow direction is being maintained between the lower and upper aquifers.
- Contaminant concentration monitoring consists of collecting groundwater samples from the wells for laboratory analysis. The samples are analyzed for chemicals associated with the contaminants found at the Wyckoff site. The laboratory results are evaluated twice a year, with special attention paid to lower aquifer sample results, which provide early warning of possible contaminant migration through the aquitard.
- The groundwater extraction system and sheet pile wall are performing effectively. Groundwater monitoring results indicate that contamination within the "point" is not adversely impacting the water quality of Eagle Harbor or Puget Sound.

In This Issue ...

Replacement of the Groundwater Treatment Plant

The existing Groundwater Treatment Plant processes the contaminated groundwater that is pumped from the extraction wells. The existing groundwater treatment system at the site has been in operation for approximately 15 years and is nearing the end of its service life.

Earlier this year, the U.S. Army Corps of Engineers (on EPA's behalf) awarded a contract to build a replacement Groundwater Treatment Plant to the ECC construction firm of Lakewood, Colorado. The treatment plant was designed by CH2M HILL.

The replacement Groundwater Treatment Plant will remove oily liquid and dissolved contaminants from the groundwater. Primary treatment processes include oil separation and dissolved phase adsorption on granular activated carbon. The new plant will use an existing building on the southern portion of the "point," with a new storage tank farm located south of the building (Figure 2). Construction activities began in June, and the new facility is scheduled to start up in the spring of 2008. During this period, the public can expect to see increased traffic and activity in the eastern portion of the site.

Summary of the 2000 Record of Decision

The 2000 Record of Decision (ROD) selected a pilot for thermal treatment of the contamination within the "point" and identified a backup contingent remedy of containment if thermal remediation failed to meet the remedial action objectives.

In 2002, the U.S. Army Corps of Engineers began a large-scale pilot study to determine how effective the innovative thermal remediation techniques would be in recovering oily liquid from the groundwater underneath the "point".

The pilot study took place between October 2002 and April 2003. Based on these results, thermal treatment would not achieve the cleanup standards established in the ROD at the Wyckoff site.

The components of the containment system are described below.

- **Site Cap**. The Former Process Area would be capped to limit public contact with contaminated soil and to decrease the amount of water that infiltrates into the upper aquifer.
- **Shoreline Stabilization System**. The shoreline stabilization system would be further enhanced to protect the sheet pile wall that is preventing contaminants from moving into Eagle Harbor and Puget Sound.
- **Optimized Groundwater Extraction System.** Operation of the groundwater extraction wells will continue to hydraulically contain the contamination within the "point".
- **Enhanced Containment Monitoring.** Additional monitoring wells will be installed in the upper and lower aquifers to monitor the effectiveness of the remedy and to provide an "early warning" if contamination does begin to move in the future.
- **Upgradient Groundwater Cutoff Wall (optional)**. A hydraulic cutoff wall may be necessary to reduce the amount of clean upgradient groundwater that may be entering the upper aquifer in the southeast corner of the "point".

What's Next?

Any remedy implemented must be protective of human health and the environment and comply with state and federal environmental regulations. EPA will continue discussions with the Suquamish Tribe, the Washington State Department of Ecology, the City of Bainbridge Island, other federal and state regulatory agencies, and the public to determine the best path forward for addressing the contamination at the "point".

For More Information

Technical Information:
Mary Jane Nearman, EPA Region 10
Project Manager
206-553-6642

General Information:
Jeanne O'Dell, EPA Community
Involvement Coordinator
206-553-6919 or toll-free at 1-800-424-4372

EPA Web Site:
http://yosemite.epa.gov/R10/CLEANUP.NSF/sites/wyckoff

Documents: The Administrative Record is a file that contains all information used by EPA to make decisions on the cleanup actions. The Administrative Record can be reviewed at:
EPA Region 10 Superfund Records Center
1200 Sixth Avenue, ECL-076
Seattle, WA 98101
206-553-4494 or toll-free at 1-800-424-4372
Please call for an appointment.

Select documents can be viewed at the Information Repository located at:
Bainbridge Island Public Library
1270 Madison Avenue North
If the library does not have the document you need, feel free to call Jeanne O’Dell, EPA Community Involvement Coordinator, at (206) 553-6919.

To request reasonable accommodations:

For people with disabilities: call Jeanne O’Dell at the number above.

For TTY users: call 1-800-877-8339 and give the operator Jeanne O’Dell’s phone number.

316783.DE.01_E022005002SEA . 2-6 _in-up hydraulic gradient_A-A.ai . 31mar05

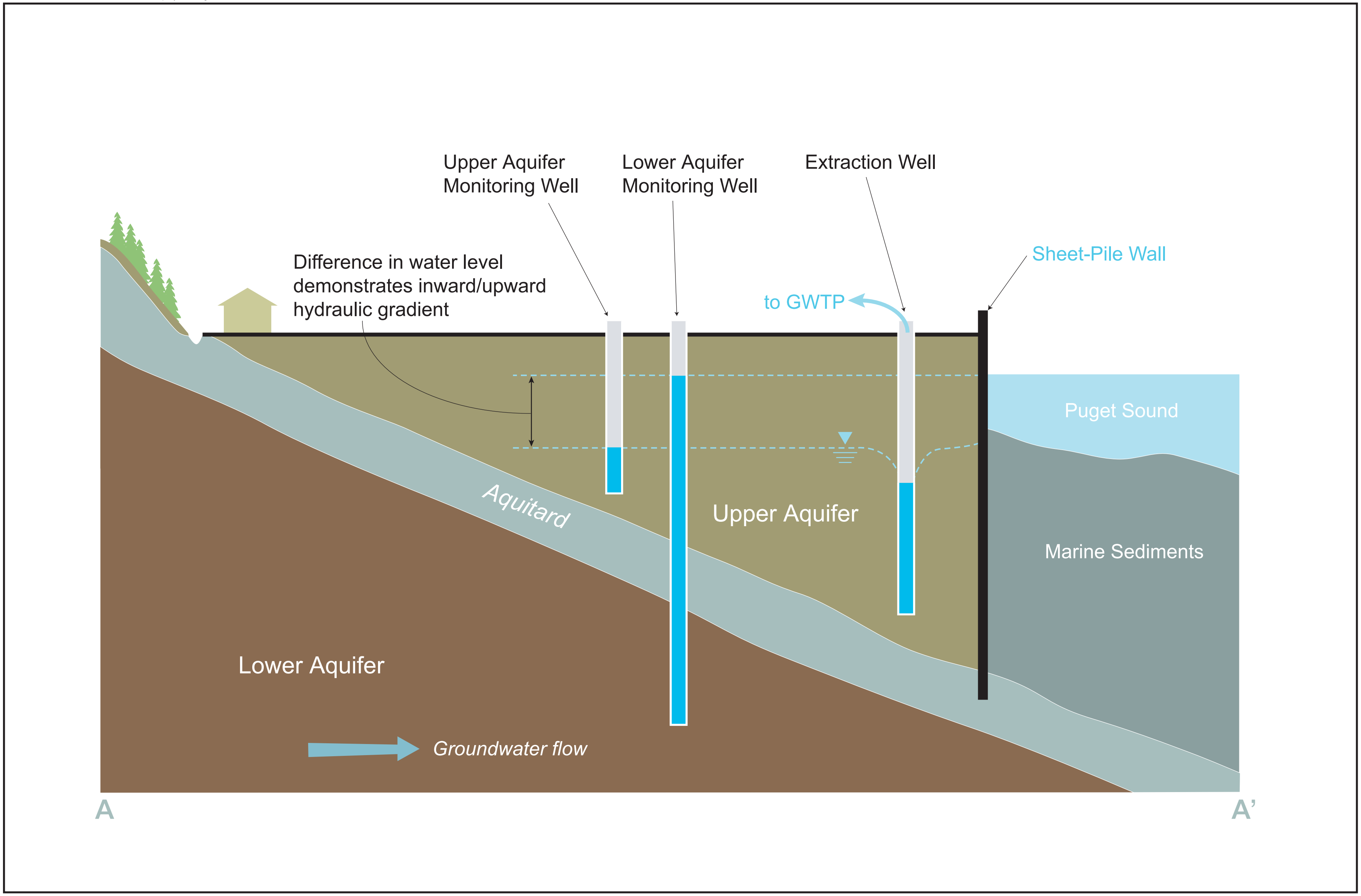


Figure 1
Cross-Section of the
Former Processing Area

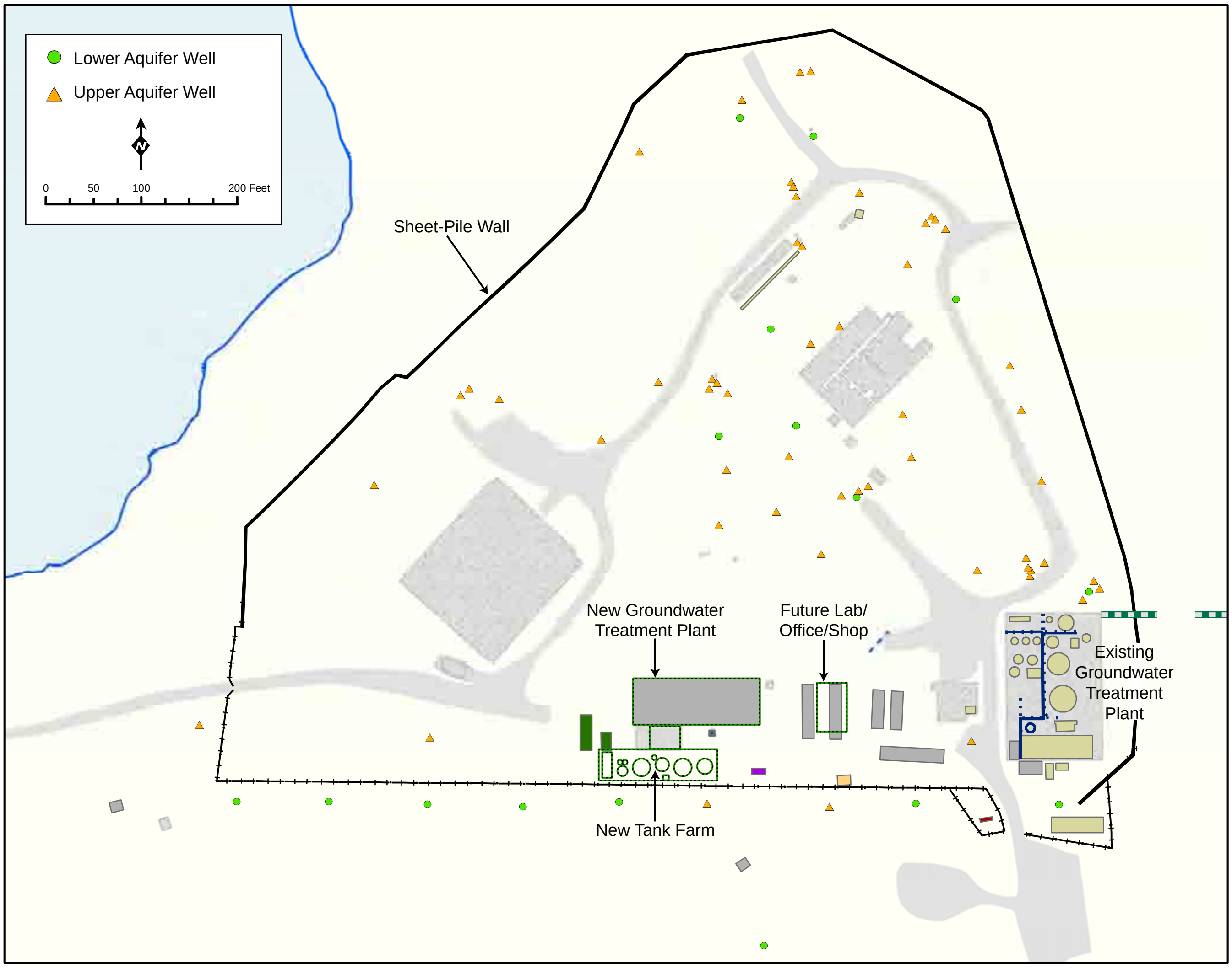


Figure 2

Overall Site Plan and Major Components of the Replacement Groundwater Treatment Plant

EPA

Wyckoff / Eagle Harbor Superfund Site, Bainbridge Island, Washington

U.S. Environmental Protection Agency, Region 10 July 2007

West Beach Cleanup Update

This fact sheet provides an update on the status of investigation and cleanup activities in the West Beach portion of the Wyckoff Superfund Site. The Wyckoff West Beach extends approximately 1,600 feet along the southern edge of Eagle Harbor, from the western edge of the Former Process Area to the western edge of the property. This beach was constructed by removing a failing wooden bulkhead and excavating the sediments behind the bulkhead to create a new beach.

History

In the summer of 2005, EPA received reports from Bainbridge Islanders about odors on the West Beach. Upon inspection, EPA found evidence of residual oily contamination and sheen on the beach in the area where the bulkheads, as well as contaminated soils and sediments behind the bulkheads, had been removed. It now appears that some of the contaminated sediments were not completely removed.

What has been done so far?

EPA roped off the portions of the West Beach with visible signs of contamination and posted signs restricting access to these portions of the beach. EPA conducted extensive sediment sampling along the beach during a period of extreme low tides in spring 2006. The objectives of the sampling program were to:

Roped-off Area 1A

- Assess the nature and extent of the contamination in the two roped-off areas;
- Determine if other portions of the West Beach were contaminated; and
- Collect data to support the cleanup action in areas where contaminated sediment was found.

The investigation determined that the extent of visual and chemical contamination at the surface of the beach was limited to the roped-off areas, but that sediment near the surface (i.e., within

In This Issue ...

4 feet of the surface) in several additional areas was also contaminated above levels that are protective of marine aquatic life. The levels also may pose a risk to humans with prolonged exposure. The data support the view that the West Beach sediments were contaminated by historical operations along the shoreline. No evidence was found to indicate that other sources up on the hillside are feeding contamination to the beach. The area of contaminated surface and near-surface sediment is shown in Views A and B of Figure 1 (attached).

Sediment sampling during low tide in spring 2006

How will the contamination be addressed?

The West Beach is part of the East Harbor Operational Unit (OU 1). Previous cleanup actions in the East Harbor are covered by the 1994 Record of Decision (ROD) issued by EPA. The primary cleanup objectives for the East Harbor sediment are compliance with the Washington State sediment quality standards (SQS) and reduction of contaminants in fish and shellfish to levels protective of human health and the environment. Over 70 acres of heavily contaminated subtidal (under water) sediments in the East Harbor OU have already been capped.

EPA coordinated with the State of Washington Department of Ecology, the Suquamish Tribe, the National Oceanic and Atmospheric Administration, the City of Bainbridge Island, and other state and federal agencies to develop the appropriate cleanup approach.

To address the newly discovered contamination, an exposure barrier system (EBS) will be constructed over the contaminated portions of the West Beach and over nearby subtidal sediments that were not capped during previous phases of the cleanup action in the East Harbor. The barrier system will effectively isolate the contaminated West Beach sediments and includes two primary elements:

1. **Beach Cover System.** A beach cover system will be placed on top of the existing beach sediments and previously placed habitat fill in the intertidal zone. The area to be covered includes locations where contaminant concentrations have recently been found to exceed cleanup levels and visual evidence of contamination has been observed in the upper 4 feet of sediment. The cover system will consist of a porous geotextile placed on the original beach, a 1-foot-thick layer of 3-inch cobbles placed on top of the geotextile, and a 2-foot-thick layer of fish habitat fill placed on top of the cobble layer.
2. **Subtidal Cap Extension.** The existing Eagle Harbor sediment cap will be extended from its current southern edge to a transition with the new beach cover system. The materials, placement methods, and placement tolerances for this cap extension will be similar to those used for the existing Eagle Harbor cap, and the cap extension will have the same overall thickness as the beach cover system. The result will be a 3-foot-thick layer of sand and gravel covering the subtidal area immediately north of the West Beach and extending up to the southern edge of the existing harbor cap.

View C in Figure 1 shows the areas where the barrier system will be constructed. Cross-sectional views are illustrated in Figure 2 (attached).

The cleanup action will address the residual contamination and will provide a protective and durable exposure barrier. This system will allow typical recreational activities on the beach and in the harbor.

When will the cleanup occur?

The design and construction drawings for the barrier system have been prepared and EPA is beginning the procurement process for construction. Construction is scheduled to begin in late fall of 2007 and will take approximately four weeks to complete.

For safety reasons, it will be necessary to close the West Beach to the public during construction. EPA is coordinating the construction activities with the City of Bainbridge Island and the Park District in an attempt to minimize the public impact.

For More Information

Technical Information:
Mary Jane Nearman, EPA Region 10
Project Manager
206-553-6642

General Information:
Jeanne O'Dell, EPA Community
Involvement Coordinator
206-553-6919 or toll-free at 1-800-424-4372

EPA Web Site:
http://yosemite.epa.gov/R10/CLEANUP.NSF/sites/wyckoff

Documents: The Administrative Record is a file that contains all information used by EPA to make decisions on the cleanup actions. The Administrative Record can be reviewed at:
EPA Region 10 Superfund Records Center
1200 Sixth Avenue, ECL-076
Seattle, WA 98101
206-553-4494 or toll-free at 1-800-424-4372
Please call for an appointment.

Select documents can be viewed at the Information Repository located at:
Bainbridge Island Public Library
1270 Madison Avenue North
If the library does not have the document you need, feel free to call Jeanne O’Dell, EPA Community Involvement Coordinator, at (206) 553-6919.

To request reasonable accommodations:

For people with disabilities: call Jeanne O’Dell at the number above.

For TTY users: call 1-800-877-8339 and give the operator Jeanne O’Dell’s phone number.

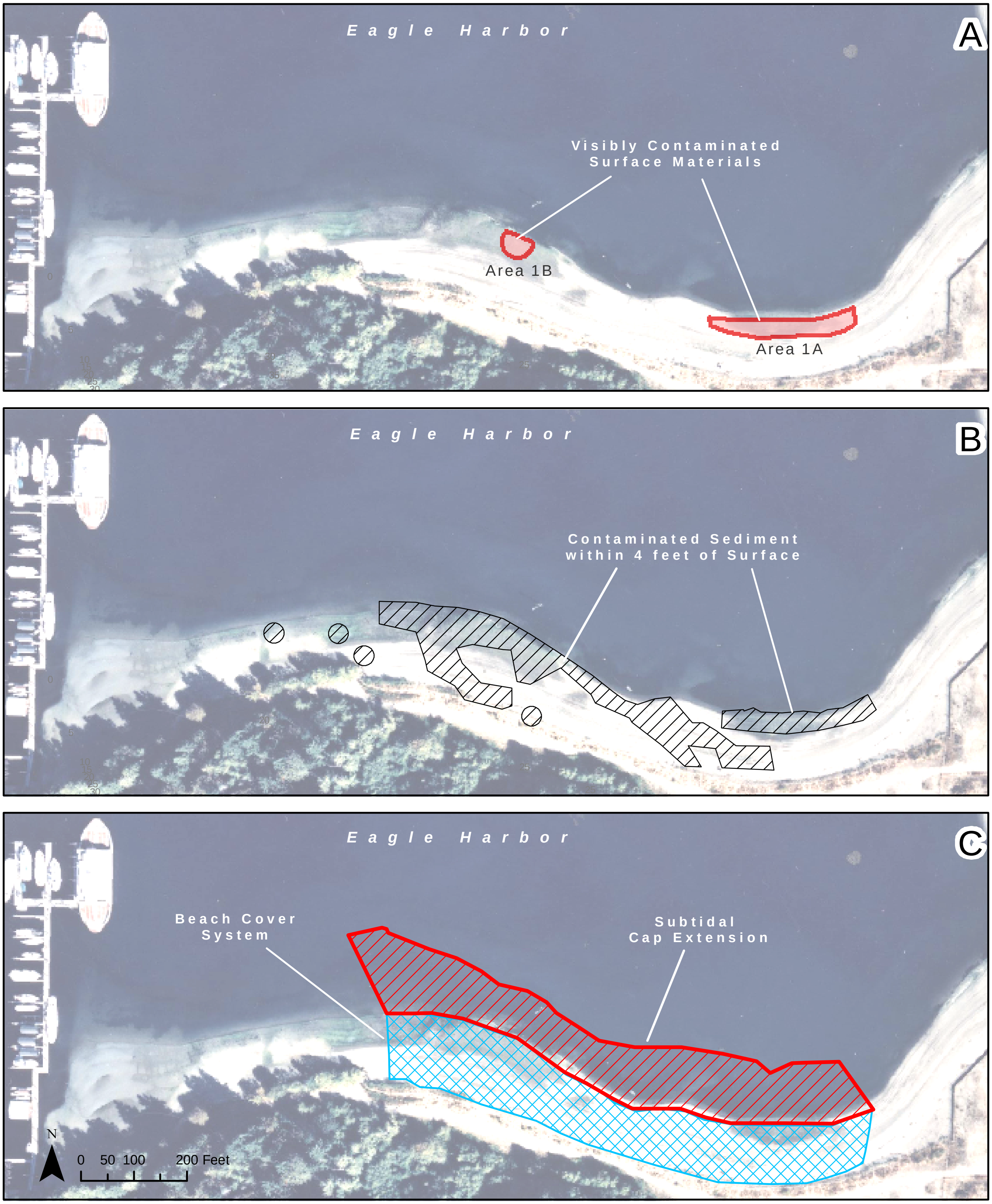


Figure 1
West Beach Views

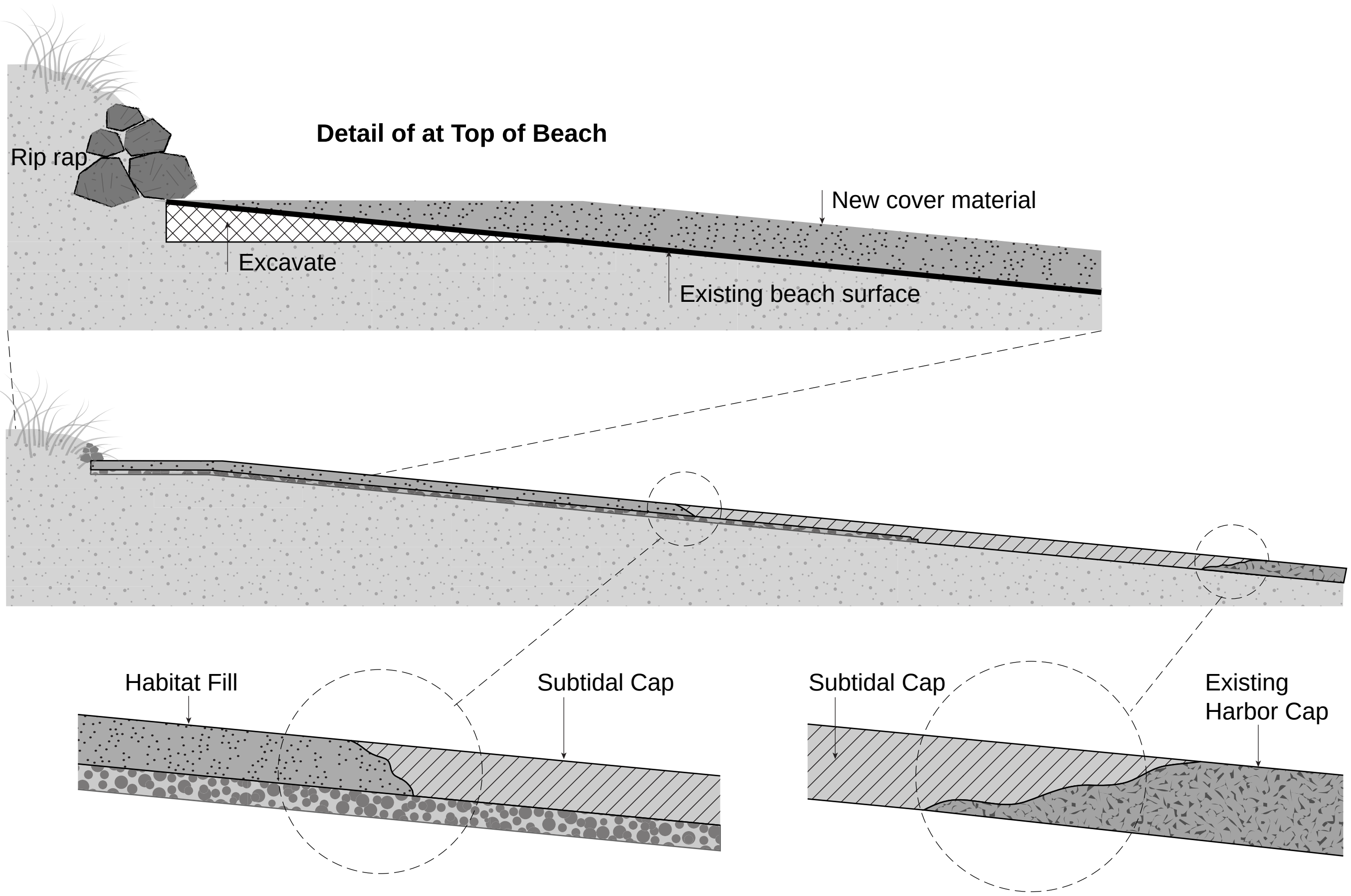


Figure 2
Barrier System

Wyckoff / Eagle Harbor Superfund Site, Bainbridge Island, Washington

U.S. Environmental Protection Agency, Region 10 July 2007

Wyckoff/Eagle Harbor Superfund Site
West Harbor (Operable Unit 3)

This fact sheet provides an update on the status of the cleanup activities at the site of the current Washington State Department of Transportation (WSDOT) Ferry Maintenance Facility. The site is located approximately 1,000 feet west of the Bainbridge Island ferry terminal. It consists of several piers, maintenance buildings, and a confined disposal facility constructed to contain upland soils and a cap of harbor sediments that are contaminated with heavy metals.

History

The West Harbor operable unit is a former shipyard that was active in Eagle Harbor through the 1950s. Eagle Harbor sediments are contaminated with polycyclic aromatic hydrocarbons (PAHs) and other organic compounds, as well as metals such as mercury, zinc, and copper. The contamination in the West Harbor is primarily the result of the historic shipyard activities.

Cleanup actions for the site were selected in the September 1992 Record of Decision (ROD). The ROD was amended in December 1995 to include construction of nearshore fill and a confined sediment disposal facility on lands owned by WSDOT. The amended 1995 ROD also provided for implementation of contaminant source control measures at the former shipyard property. The confined disposal facility was constructed in an intertidal area adjacent to the former shipyard property. Its purpose is to isolate contaminated sediments and prevent them from entering Eagle Harbor.

Aerial View of the West Harbor (Operable Unit 3)

The selected remedy for the West Harbor operable unit also included placement of a clean sediment cap over contaminated areas of the harbor bottom. Construction of the West Harbor operable unit remedy began in April 1997.

Cleanup Actions to Date

The following actions have been implemented at this site:

In This Issue ...

- Contaminated sediments in Eagle Harbor have been capped.
- Construction of the confined disposal facility for upland isolation of the contaminated sediments was completed.
- In 2006, an additional tidal barrier was constructed between the confined disposal facility and the adjacent estuary. See Figure 1 (attached).
- Institutional controls have been implemented to prevent people from collecting and eating contaminated fish and shellfish.
- Regular monitoring is ongoing to ensure the remedy is working to protect human health and the environment.

Recent Community Questions and Concerns

EPA recently received inquiries about seepage that had been observed moving from the tidal barrier into the estuary, and whether this seepage was releasing metals into the harbor. There were also questions about the attempts to plant eel grass at the mouth of the estuary.

Seepage

WSDOT completed construction of the confined disposal facility and initial tidal barrier in December 1997. Intermittent seeps from the intertidal barrier were identified shortly after its placement. These intermittent seeps result from the flooding and saturation of the tidal barrier material at high tide and the subsequent draining of the water at low tide. Quarterly monitoring of the seeps was conducted in accordance with the EPA-approved plan. This sampling determined that the concentrations of copper and zinc in the seep water exceeded the applicable state standards. Based on these data, EPA required WSDOT to propose options for addressing the seepage.

Construction of the Additional Tidal Barrier

The monitoring data initially indicated that the seep volume and metals concentrations may be decreasing over time. Also, sampling of the adjacent estuary indicated that there were no environmental risks to fish. For these reasons, it was decided to continue monitoring the seeps for a limited time to see if the seep volume and metals concentrations would decrease to acceptable levels.

When subsequent monitoring indicated that the seepage was not decreasing to acceptable levels, EPA required WSDOT to construct an additional tidal barrier. WSDOT completed construction of this additional barrier in 2006. Monitoring of the active seeps now indicates that the barrier is effectively isolating the upland contamination sources from Eagle Harbor, and that no further cleanup actions are needed. Monitoring is continuing on a regular basis.

Habitat Mitigation

The ROD required WSDOT to perform habitat mitigation in accordance with the Clean Water Act. The habitat mitigation included three components: (1) habitat enhancement of the tidal barrier; (2) a 0.6-acre eel grass planting; and (3) restoration of additional habitat in the Schel-chelb estuary.

WSDOT first attempted the eelgrass planting site immediately west of the confined disposal facility in 1998. When this planting effort did not succeed, the mitigation plan required WSDOT to attempt a second planting. In spite of using best available techniques and expertise, the eel grass did not take hold in this area. The two eelgrass planting efforts met this component of the mitigation requirement.

In addition to the eel grass planting, WSDOT was required to enhance the habitat of the tidal barrier and to restore additional habitat in the Schel-chelb estuary. WSDOT performed the habitat enhancements and successfully restored this 2-acre estuary located at the south end of Bainbridge Island near Lynwood Center.

WSDOT has now met the ROD requirements for habitat mitigation.

Continuing Monitoring

WSDOT and EPA will continue to closely monitor the groundwater, surface water, and capping elements related to the cleanup actions. The monitoring requirements are specified in the existing site operations, maintenance, and monitoring plan. Any issues that are identified by those monitoring efforts will continue to be addressed in accordance with the provisions of the ROD and its amendment.

For More Information

Technical Information:
Mary Jane Nearman, EPA Region 10
Project Manager
206-553-6642

General Information:
Jeanne O'Dell, EPA Community
Involvement Coordinator
206-553-6919 or toll-free at 1-800-424-4372

EPA Web Site:
http://yosemite.epa.gov/R10/CLEANUP.NSF/sites/wyckoff

Documents: The Administrative Record is a file that contains all information used by EPA to make decisions on the cleanup actions. The Administrative Record can be reviewed at:
EPA Region 10 Superfund Records Center
1200 Sixth Avenue, ECL-076
Seattle, WA 98101
206-553-4494 or toll-free at 1-800-424-4372
Please call for an appointment.

Select documents can be viewed at the Information Repository located at:
Bainbridge Island Public Library
1270 Madison Avenue North
If the library does not have the document you need, feel free to call Jeanne O'Dell, EPA Community Involvement Coordinator, at (206) 553-6919.

To request reasonable accommodations:

For people with disabilities: call Jeanne O'Dell at the number above.

For TTY users: call 1-800-877-8339 and give the operator Jeanne O'Dell's phone number.

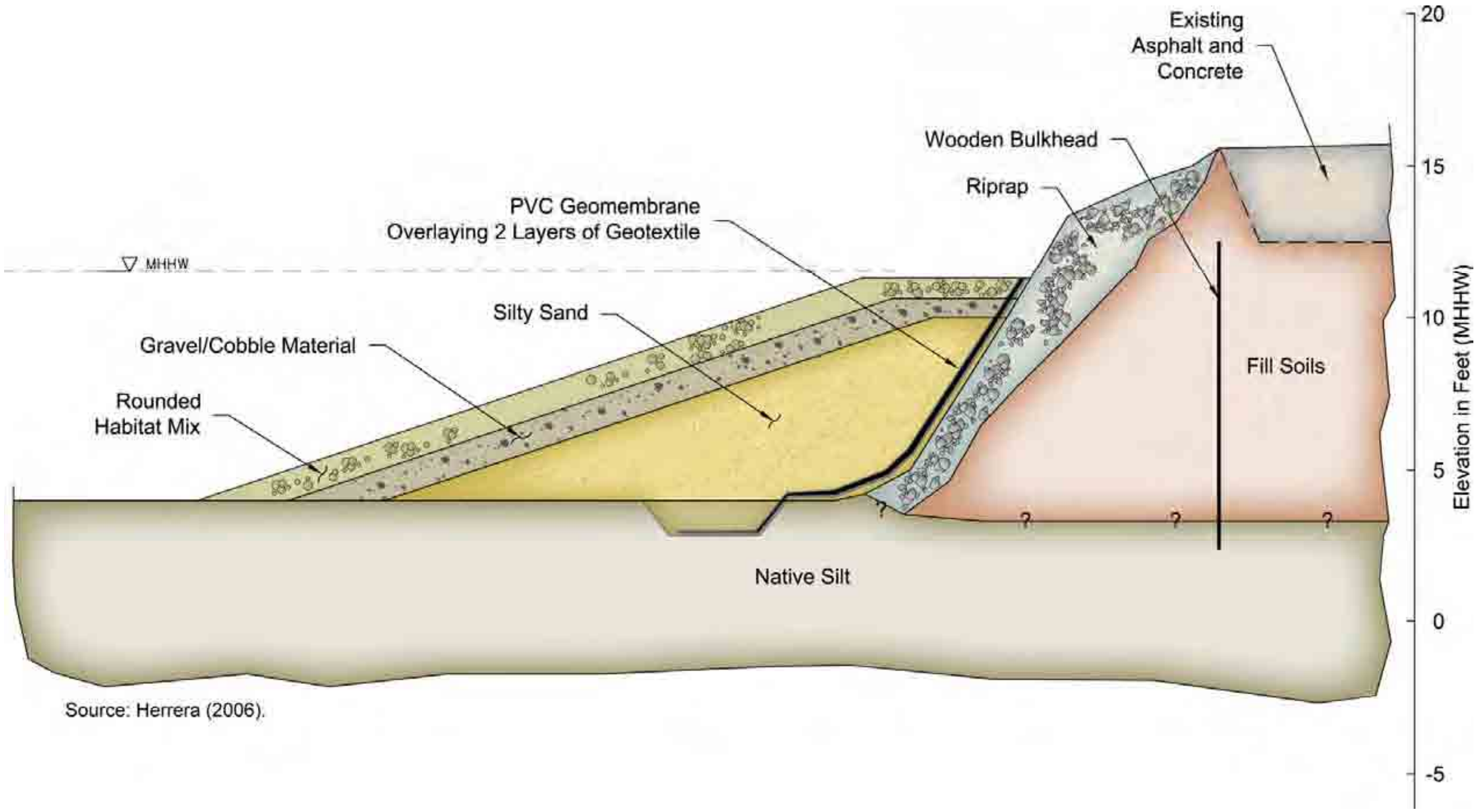


FIGURE 1
Tidal Barrier

EPA Wyckoff / Eagle Harbor Superfund Site Bainbridge Island, WA

The U.S. Environmental Protection Agency (EPA) is conducting a Five-Year Review of the cleanup at the Wyckoff / Eagle Harbor Superfund site, located on Eagle Harbor, Bainbridge Island, Washington. EPA reviews Superfund sites at least every five years after cleanup begins. The review is a checkup to evaluate the progress and the effectiveness of the cleanup activities. EPA conducts these reviews to ensure that actions are protective of people and the environment.

EPA welcomes your participation during this process. The evaluation will be completed by September 2007. If you have information that may help EPA with the review, please contact Mary Jane Nearman, EPA Project Manager, by phone: 206-553-6642 or by email: nearman.maryjane@epa.gov .TTY users may call the Federal Relay Service at 800-877-8339 and give the operator Mary Jane Nearman's phone number.

The Wyckoff / Eagle Harbor Site is listed on EPA's National Priorities List of the nation's most contaminated hazardous waste sites. Contamination includes metals, creosote and wood treatment compounds. EPA is currently treating contaminated groundwater from the "point" or the Wyckoff former processing area. In Eagle Harbor, contaminated bottom sediments were capped with clean sand to isolate the contamination from the environment. The monitoring results of these cleanup actions are being reviewed to ensure continuing protection of human health and the environment.

To learn more, visit www.epa.gov/r10earth , click on "index" and then click on "W" for Wyckoff.

WYCKOFF-EAGLE HARBOR SUPERFUND SITE

Five-Year Review Public Meeting

August 16, 2007 6:30 – 8:30

Bainbridge Island Commons

US Army Corps of Engineers®

CH2MHILL

EPA

Agenda

6:30 – 7:15

Overview of 5-year review process and status of cleanup in four operable units (MJ Nearman, EPA)

7:15 – 7:30

Agency for Toxic Substances Disease Registry Health Consultation (Richard Kauffman, ATSDR)

7:30 – 8:30

Questions and Open Discussion

Overview of Five-Year Review Process

- Review required by Superfund law when contamination is left in place.
- Evaluates implementation and performance of a remedy to determine if remedy is or will be protective of human health and the environment.
- Last five-year review conducted in 2002.

Superfund Listing

- March 1984, the National Oceanic and Atmospheric Administration notified the EPA of finding tumors on fish in Eagle Harbor
- In 1985, a public health advisory was issued on shellfish and fishing in the harbor
- July 1987, the site was added to the National Priorities List by the EPA

Operable Units

- **Four major areas or operable units (OUs) at Wyckoff/Eagle Harbor site:**

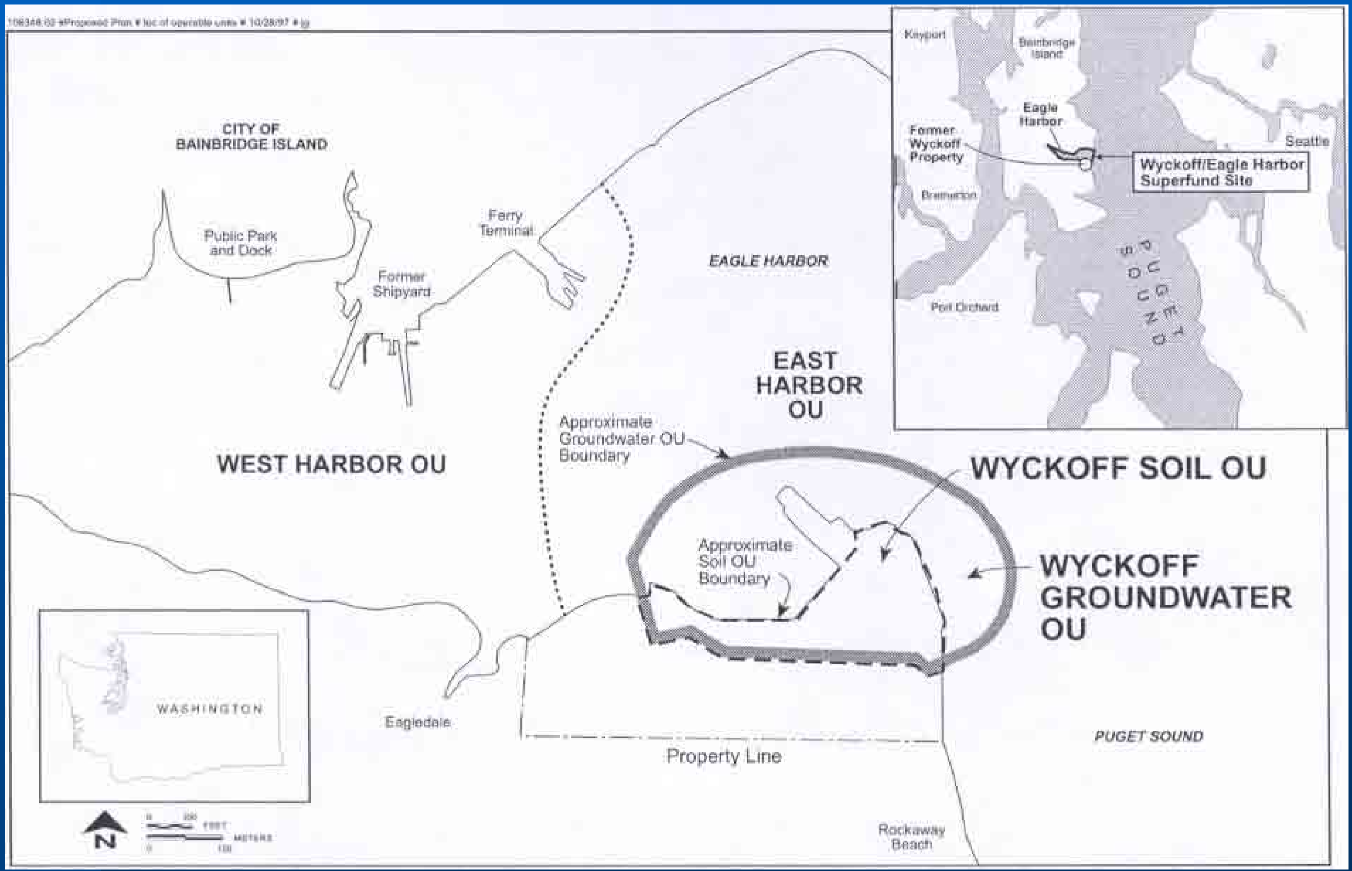
  - West Harbor (currently ferry maintenance facility)

  - Eagle Harbor

  - Soil at Wyckoff facility

  - Groundwater at Wyckoff facility

Operable Unit Location Map



West Harbor Operable Unit


© 2007 Europa Technologies

West Harbor OU Background

- **Contamination primarily result of historic shipyard activities, not from ferry maintenance operations**
- **Contaminants include polycyclic aromatic hydrocarbons (PAHs) and metals (mercury, zinc, and copper) in marine sediments and upland soils**

Components of West Harbor OU cleanup

- Record of Decision September 1992, amended in December 1995
- Capping of contaminated harbor sediments
- Construction of confined disposal facility (CDF) to contain upland soils
- Construction of tidal barrier between CDF and adjacent estuary
- Institutional controls to protect remedy
- Monitoring of cap, groundwater and seeps

Construction of Additional Tidal Barrier

- Intermittent seeps within tidal barrier exceeded state regulatory standards for copper and zinc.
- WSDOT constructed additional tidal barrier in 2006.
- Monitoring now indicates seeps meet regulatory standards. No further cleanup actions needed.

Aerial Photographs


1984


1996


2000

Marine Cap

Current View

Eagle Harbor Operable Unit

East Harbor Subtidal/Intertidal Cap

- Monitoring of cap (bathymetry and through-cap coring) occurred in 2002 and 2003.
- Intertidal and subtidal caps are physically stable. Caps are effectively isolating underlying contaminated sediments
- Placement of additional cap on West Beach anticipated in October 2007

North Shoal and East Beach

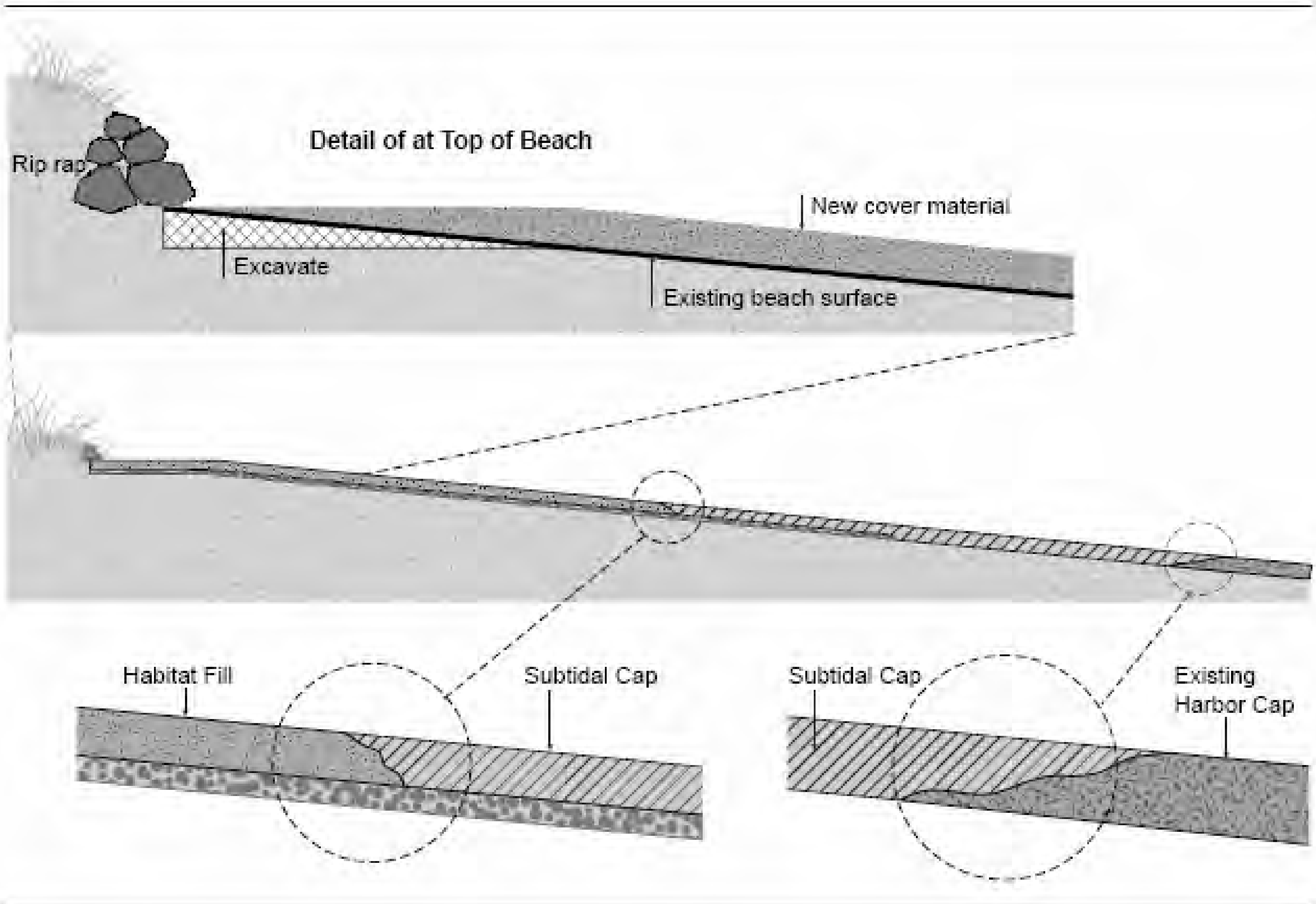
- Residual contamination (PAHs) remain outside the sheet pile wall on the north shoal and east beach.
- These areas are posted to restrict human access.
- ATSDR will review potential human health risks to public in health consultation.

West Beach Cleanup

Summary of Results

- Summer 2005, EPA received reports from beach users about odors on West Beach.
- Soil and sediment sampling conducted in spring 2006.
- Areas of PAH contamination and oily sheen identified.
- Exposure Barrier System to be placed in October 2007 to prevent human contact and protect marine waters.

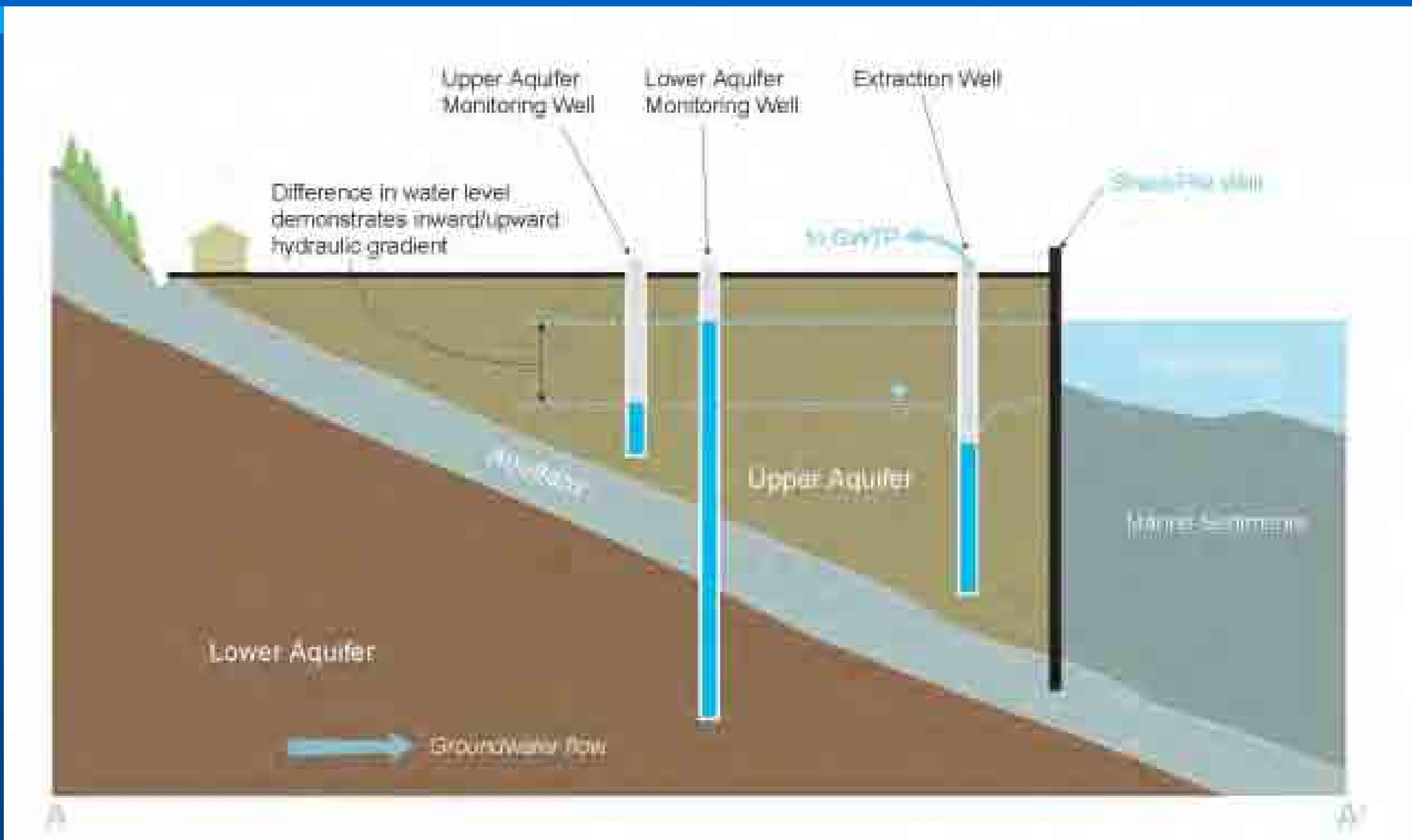

Eagle Harbor
A
Visibly Contaminated
Surface Materials
Area 1B
Area 1A


Detail of at Top of Beach
Rip rap
New cover material
Excavate
Existing beach surface
Habitat Fill
Subtidal Cap
Subtidal Cap
Existing
Harbor Cap

Soil and Groundwater Operable Units

(Former Process Area or the “Point”)

Current Conditions: Hydraulic Containment



Replacement Groundwater Treatment Plant

- Existing treatment plant has been in operation for 15 years and is in need of replacement.
- U.S. Army Corps of Engineers awarded contract to ECC construction firm. Construction expected to be complete in spring 2008.
- New plant to be located in large green boiler building with new storage tank farm located to south of building.

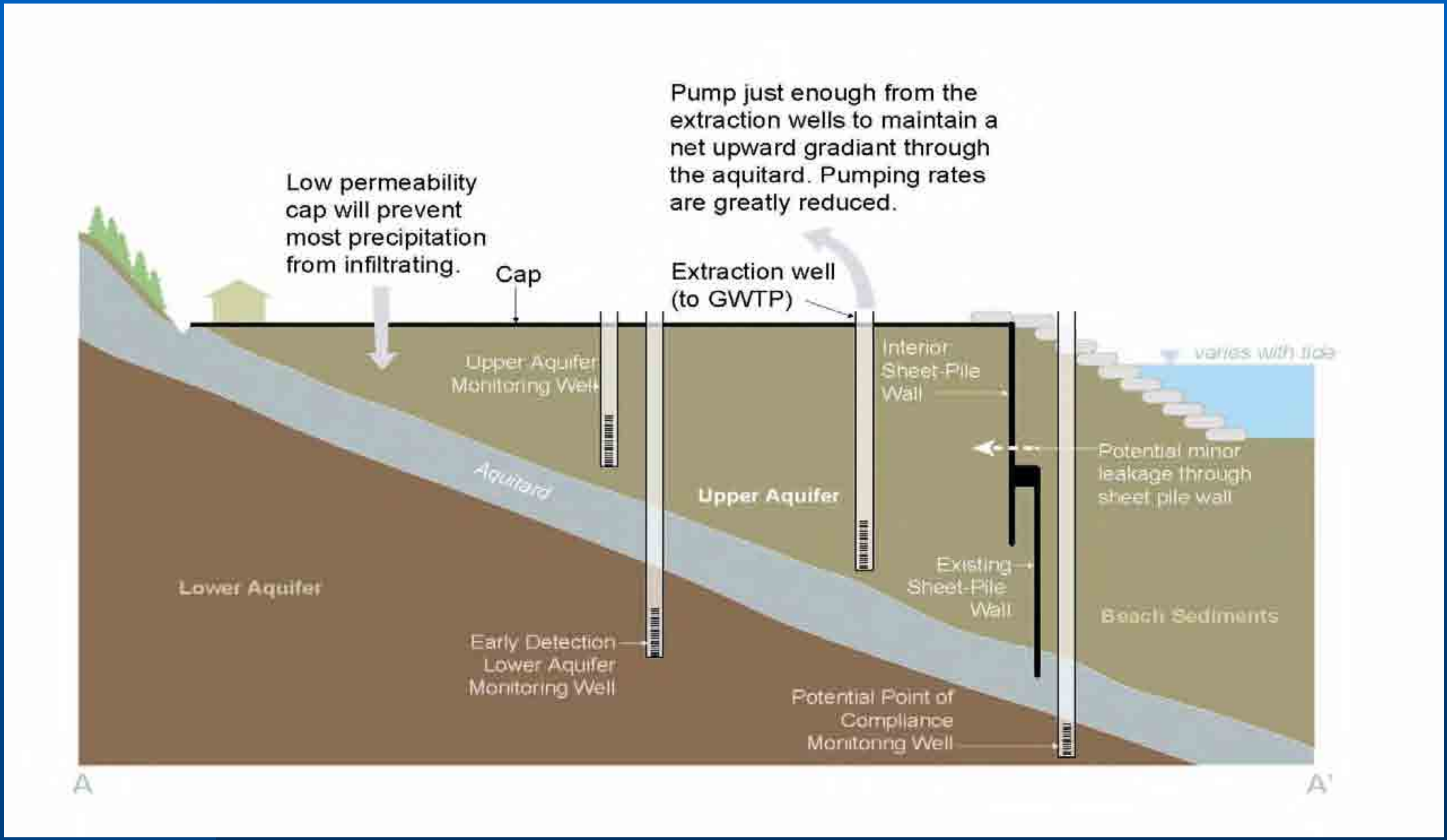
2000 Record of Decision

- **Selected thermal treatment pilot to remove wood-treating wastes;**
- **Selected containment as contingency remedy in event thermal treatment could not meet cleanup objectives;**
- **State of WA and Suquamish tribe concurred with 2000 ROD;**
- **City of Bainbridge Island, as new property owner, increasing invested in decisions.**

Results of Thermal Treatment Pilot

- Conducted in 2002/2003;
- Will achieve some mass contaminant removal but will not achieve ROD goals for cleanup (i.e., will not result in “walk away” remedy);
- WA state regulatory standard for soil, groundwater, and sediments will not be achieved by thermal treatment.

Summary of Containment Remedy Components



Path Forward for the "Point"

- Any remedy implemented must be protective of human health and the environment and comply with environmental regulations.
- EPA is continuing discussions with Suquamish Tribe, WA Department of Ecology, the City of Bainbridge Island, and other federal and state regulatory agencies.

Five-Year Review

- **Draft report will be reviewed by regulatory agencies.**
- **Final five-year review to be signed by September 2007.**
- **Final report will identified outstanding issues and plan for resolution of these issues.**

APPENDIX B

List of Documents Reviewed During the Second Five-Year Review

APPENDIX B

List of Documents Reviewed During the Second Five-Year Review

California Environmental Protection Agency (Cal EPA). 1994. *Benzo(a)pyrene as a toxic air contaminant. Part B: Health Assessment*. Office of Environmental Health Hazard Assessment, Berkeley, California.

CH2M HILL. June 1997. *Remedial Investigation Report, Wyckoff Soil and Groundwater Operable Units, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington*.

CH2M HILL. April 2004. *Technical Memorandum: Sheet Pile Wall Corrosion Issues*.

CH2M HILL. November 2005. *Wyckoff/Eagle Harbor Superfund Site, Soil and Groundwater Operable Units, Engineering Evaluation of Groundwater and Soil Remediation Scenarios*.

CH2M HILL. November 2006. *West Beach Investigation Data Evaluation Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington*.

CH2M HILL. February 2007 (2007a). *September 2006 Groundwater Sampling Results for Wyckoff/Eagle Harbor Superfund Site Report*.

CH2M HILL. February 15, 2007 (2007b). *Memorandum: Wyckoff West Beach Exposure Barrier System (EBS) Design Concept*.

CH2M HILL. February 16, 2007 (2007c). *Memorandum: Wyckoff West Beach Exposure Barrier System (EBS) Design Basis*.

CH2M HILL. March 2007 (2007d). *Contract Documents for the Replacement of the Wyckoff Groundwater Treatment Plant*.

CH2M HILL. March 5, 2007 (2007e). *Technical Memorandum: Wyckoff West Beach Stability Evaluation*.

CH2M HILL. April 2007 (2007f). *Groundwater Conceptual Site Model Update Report for the Former Process Area, Wyckoff/Eagle Harbor Superfund Site, Soil and Groundwater Operable Units.*

Dorn, Paul. 2006. *Memorandum: Wyckoff Beach Seining Data from 2003 and 2004*. The Suquamish Tribe Fisheries Department, Suquamish, Washington.

Harper, B.L., A. K Harding, T. S. Waterhouse, and S. G. Harris. 2006. *Regional Tribal Exposure Scenarios Based on Major Ecological Zones and Traditional Subsistence*

Lifestyles. Prepared for the U.S. Environmental Protection Agency (EPA) by Oregon State University and the Confederated Tribes of the Umatilla Indian Reservation under EPA Grant Number R831046. Appendix 3. http://www.hhs.oregonstate.edu/ph/tribal-grant/FishIngestionAppendix.pdf/

Hart Crowser. 1997. *Operations, Maintenance, and Monitoring Plan (OMMP), West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington*.

Herrera Environmental Consultants (Herrera). April 4, 2001. *Year 3 (2000) Fourth Quarter Data Report and Annual Summary, West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington.*

Herrera Environmental Consultants (Herrera). 2007. *Year 9 (2006) Fourth Quarter Data Report and Annual Summary, West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington.*

Incardona, J.P., M.G. Carls, H.Teraoka, C.A. Sloan, T.K. Collier, and N.L. Scholz. December 2005. "Aryl Hydrocarbon Receptor–Independent Toxicity of Weathered Crude Oil during Fish Development." *Environmental Health Perspectives* 113(12): 1755-1762.

Integral Consulting, 2004. *2002-2003 Year 8 Environmental Monitoring Report, Wyckoff/Eagle Harbor Superfund Site, East Harbor Operable Unit, Bainbridge Island, Washington*.

Johnson, L.L, T.K. Collier, and J.E. Stein. 2002. "An analysis in support of sediment quality thresholds for polycyclic aromatic hydrocarbons (PAHs) to protect estuarine fish." *Aquatic Conserv: Mar. Freshw. Ecosyst*. 12: 517–538.

Magar, V.S. U. Ghosh, and B.M. Sass. May 2007. "Characterization of Contaminant Migration Potential Through In-Place Sediment Caps." Presentation at Strategic Environmental Research and Development Program (SERDP) ER-1370 In-progress review meeting.

Meador, J., F.C. Sommers, G.M. Ylitalo, and C.A. Sloan. 2006. "Altered growth and related physiological responses in juvenile Chinook salmon (*Oncorhyncus tsawytscha*) from dietary exposure to polycyclic aromatic hydrocarbons (PAHs)." *Can. J. Fish Aquat. Sci.* 63:2364-2376.

Operations and Maintenance International (OMI). June 2005. *Final Remedial Action Plan, Operation and Maintenance, Wyckoff Facility and Groundwater Operable Units, Wyckoff/Eagle Harbor Superfund Site.*

Sechena, R., C. Nakano, S. Liao, N. Polissar, R. Lorenzana, S. Truong, and R. Fenske. 1999. *Asian and Pacific Islander Seafood Consumption Study*. EPA 910/R-9903: http://www.epa.gov/r10earth/offices/oea/risk/a&pi.pdf

Sechena, R., S. Liao, R. Lorenzana, C. Nakano, N. Polissar, and R. Fenske. 2003. "Asian American and Pacific Islander seafood consumption -- a community-based study in King County, Washington." J. *Expo. Anal. Environ. Epidemiol.* 13(4):256-266.

Suquamish Tribe Fisheries Department. 2000. *Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound.*

Thom, R.M., and L.D. Antrim. April 6, 1998. *Habitat Mitigation for West Eagle Harbor Nearshore Fill: Eelgrass (Zostera marina L.) Mitigation Plan Specifications*. Battelle Marine Sciences Laboratory, Sequim, Washington.

Toy K.A., N.L. Polissar, S. Liao, and G.D. Mittelstaedt. 1996. *A Fish Consumption Survey of the Tulalip and Squaxin Island Tribes of the Puget Sound Region.* Tulalip Tribes Department of the Environment.

Ultican, Shawn. December 12, 2006. Personal communication (telephone conversation with Alex Svendsen, Herrera Environmental Consultants, Seattle, Washington, regarding health advisories). Bremerton-Kitsap County Health District, Bremerton, Washington.

U.S. Army Corps of Engineers (USACE). 1995. *Addendum to Operations, Maintenance, and Monitoring Plan, Wyckoff/Eagle Harbor Superfund Site, East Harbor Operable Unit.*

U.S. Army Corps of Engineers (USACE). 1997. *Operations, Maintenance, and Monitoring Plan, Wyckoff/Eagle Harbor Superfund Site, West Harbor Operable Unit.*

U.S. Army Corps of Engineers (USACE). May 2000. *Comprehensive Report, Wyckoff NAPL Field Exploration, Wyckoff Soil and Groundwater Operable Units, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, WA.*

U.S. Army Corps of Engineers (USACE). March 2001. *Sheet Pile Hydraulic Conductivity Report, Wyckoff Soil and Groundwater Operable Units, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington.*

U.S. Army Corps of Engineers (USACE). 2002 (2002a). *2002 OMMP Addendum, Wyckoff/Eagle Harbor Superfund Site, East Harbor Operable Unit*.

U.S. Army Corps of Engineers (USACE). 2002 (2002b). *East Beach Intertidal Investigation Report, Wyckoff/Eagle Harbor Superfund Site, East Harbor Operable Unit*.

U.S. Army Corps of Engineers (USACE). 2002 (2002c). *Year 8 Environmental Monitoring Report, Wyckoff/Eagle Harbor Superfund Site, East Harbor Operable Unit.*

U.S. Army Corps of Engineers (USACE). August 2005 (2005a). *Quality Assurance Project Plan: Surface Water Exposure Assessment, Wyckoff Facility and Groundwater Operable Units, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington*.

U.S. Army Corps of Engineers (USACE). December 2005 (2005b). *Surface Water Sampling Report – Surface Water Exposure Assessment, Wyckoff Facility and Groundwater Operable Units, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington*.

U.S. Environmental Protection Agency (EPA). 1987. *Interim procedures for estimating risks associated with exposures to mixtures of chlorinated dibenzo-p-dioxins and -dibenzofurans (CDDs and CDFs).* EPA/625/3-87/012.

U.S. Environmental Protection Agency (EPA). September 1992. *Record of Decision for the West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington.*

U.S. Environmental Protection Agency (EPA). July 1993. *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons*. EPA/600/R-93/089.

U.S. Environmental Protection Agency (EPA). September 1994 (1994a). *Record of Decision for the East Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington.*

U.S. Environmental Protection Agency (EPA). September 1994 (1994b). *Interim Record of Decision for the Groundwater Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington.*

U.S. Environmental Protection Agency (EPA). 1995 (1995a). *1995 Environmental Monitoring Report, Long-Term Monitoring Program, East Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington.*

U.S. Environmental Protection Agency (EPA). 1995 (1995b). *Operations, Maintenance and Monitoring Plan for the East Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington.*

U.S. Environmental Protection Agency (EPA). December 1995 (1995c). *Record of Decision Amendment for the West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington.*

U.S. Environmental Protection Agency (EPA). 1997. *1997 Environmental Monitoring Report, East Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington.*

U.S. Environmental Protection Agency (EPA). 2000 (2000a). *1999 Environmental Monitoring Report, East Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington.*

U.S. Environmental Protection Agency (EPA). February 2000 (2000b). *Wyckoff/Eagle Harbor Superfund Site, Soil and Groundwater Operable Units, Bainbridge Island, Washington: Record of Decision.*

U.S. Environmental Protection Agency (EPA). 2002 (2002a). *Operations, Maintenance and Monitoring Plan Addendum for the East Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington.*

U.S. Environmental Protection Agency (EPA). September 2002 (2002b). *Five-Year Review Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington.*

U.S. Environmental Protection Agency (EPA). November 2003 (2003a). *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures.* EPA-600-R-02-013.

U.S. Environmental Protection Agency (EPA). December 2003 (2003b). *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds.* Chapter 9, Toxic Equivalency Factors (TEF) for Dioxin and Related Compounds. Part II: Health Assessment for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds. NCEA-I-0836. http://www.epa.gov/ncea/pdfs/dioxin/nas-review/pdfs/part2/dioxin_pt2_ch09_dec2003.pdf

U.S. Environmental Protection Agency (EPA). February 2, 2004 (last update). "Low Concentration Organic Analysis, OLC03.2." Superfund Analytical Services/Contract Laboratory Program (CLP). <http://www.epa.gov/oerrpage/superfund/programs/clp/olc32.htm>

U.S. Environmental Protection Agency (EPA). 2006. *Thermal Remediation Pilot Study Summary Report, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington.*

U.S. Environmental Protection Agency (EPA). January 2007 (2007a). *Evaluating Ecological Risk to Invertebrate Receptors from PAHs in Sediments at Hazardous Waste Sites.* (External Review Draft). EPA/600/R-06, ERASC-011.

U.S. Environmental Protection Agency (EPA). August 2007 (2007b). *Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based*

Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia. Working Document To Be Applied in Consultation with Tribal Governments on a Site-specific Basis.

Van den Berg et al. 1998. "Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife." *Environmental Health Perspe*ctives Vol. 106, No. 12, pp. 775-792.

Van den Berg et al. 2005. *Project for the re-evaluation of human and mammalian toxic equivalency factors (TEFs) of dioxins and dioxin-like compounds.* http://www.who.int/ipcs/assessment/tef_update/en/

Washington Department of Fish and Wildlife (WDFW). 1997. *Salmonid stock inventory: appendix, bull trout and Dolly Varden.*

Washington Department of Fish and Wildlife (WDFW). 1999. Web site for forage fish biology.

Washington Department of Fish and Wildlife (WDFW). November 22, 2006. *Forage Fish Spawning Habitat Survey Field Report, Area: Blakely and Eagle Harbors, SE Bainbridge Island.*

Washington State Department of Transportation (WSDOT). 1999. *Subsidence Investigation Report, West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site*.

Washington State Department of Transportation (WSDOT). 2001. *Contingent Habitat Mitigation Screening Analysis, West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site.*

Washington State Department of Transportation (WSDOT). 2007. *Year 9 (2006) Fourth Quarter Data Report and Annual Summary, West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site.*

APPENDIX C

Monthly Groundwater Extraction and Treatment System Operations Report, May 2007

Wyckoff/Eagle Harbor Superfund Site

Monthly Report

May 2007

Prepared for

US Army Corps of Engineers
Seattle District
W912DW-04Q-0170

Prepared by

Operations Management International
5350 Creosote Place N.E.
Bainbridge Island, Washington 98110

Table of Contents

Tables

Figures

Wyckoff O&M Project
Operations Report for the Month of May, 2007

Introduction

This progress report represents the twenty-eighth month of Remediation Operations and Maintenance (O&M). The purpose of this report is to provide a summary of site operations for the month.

Notable Issues:

- A quarterly contract review was completed with the USACE at the Seattle District office. No contract issues were noted. **5-1-07**
- The testing and certification of both site potable water backflow assemblies was completed. Copies of the reports were sent to the City of Bainbridge Island for their records. **5-5-07**
- OMI staff member Stan Warner attended the pre construction partnering meeting held at the USACE Seattle District office. **5-16-07**
- OMI staff completed their annual eight hour Hazardous Waste and Emergency Response refresher training as required in the site Safety and Health plan. **5-24-07**
- Contractor Pieroni Industrial Equipment was on site to repair the emergency propane generator. Temporary adjustments were made to the generator governor and a successful operational test was completed. A replacement governor has been placed on order for this unit due to the unreliability of the generator. **5-24-07**
- Washington State Department of Fish and Wildlife officers were called to the site to remove a severely injured deer. When the officers arrived the deer had expired and they removed the deer from the facility. **5-29-07**
- The site deep well water system was taken off line briefly for water testing by the City of Bainbridge Island. **5-30-07**
- OMI staff assisted USACE personnel with the site five year review inspection check list and site specific data collection. **5-31-07**

System Status

Pilot Area Extraction System

- Extraction wells EW-2 and EW-6 have operated through out the month with no issues.

Former Process Area Well Field Extraction System

- OMI staff inspected the well field ground water pump zinc anodes. **5-6-07**
- OMI staff removed debris and cleaned the spill containment sump at PW-4. **5-8-07**
- The batteries in the flow meter at PW-2 were replaced. **5-12-07**

- OMI staff installed a rebuilt ground water pump at PW-9. A satisfactory operational test was completed and the pump was placed on line. **5-17-07**

- OMI staff probed and Pumped FPA throughout the month.

Groundwater Treatment Plant

Primary System

- OMI staff lubricated the DAFT float drive shaft bearings and inspected the chain tension. **5-17-07**

Secondary System

- The basin polyblend system failed due to loss of the digital pump controller. The system was placed in the manual mode and a new logic controller unit was placed on order. **5-8-07**

- OMI staff removed ABET effluent pump 205A for troubleshooting due to excessive pump vibration and noise. The root cause of the pump failure was determined to be severely deteriorated pump drive shaft and bearings. A new drive shaft was placed on order. **5-9-07**

- OMI staff removed the ABET two inch fisher level control valve and installed a one and one half inch control valve due to reduced flows through the treatment plant. **5-9-07**

- The aeration basin polymer system water control flow meter was repaired. **5-13-07**

- OMI staff replaced a failed pump block and the ball check valves on the aeration basin polymer system. **5-17-07**

- Cleaned and painted ABET effluent pump 205-A. This pump is ready for rebuild as soon as we receive a replacement drive shaft that was placed on order. **5-21-07**

- A replacement digital pump controller for the aeration basin polyblend system was installed and programmed. A successful operational test was completed. **5-22-07**

- The aeration basin continues to operate well with good contaminant reductions for both PCP and PAH. 99 % reductions have been recorded for both analytes across the basin.

Tertiary System

- Carbon vessels remain stable with very little change in analytical results. No carbon change is forecast in the immediate future.

Miscellaneous

- OMI staff changed the oil filters on both Sullivan/ Palatek air compressors. **5-2-07**

Wyckoff O&M Project
Operations Report for the Month of May, 2007

- OMI staff removed brush from the site exclusion zone fencing. **5-4-07**

- Brush and debris were cleared from the site deep well pump house, office and decontamination trailers. **5-6-07**

- OMI staff replaced a broken pump drive shaft in the treatment plant 3" air diaphragm pump.

  5-10-07

- The site decontamination pad was cleaned and pressure washed. **5-14-07**

- Silt buildup and debris was removed from the site decontamination pad submersible pump vault.

  5-15-07

- OMI staff cleaned the interior of the site electrical and telephone distribution building. **5-16-07**

- OMI staff cleaned the treatment plant sump and repaired the sump debris screen. **5-20-07**

- The treatment plant Fisher level control valve stems were cleaned and the valves were operationally tested. **5-21-07**

- OMI staff installed a replacement ultra sonic level control transducer for the site deep well water storage tank. The high and low level set points were calibrated and the system operates as designed. **5-25-07**

- The cabinet air filter on the treatment plant Palatek air compressor was changed out. **5-27-07**

- OMI staff removed three inch PVC piping from the fiberglass digester tank. This piping was temporarily attached to the tank and was previously used to test a deep bed hydromation filter system. **5-29-07**

- The fiberglass digester tank was pressure washed and decontaminated. This tank is ready for removal from the existing treatment plant and reuse in the new treatment plant. **5-30-07**

Phased OMI Staffing Plan Update

- There were no OMI Staffing changes.

Compliance Monitoring Results

No violations of effluent discharge criteria were reported based on weekly monitoring of the effluent discharge from the groundwater treatment plant.

TABLE 1. Extraction Well Operation, Daily Flow, Groundwater Recover, Product Recovery, and Onsite Storage

		SP-0: Combined Extracted Liquid Influent to GWTP						SP-3: DAFT Effluent		SP-4: T-402 Effluent				SP-6: Clarifier Effluent				SP-8: Multi-Media Filter Effluent				SP-9: Lead Carbon			
		2113						2102		2103				2104				2105				2106			
Date	Week Number	Total PAH (ug/L)		PCP (ug/L)		O&G (mg/L)		O&G (mg/L)		Total PAH (ug/L)		PCP (ug/L)		Total PAH (ug/L)		PCP (ug/L)		Total PAH (ug/L)		PCP (ug/L)		Total PAH (ug/L)		PCP (ug/L)	
1/2/07	1	16065		270		14.50	J	10.50	J	3900.00		360.00		3.31		0.11		0.99		3.20		1.10		0.110	
1/9/07	2	23123		480		14.20	J	8.30	J	1561.00		450.00		2.76		1.40		1.40		0.69		1.10		0.098	
1/16/07	3	NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC	
1/23/07	4	16925		510		12.80	J	7.50	J	1699.00		550.00		3.89		49.00		0.81		51.00		0.97		11.00	
1/30/07	5	18271		550		12.90	J	8.20	J	1739.00		490.00		1.60		5.40		1.70		3.50		1.60		0.480	
2/6/07	6	25104		570		14.20	J	9.30	J	4121.00		520.00		2.28		5.80		1.60		3.60		1.50		0.460	
2/13/07	7	20974		450		12.40	J	9.40	J	1861.00		400.00		1.60		9.00		1.70		5.60		1.60		0.920	
2/20/07	8	22470		560		12.10	J	7.50	J	2201.00		550.00		1.50		4.50		1.10		2.90		1.10		0.310	
2/27/07	9	23820		540		14.30	J	8.00	J	1807.00		570.00		1.20		0.690		1.40		0.430		1.40		0.059	
3/6/07	10	19710		500		20.00	J	9.40	J	1968.00		570.00		1.30		0.200		1.50		0.120		1.40		0.088	
3/13/07	11	20558		350		12.30	J	8.00	J	2236.00		480.00		1.20		0.340		1.50		0.180		1.00		0.061	J
3/20/07	12	38589		570		31.20	J	9.00	J	2669.00		580.00		1.00		0.160		0.95		0.120		0.95		0.057	J
3/27/07	13	21712		510		9.50	J	6.70	J	1843.00		570.00		1.57		0.094		0.89		0.068	J	0.56		0.05	J
4/3/07	14	50871		520		77.00	J	7.60	J	2174.00		490.00		1.40		0.091		1.50		0.042	J	1.20		0.042	J
4/10/07	15	NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC		NC	
4/17/07	16	11913		410		18.90	J	5.30	J	766.00		460.00		1.55		0.18		0.92	J	0.110		0.00	U	0.00	U
4/24/07	17	21,903		490		13.60	J	5.50	J	743.00		510.00		1.70		0.083		1.50		0.052	J	0.00	U	0.00	U
5/1/07	18	15814		480		10.60	J	5.50	J	770.00		450.00		1.30		0.079		1.20		0.044	J	0.00	U	0.00	U
5/8/07	19	18789		400		12.30	J	5.70	J	937.00		440.00		1.40		0.074	J	1.40		0.053	J	0.00	U	0.00	U
5/15/07	20	27531		480		12.30	J	6.30	J	430.00		440.00		1.10		0.051	J	0.89	J	0.000	U	0.00	U	0.00	U
5/22/07	21	27657		450		29.70	J	6.10	J	1091.00		590.00		1.40		0.110		1.40		0.067	J	0.00	U	0.00	U
5/29/07	22	33699		400		27.50	J	6.40	J	738.00		370.00		1.30		0.120		1.40		0.058	J	0.00	U	0.00	U

Note: NC denotes "NOT COLLECTED".

Note: No samples colected for week 3 Teatment Plant shut down due to freezing temp.

Note: No Samples collected for week 15 Treatment Plant off line for carbon change out.

TABLE 1. Extraction Well Operation, Daily Flow, Groundwater Recover, Product Recovery, and Onsite Storage

Date	Week Number	SP-12: Mid Carbon 2116				SP-10: Lag Carbon 2107				SP-11: Treated Effluent 2108							DAFT Efficiency		Aeration Basin Efficiency		Carbon Treatment System Efficiency	
		Total PAH (ug/L)		PCP (ug/L)		Total PAH (ug/L)		PCP (ug/L)		Total PAH (ug/L)		PCP (ug/L)		pH	Temp. (deg. C)	D.O. (mg/L)	O&G Removal (%)	PAH Removal (%)	PAH Removal (%)	PCP Removal (%)	Carbon Treatment System Efficiency	PCP Removal (%)
1/2/07	1	0.80		0.039	J	0.6500		0.000	U	0.590		0.000	U	7.73	12.0	6.4	27.59	75.72	99.92	99.97	99.34	100.00
1/9/07	2	0.94		0.045	J	0.6600		0.000	U	0.590		0.000	U	7.62	12.0	5.7	41.55	93.25	99.82	99.69	99.53	100.00
1/16/07	3	NC		NC		NC		NC		NC		NC		NC	NC	NC	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
1/23/07	4	0.79		1.100		0.6400		0.000	U	0.490		0.000	U	7.63	13.0	6	41.41	89.96	99.77	91.09	99.21	100.00
1/30/07	5	1.20		0.120		1.2000		0.000	U	0.000	U	0.000	U	7.58	11.0	6.8	36.43	90.48	99.91	98.90	99.29	100.00
2/6/07	6	1.10		0.084		1.0000		0.000	U	0.990		0.000	U	7.72	12.0	6.5	34.51	83.58	99.94	98.88	99.38	100.00
2/13/07	7	1.00		0.031	J	0.0000	U	0.000	U	0.000	U	0.000	U	7.75	13.0	6.2	24.19	91.13	99.91	97.75	100.00	100.00
2/20/07	8	0.00	U	0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	7.84	12.0	7.4	38.02	90.20	99.93	99.18	100.00	100.00
2/27/07	9	0.00	U	0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	7.78	11.0	6.4	44.06	92.41	99.93	99.88	100.00	100.00
3/6/07	10	0.94		0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	7.75	13.0	6.6	53.00	90.02	99.93	99.96	100.00	100.00
3/13/07	11	1.10		0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	7.83	12.0	6.9	34.96	89.12	99.95	99.93	100.00	100.00
3/20/07	12	0.51		0.025	J	0.0000	U	0.000	U	0.000	U	0.000	U	7.73	13.0	6.6	71.15	93.08	99.96	99.97	100.00	100.00
3/27/07	13	0.57		0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	7.76	13.0	6.3	29.47	91.51	99.91	99.98	100.00	100.00
4/3/07	14	1.00		0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	7.81	12.0	6.9	90.13	95.73	99.94	99.98	100.00	100.00
4/10/07	15	NC		NC		NC		NC		NC		NC		NC	NC	NC	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
4/17/07	16	0.00	U	0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	8.25	13.0	6.6	71.96	93.57	99.80	99.96	100.00	100.00
4/24/07	17	0.00	U	0.000	U	0.0000	U	0.000	U	0.000	U	0.140		7.95	14.0	6.1	59.56	96.61	99.77	99.98	100.00	100.00
5/1/07	18	0.00	U	0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	8.03	14.0	6.8	48.11	95.13	99.83	99.98	100.00	100.00
5/8/07	19	0.00	U	0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	7.85	16.0	5.6	53.66	95.01	99.85	99.98	100.00	100.00
5/15/07	20	0.00	U	0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	7.86	16.0	6.0	48.78	98.44	99.74	99.99	100.00	100.00
5/22/07	21	0.00	U	0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	7.89	15.0	5.9	79.46	96.06	99.87	99.98	100.00	100.00
5/29/07	22	0.00	U	0.000	U	0.0000	U	0.000	U	0.000	U	0.000	U	7.85	16.0	5.8	76.73	97.81	99.65	99.97	100.00	100.00

Note: NC denotes "NOT COLLECTED".

Note: No samples colected for week 3 Teatment Plant shut down due to freezing temp.

Note: No Samples collected for week 15 Treatment Plant off line for carbon change out.

Figure 1
Oil and Grease Concentration Into and Out of DAFT

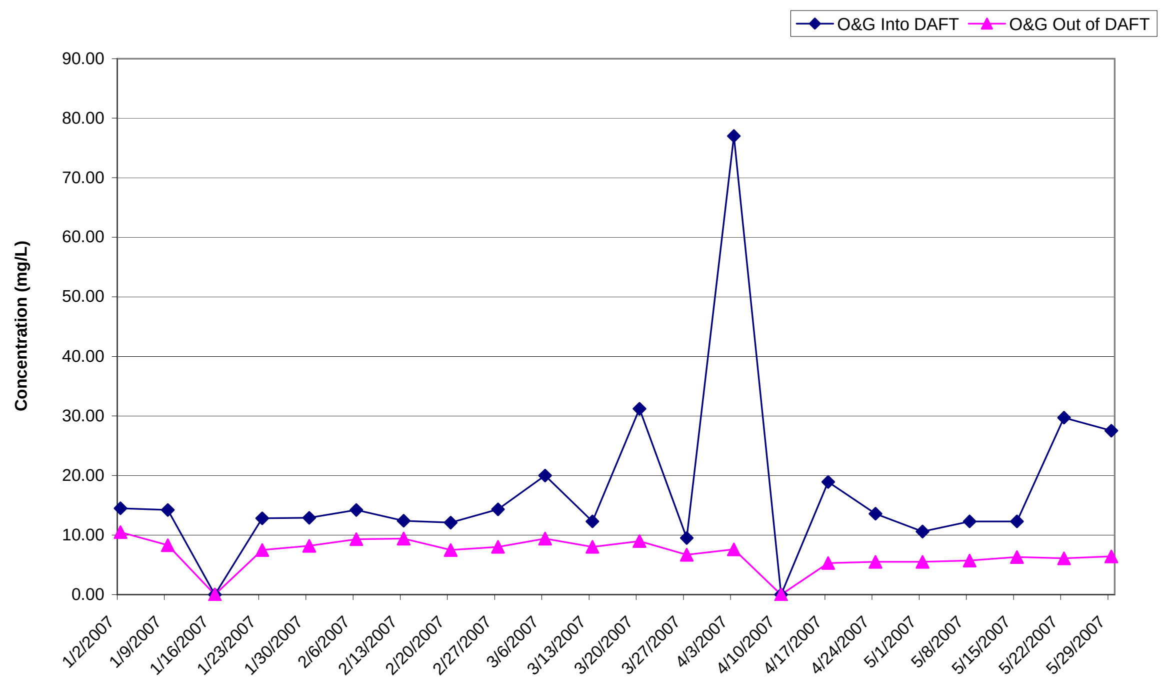
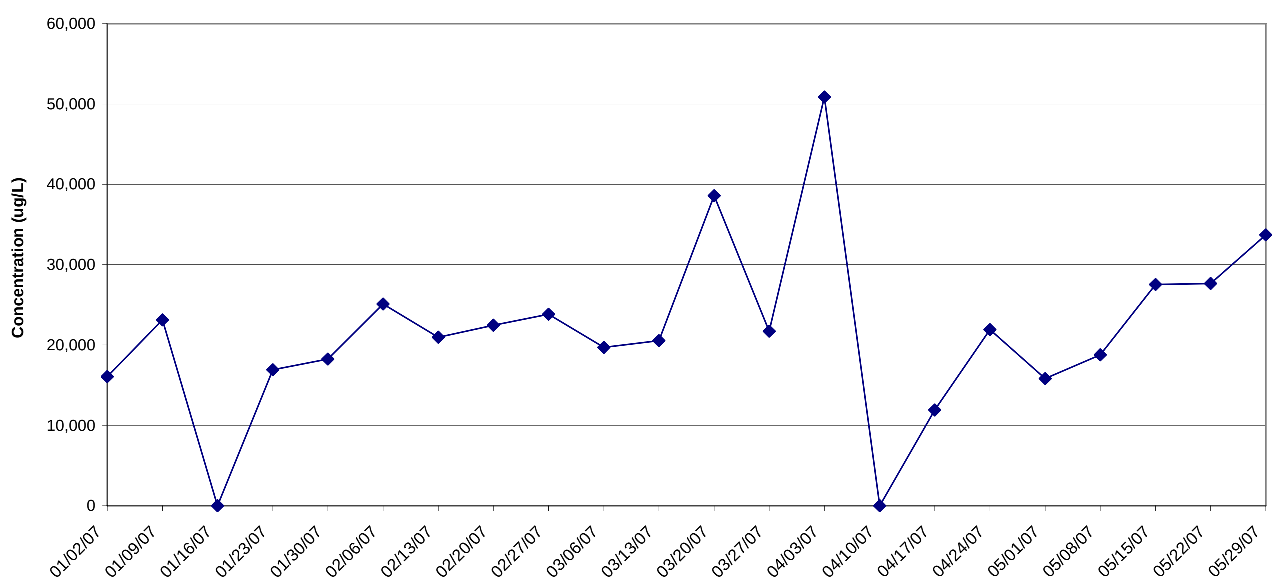


Figure 2
PAH concentration at Influent from Well Field



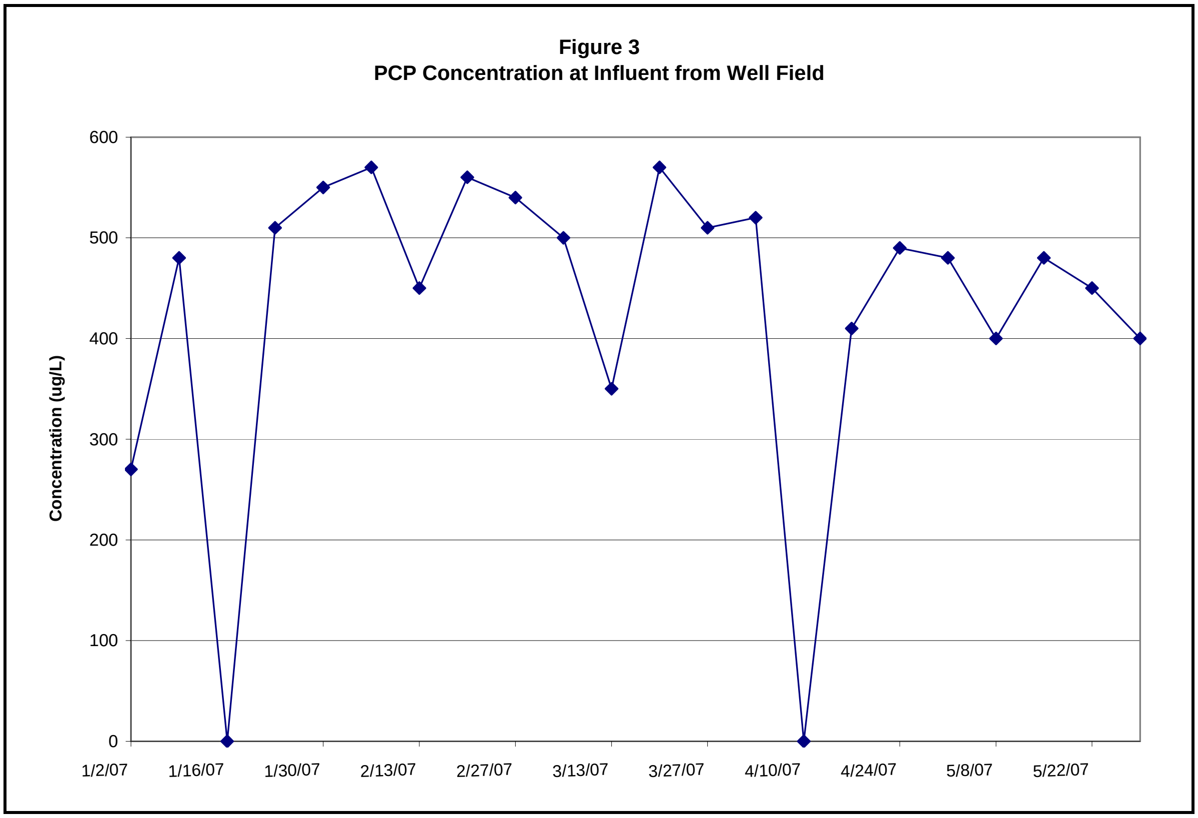


Figure 3
PCP Concentration at Influent from Well Field
Concentration (ug/L)
600
500
400
300
200
100
0
1/2/07
1/16/07
1/30/07
2/13/07
2/27/07
3/13/07
3/27/07
4/10/07
4/24/07
5/8/07
5/22/07

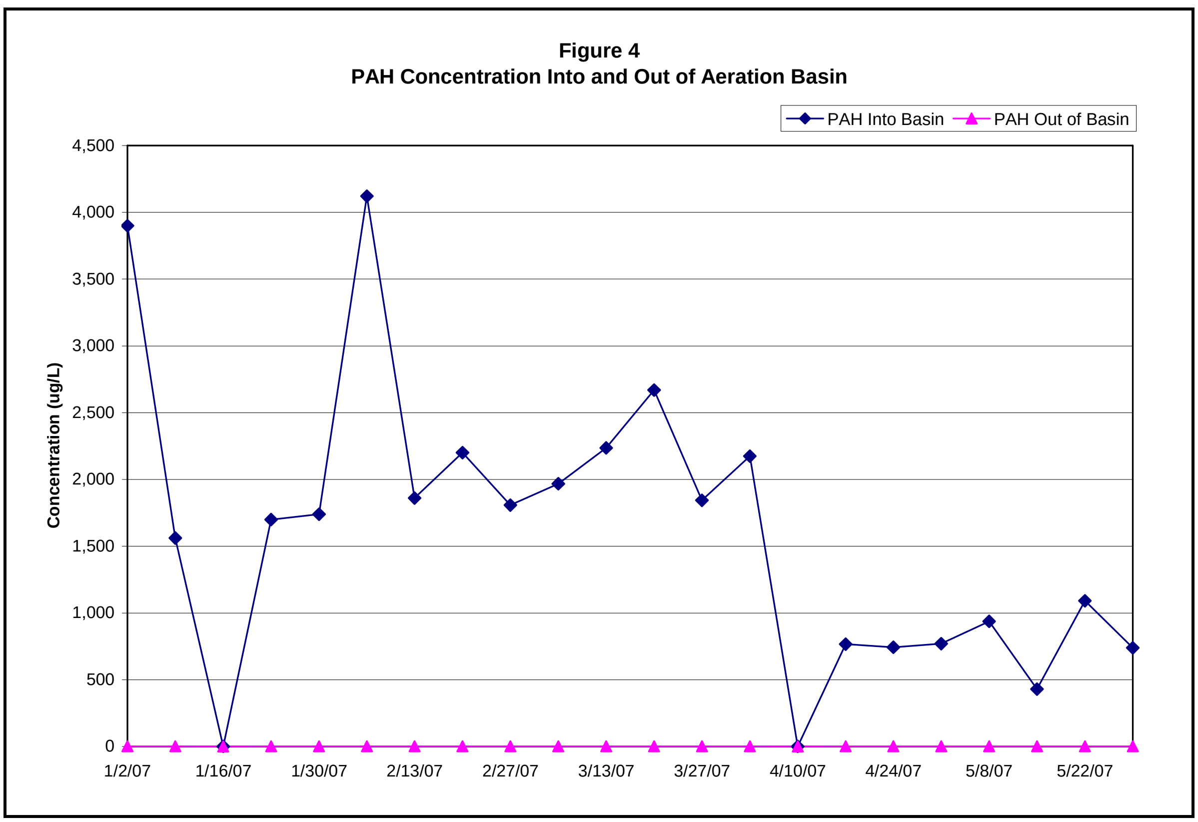


Figure 4
PAH Concentration Into and Out of Aeration Basin
PAH Into Basin
PAH Out of Basin
Concentration (ug/L)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1/2/07
1/16/07
1/30/07
2/13/07
2/27/07
3/13/07
3/27/07
4/10/07
4/24/07
5/8/07
5/22/07

Figure 5
PCP Concentration Into and Out of Aeration Basin

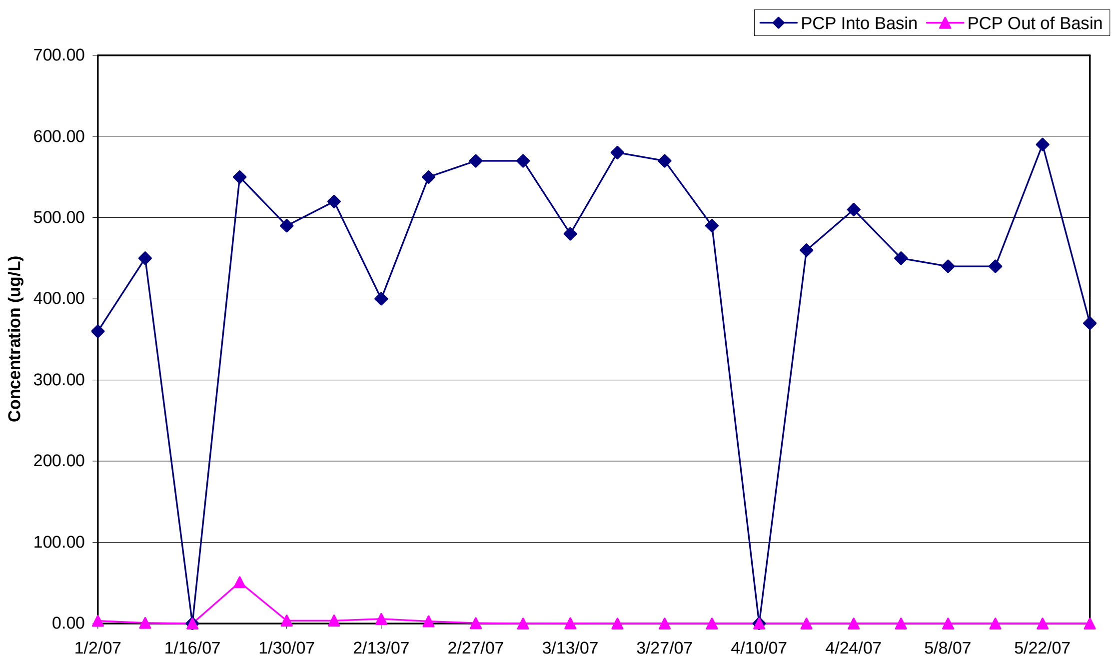
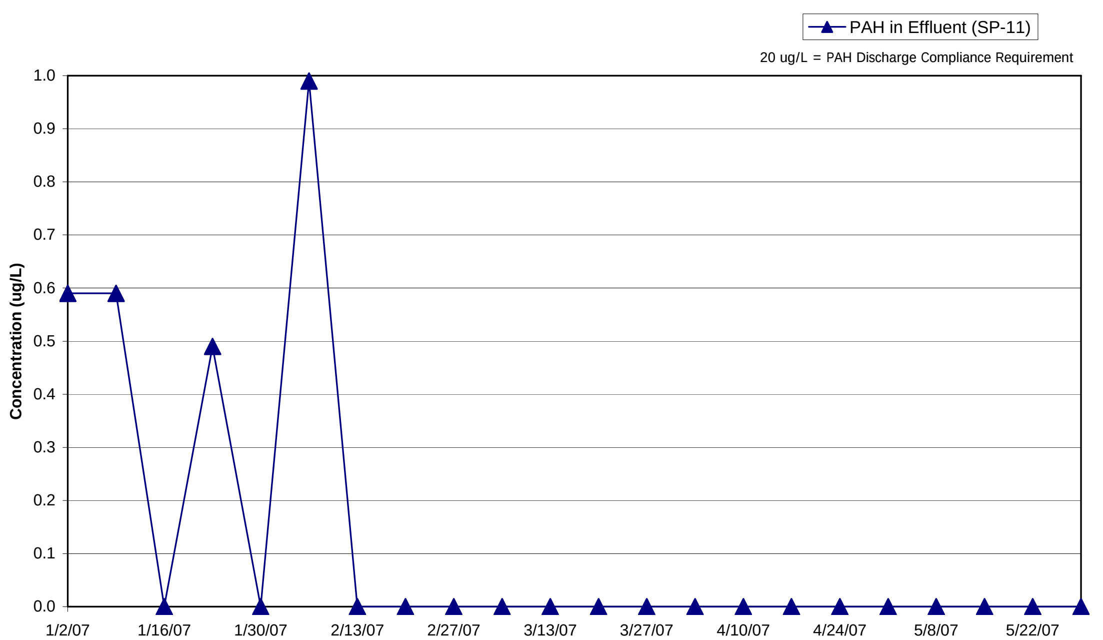


Figure 6
PAH Concentration at Effluent Discharge to Puget Sound



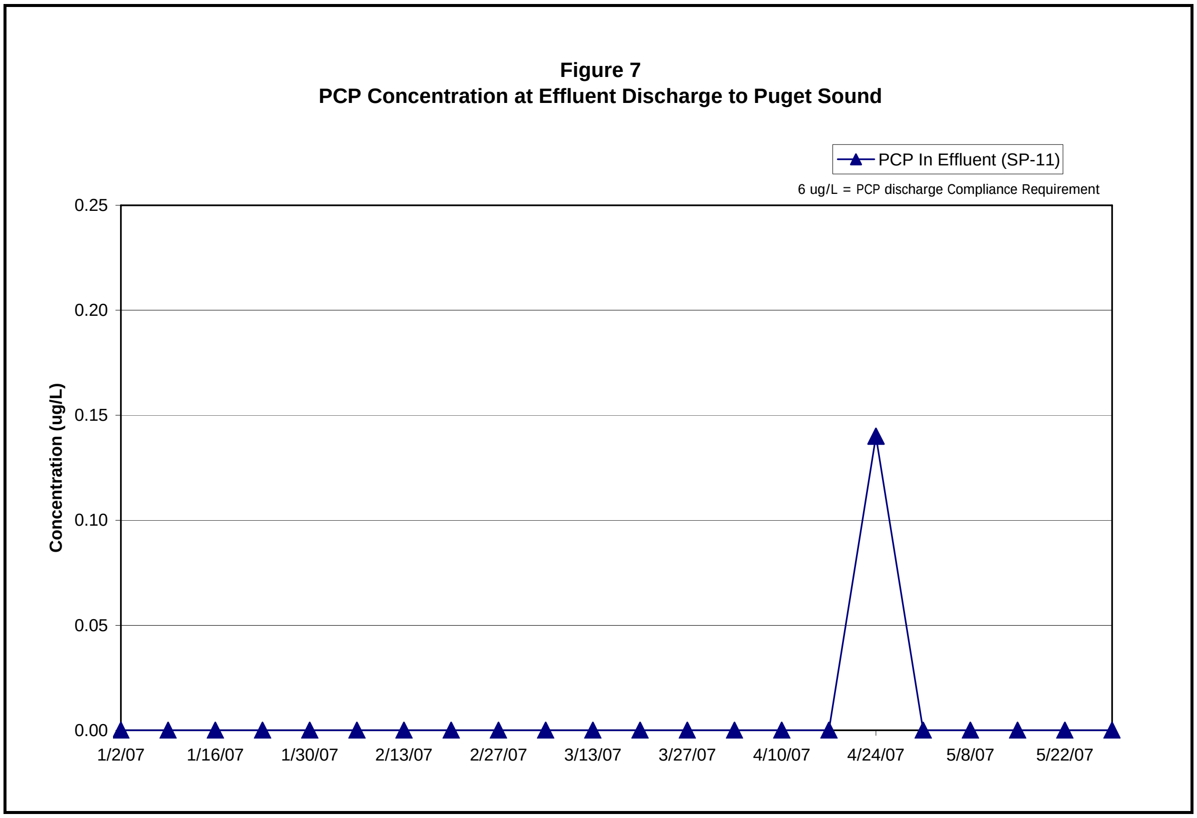


Figure 7
PCP Concentration at Effluent Discharge to Puget Sound
PCP In Effluent (SP-11)
6 ug/L = PCP discharge Compliance Requirement
Concentration (ug/L)
0.25
0.20
0.15
0.10
0.05
0.00
1/2/07
1/16/07
1/30/07
2/13/07
2/27/07
3/13/07
3/27/07
4/10/07
4/24/07
5/8/07
5/22/07

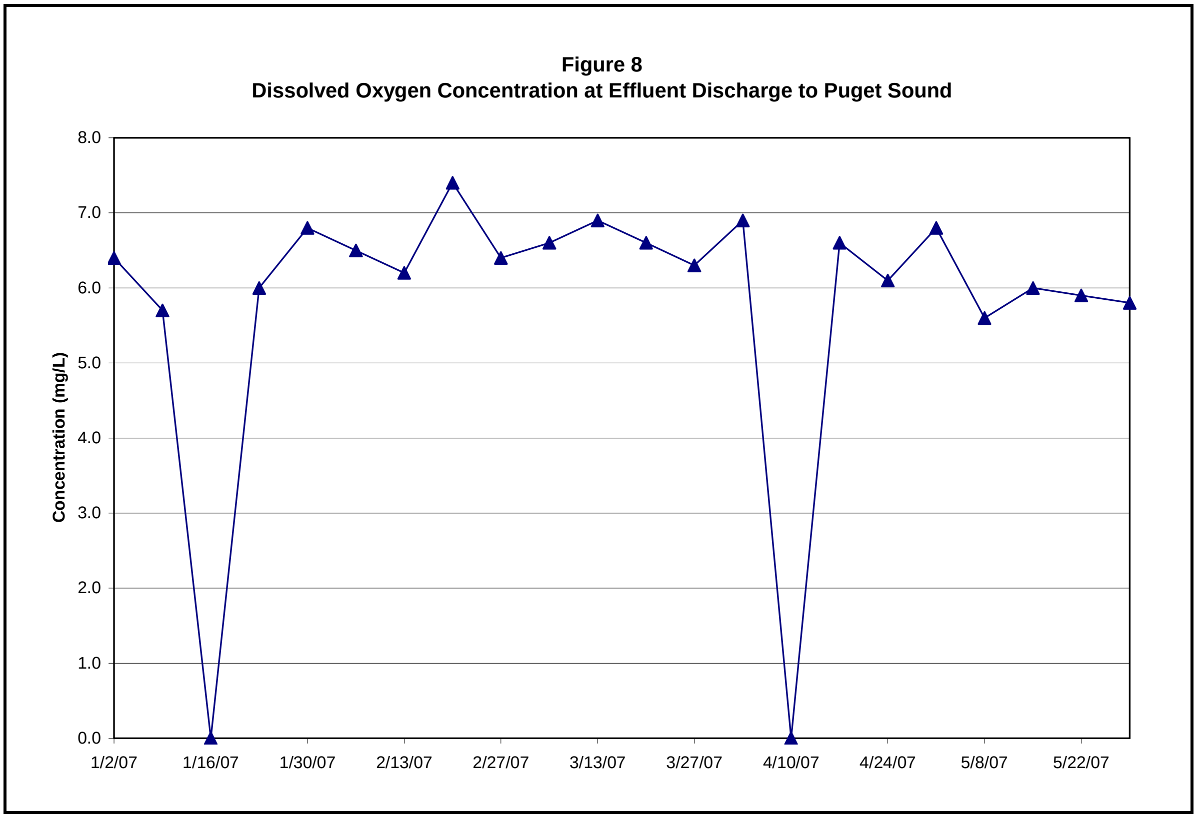


Figure 8
Dissolved Oxygen Concentration at Effluent Discharge to Puget Sound
Concentration (mg/L)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/2/07
1/16/07
1/30/07
2/13/07
2/27/07
3/13/07
3/27/07
4/10/07
4/24/07
5/8/07
5/22/07

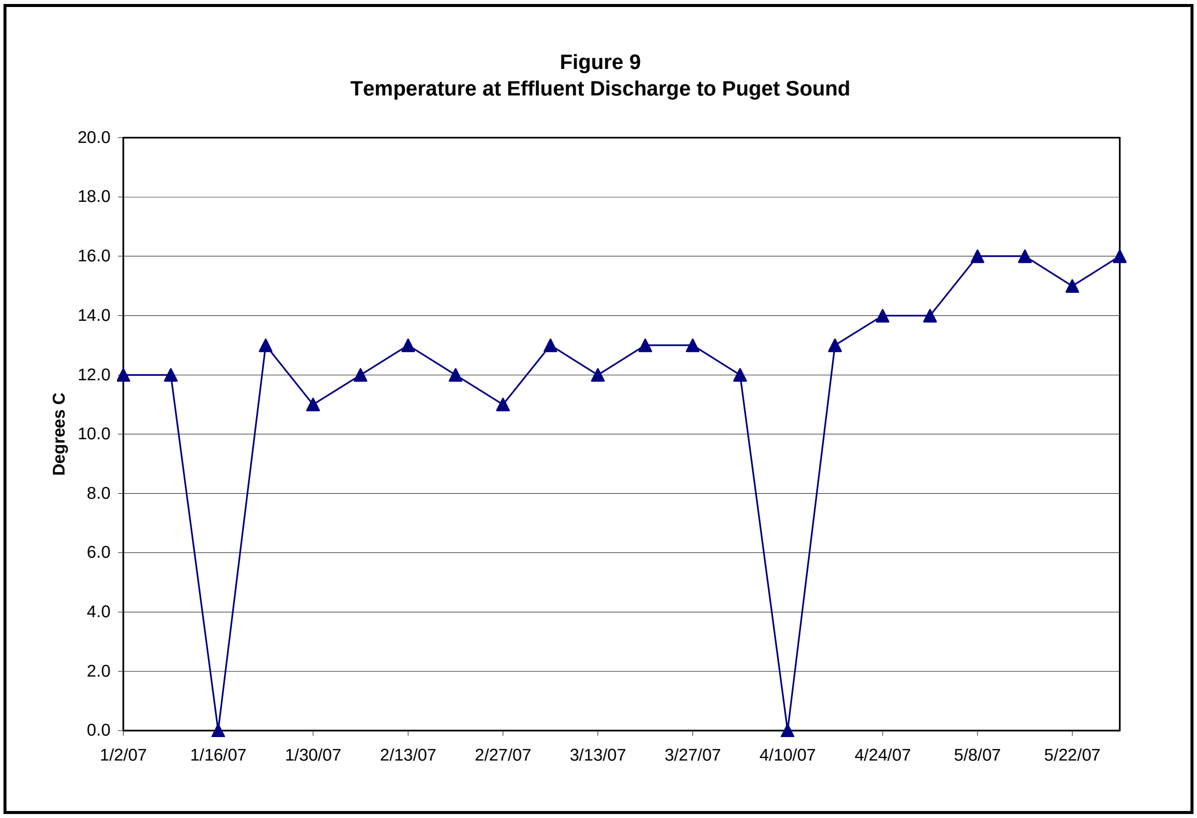


Figure 9
Temperature at Effluent Discharge to Puget Sound
Degrees C
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1/2/07
1/16/07
1/30/07
2/13/07
2/27/07
3/13/07
3/27/07
4/10/07
4/24/07
5/8/07
5/22/07

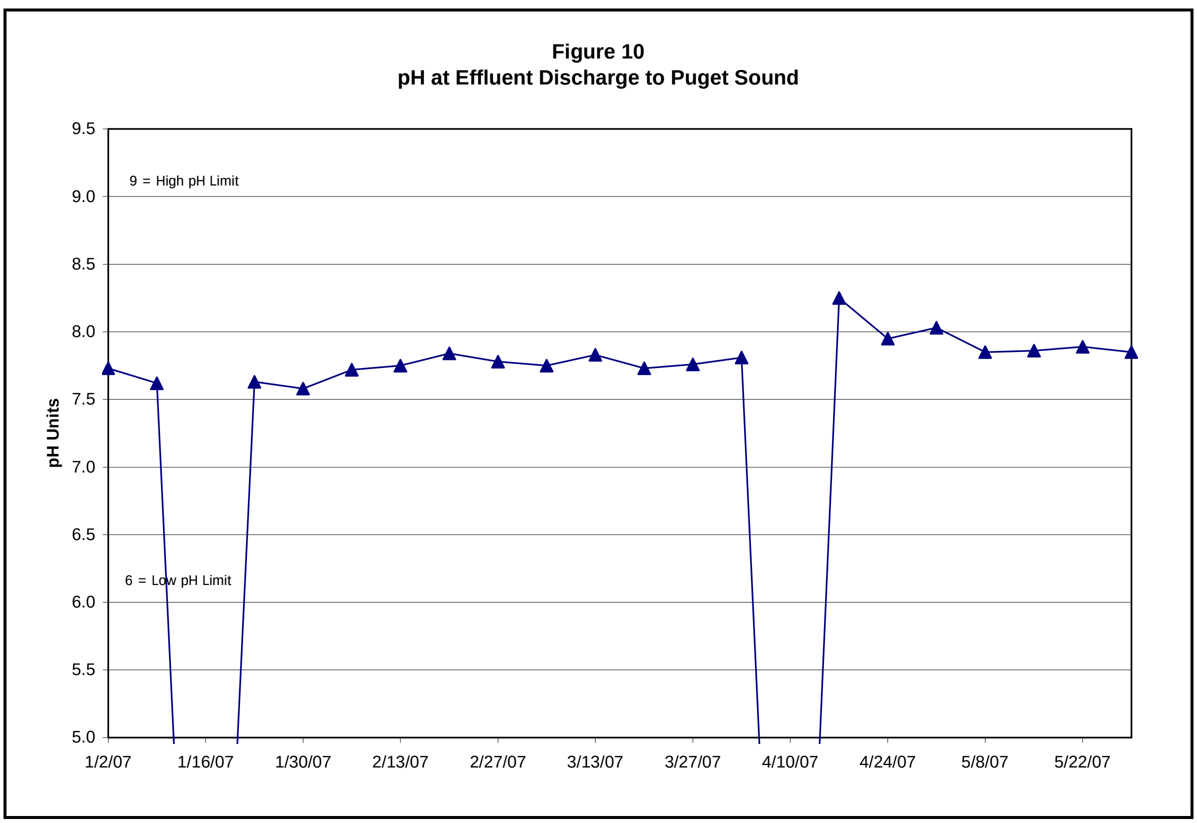


Figure 10
pH at Effluent Discharge to Puget Sound
pH Units
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
9 = High pH Limit
6 = Low pH Limit
1/2/07
1/16/07
1/30/07
2/13/07
2/27/07
3/13/07
3/27/07
4/10/07
4/24/07
5/8/07
5/22/07

APPENDIX D

Site Inspection Checklists

APPENDIX D
2007 SITE INSPECTION CHECKLISTS

1. Site Inspection Checklist – Soil, Groundwater, and East Harbor Operable Units (OUs)

I. SITE INFORMATION	
Site name: Wyckoff/Eagle Harbor Superfund Site	**Date of inspection: 31 May 2007**
Location and Region: Bainbridge Island, WA	**EPA ID: WAD0009248295**
Agency, office, or company leading the five-year review: USACE, Seattle District Kathryn Carpenter, USACE Project Manager Marlowe Dawag, USACE Chemical Engineer Michael Bailey, USACE Hydrogeologist Brenda Bachman, USACE Biologist	**Weather/temperature: Sunny, 78^{o}F**

Remedy Includes: (Check all that apply)

_ Landfill cover/containment _ Monitored natural attenuation

x Access controls x Groundwater containment

x Institutional controls x Vertical barrier walls

x Groundwater pump and treatment

_ Surface water collection and treatment

Other____

____

Attachments: x Inspection team roster attached x Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Stan Warner Site Manager 31 May 2007

Name Title Date

Interviewed at site Phone no. 206-780-1711

Problems, suggestions; _ Report attached No problems or suggestions noted

2. **O&M staff** Keith Allers Treatment Plant Operator 31 May 2007

Name Title Date

Interviewed at site Phone no. see above

Problems, suggestions; _ Report attached No problems or suggestions noted

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________________________

Contact ______________________________ ___________________ ________ _____________

Name Title Date Phone no.

Problems; suggestions; G Report attached ____

____

Agency ______________________________

Contact ______________________________ ___________________ ________ _____________

Name Title Date Phone no.

Problems; suggestions; _ Report attached ____

____

Agency ______________________________

Contact ______________________________ ___________________ ________ _____________

Name Title Date Phone no.

Problems; suggestions; G Report attached ____

____

Agency ______________________________

Contact ______________________________ ___________________ ________

4. **Other interviews** (optional) _ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

x O&M manual — x Readily available — x Up to date — _ N/A

x As-built drawings — x Readily available — x Up to date — _ N/A

x Maintenance logs — x Readily available — x Up to date — _ N/A

Remarks Maintenance logs printed monthly and stored on-site in file cabinet. Corrective maintenance logs and routine maintenance logs on-site. Monthly reports will all maintenance records sent to USACE. All O&M manuals for equipment on-site. SOP's and joint service agreement records on-site.

2. **Site-Specific Health and Safety Plan** — x Readily available — x Up to date — _ N/A

x Contingency plan/emergency response plan — x Readily available — x Up to date — _ N/A

Remarks____

3. **O&M and OSHA Training Records** — x Readily available — x Up to date — _ N/A

Remarks____

4.	**Permits and Service Agreements**				
	_ Air discharge permit	_ Readily available	_ Up to date	**x** N/A	
	_ Effluent discharge	_ Readily available	_ Up to date	_ N/A	
	_ Waste disposal, POTW	_ Readily available	_ Up to date	_ N/A	
	_ Other permits______________________	_ Readily available	_ Up to date	_ N/A	
	Remarks No permits required under CERCLA, however, substantive requirements are met under a "Summary of current effluent limitation and monitoring requirements". Effluent rate and chemical analysis submitted to the USACE monthly.				
5.	**Gas Generation Records**	_ Readily available	_ Up to date	_ N/A	
	Remarks____				
6.	**Settlement Monument Records**	_ Readily available	_ Up to date	**x** N/A	
	Remarks____				
7.	**Groundwater Monitoring Records**	**x** Readily available	_ Up to date	_ N/A	
	Remarks____				
8.	**Leachate Extraction Records**	_ Readily available	_ Up to date	**x** N/A	
	Remarks____				

9. **Discharge Compliance Records**

_ Air   _ Readily available   _ Up to date   _ N/A

x Water (effluent)   x Readily available   x Up to date   _ N/A

Remarks See notes #7 above.

____

____

10. **Daily Access/Security Logs**   x Readily available   x Up to date   _ N/A

Remarks____

____

____

____

IV. O&M COSTS

1. **O&M Organization**

_ State in-house　　　　_ Contractor for State

_ PRP in-house　　　　_ Contractor for PRP

_ Federal Facility in-house　　　　_ Contractor for Federal Facility

Other____

__

____

______

2. **O&M Cost Records**

_ Readily available _ Up to date

_ Funding mechanism/agreement in place

Original O&M cost estimate____________________ _ Breakdown attached

Total annual cost by year for review period if available

From__________ To__________ __________________ _ Breakdown attached

Date Date Total cost

From__________ To__________ __________________ _ Breakdown attached

Date Date Total cost

From__________ To__________ __________________ _ Breakdown attached

Date Date Total cost

From__________ To__________ __________________ _ Breakdown attached

Date Date Total cost

From__________ To__________ __________________ _ Breakdown attached

Date Date Total cost

3.	**Unanticipated or Unusually High O&M Costs During Review Period** Describe costs and reasons: ____
	V. ACCESS AND INSTITUTIONAL CONTROLS **x** Applicable _ N/A
	A. Fencing

1.	**Fencing damaged** **x** Location shown on site map **x** Gates secured _ N/A Remarks: See photos. Fence generally in good shape. Fence post in SE corner is loose due to wind and wave action.
	B. Other Access Restrictions
1.	**Signs and other security measures** **x** Location shown on site map _ N/A Remarks: Most signs in good shape and well fastened. One sign on east end of the West Beach requires replacement.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented _ Yes x No _ N/A

Site conditions imply ICs not being fully enforced _ Yes x No _ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self-reporting

Frequency Daily

Responsible party/agency USACE/OMI

Contact Matthew Allen USACE PM 31 May 2007 206-764-3697

Name Title Date Phone no.

Reporting is up-to-date x Yes _ No _ N/A

Reports are verified by the lead agency x Yes _ No _ N/A

Specific requirements in deed or decision documents have been met x Yes _ No _ N/A

Violations have been reported x Yes _ No _ N/A

Other problems or suggestions: _ Report attached

2.	**Adequacy**	**x** ICs are adequate	_ ICs are inadequate	_ N/A
	Remarks____			
	D. General			
1.	**Vandalism/trespassing**	**x** Location shown on site map	_ No vandalism evident	
	Remarks: (A) Winter 2006, a person climbed over the west beach gate and entered the USACE trailer. Early morning staff noted that the lights were on in the trailer when they arrived on site. By the time they entered the site, the lights had been turned off and a person was seen running across the site and climbing over the fence. Information reported to police. (B) Graffiti on outside of sheet pile wall.			
2.	**Land use changes on site**	**x** N/A		
	Remarks: (A) Property sold to the City of Bainbridge Island. Much of the non-contaminated portion of the property including the West Beach area became a public site. Japanese Memorial Park partially constructed on west end of property includes a parking lot and addition of a city gate and site gate on the old access road. (B) New gate in SE portion of site for treatment plant reconstruction access.			
3.	**Land use changes off site**	**x** N/A		
	Remarks: (A) A home was built adjacent to the SE portion of the property near the road entrance.			
	VI. GENERAL SITE CONDITIONS			
A. Roads	_ Applicable	_ N/A		
1.	**Roads damaged**	**x** Location shown on site map	_ Roads adequate_ N/A	
	Remarks: Steep bank along main access road to site is eroding potentially jeopardizing the road.			

B. Other Site Conditions

Remarks: New vegetative growth on process area. This is good for mud and dust reduction.

VII. LANDFILL COVERS _ Applicable **x** N/A

A. Landfill Surface

1. **Settlement** (Low spots) _ Location shown on site map _ Settlement not evident

Areal extent______________ Depth____________

Remarks____
__

____
__

2. **Cracks** _ Location shown on site map _ Cracking not evident

Lengths____________ Widths___________ Depths__________

Remarks____
__

____
__

3. **Erosion** _ Location shown on site map _ Erosion not evident

Areal extent______________ Depth____________

Remarks____
____

____
____

4. **Holes** _ Location shown on site map _ Holes not evident Areal extent_______________ Depth_____________ Remarks____ ____ ____ ____	
5. **Vegetative Cover** _ Grass _ Cover properly established _ No signs of stress _ Trees/Shrubs (indicate size and locations on a diagram) Remarks____ ____ ____ ____	
6. **Alternative Cover (armored rock, concrete, etc.)** _ N/A Remarks____ ____ ____ ____	
7. **Bulges** _ Location shown on site map _ Bulges not evident Areal extent_______________ Height_____________ Remarks____ ____ ____ ____	

8. **Wet Areas/Water Damage** _ Wet areas/water damage not evident

_ Wet areas _ Location shown on site map Areal extent______________

_ Ponding _ Location shown on site map Areal extent______________

_ Seeps _ Location shown on site map Areal extent______________

_ Soft subgrade _ Location shown on site map Areal extent______________

Remarks____
____

____
____

9. **Slope Instability** _ Slides _ Location shown on site map _ No evidence of slope instability

Areal extent______________

Remarks____
____

____
____

B. Benches _ Applicable _ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** _ Location shown on site map _ N/A or okay

Remarks____
____

____
____

2. **Bench Breached** _ Location shown on site map _ N/A or okay

Remarks____
____

____
____

3. **Bench Overtopped** _ Location shown on site map _ N/A or okay Remarks____ ____	
C. Letdown Channels _ Applicable _ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)	
1. **Settlement** _ Location shown on site map _ No evidence of settlement Areal extent______________ Depth____________ Remarks____ ____	
2. **Material Degradation** _ Location shown on site map _ No evidence of degradation Material type_______________ Areal extent_____________ Remarks____ ____	
3. **Erosion** _ Location shown on site map _ No evidence of erosion Areal extent______________ Depth____________ Remarks____ ____	

4. **Undercutting** _ Location shown on site map _ No evidence of undercutting Areal extent______________ Depth____________ Remarks____ ____ ____ ____	
5. **Obstructions** Type_____________________ _ No obstructions _ Location shown on site map Areal extent______________ Size____________ Remarks____ ____ ____ ____	
6. **Excessive Vegetative Growth** Type____________________ _ No evidence of excessive growth _ Vegetation in channels does not obstruct flow _ Location shown on site map Areal extent______________ Remarks____ ____ ____ ____	
D. Cover Penetrations _ Applicable _ N/A	

1.	**Gas Vents** _ Active _ Passive _ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition _ Evidence of leakage at penetration _ Needs Maintenance _ N/A Remarks____ ____
2.	**Gas Monitoring Probes** _ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition _ Evidence of leakage at penetration _ Needs Maintenance _ N/A Remarks____ ____
3.	**Monitoring Wells** (within surface area of landfill) _ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition _ Evidence of leakage at penetration _ Needs Maintenance _ N/A Remarks____ ____

4.	**Leachate Extraction Wells** _ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition _ Evidence of leakage at penetration _ Needs Maintenance _ N/A Remarks____ ____ ____ ____	
5.	**Settlement Monuments** _ Located _ Routinely surveyed _ N/A Remarks____ ____ ____ ____	

E. Gas Collection and Treatment _ Applicable _ N/A

1. **Gas Treatment Facilities**

_ Flaring _ Thermal destruction _ Collection for reuse

_ Good condition_ Needs Maintenance

Remarks____
____

____
____

2. **Gas Collection Wells, Manifolds and Piping**

_ Good condition_ Needs Maintenance

Remarks____
____

____
____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)

_ Good condition_ Needs Maintenance _ N/A

Remarks____
____

____
____

F. Cover Drainage Layer _ Applicable _ N/A

1. **Outlet Pipes Inspected** _ Functioning _ N/A

Remarks____
____

____
____

2.	**Outlet Rock Inspected**	_ Functioning	_ N/A
	Remarks____		
	____		
G. Detention/Sedimentation Ponds		_ Applicable	_ N/A
1.	**Siltation** Areal extent_______________ Depth_____________		_ N/A
	_ Siltation not evident		
	Remarks____		
	____		
2.	**Erosion** Areal extent_______________ Depth_____________		
	_ Erosion not evident		
	Remarks____		
	____		
3.	**Outlet Works**	_ Functioning	_ N/A
	Remarks____		
	____		
4.	**Dam**	_ Functioning	_ N/A
	Remarks____		
	____		

H. Retaining Walls _ Applicable _ N/A
1. **Deformations** _ Location shown on site map _ Deformation not evident Horizontal displacement_____________ Vertical displacement________________ Rotational displacement_____________ Remarks____ ____ ____ ______
2. **Degradation** _ Location shown on site map _ Degradation not evident Remarks____ ____ ____ ____
I. Perimeter Ditches/Off-Site Discharge _ Applicable _ N/A
1. **Siltation** _ Location shown on site map _ Siltation not evident Areal extent_______________ Depth_____________ Remarks____ ____ ____ ____
2. **Vegetative Growth** _ Location shown on site map _ N/A _ Vegetation does not impede flow Areal extent_______________ Type_____________ Remarks____ ____ ____ ____

3.	**Erosion** _ Location shown on site map _ Erosion not evident Areal extent______________ Depth____________ Remarks____ ____	
4.	**Discharge Structure** _ Functioning _ N/A Remarks____ ____	
	VIII. VERTICAL BARRIER WALLS _ Applicable _ N/A	
1.	**Settlement** x Location shown on site map _ Settlement not evident Areal extent______________ Depth____________ Remarks: (A) Sheet pile wall installed around site for groundwater containment. No changes since installation in 2000. (B) Wooden retaining wall on slope below entrance road is failing.	
2.	**Performance Monitoring** Type of monitoring__________________________ x Performance not monitored Frequency_______________________________ _ Evidence of breaching Head differential__________________________	

IX. GROUNDWATER/SURFACE WATER REMEDIES _ Applicable _ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines x Applicable _ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** _ Good condition _ All required wells properly operating _ Needs Maintenance _ N/A Remarks____________________
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** _ Good condition _ Needs Maintenance Remarks____________________
3. **Spare Parts and Equipment** _ Readily available _ Good condition _ Requires upgrade _ Needs to be provided Remarks____________________
B. Surface Water Collection Structures, Pumps, and Pipelines _ Applicable _ N/A
1. **Collection Structures, Pumps, and Electrical** _ Good condition _ Needs Maintenance Remarks____________________
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** _ Good condition _ Needs Maintenance Remarks____________________

3. **Spare Parts and Equipment**

_ Readily available _ Good condition _ Requires upgrade _ Needs to be provided

Remarks____

____

C. Treatment System _ Applicable _ N/A

1. **Treatment Train** (Check components that apply)

_ Metals removal **x** Oil/water separation **x** Bioremediation

_ Air stripping **x** Carbon adsorbers

x Filters: multimedia

x Additive (*e.g.*, chelation agent, flocculent): flocculent

Others____

_ Good condition _ Needs Maintenance

x Sampling ports properly marked and functional

x Sampling/maintenance log displayed and up to date

x Equipment properly identified

x Quantity of groundwater treated annually:

2002: 23 million Gallons

2003: 19 million Gallons

2004: 23 million Gallons

2005: 22 million Gallons

2006: 26 million Gallons

_ Quantity of surface water treated annually__________________________

Remarks: Total of approximately 115 million gallons of groundwater treated in the last five years.

2.	**Electrical Enclosures and Panels** (properly rated and functional) _ N/A **x** Good condition_ Needs Maintenance Remarks____ ____
3.	**Tanks, Vaults, Storage Vessels** _ N/A **x** Good condition_ Proper secondary containment _ Needs Maintenance Remarks: Sump/vault in good condition.
4.	**Discharge Structure and Appurtenances** _ N/A _ Good condition_ Needs Maintenance Remarks: End of water discharge pipe is in good condition as per diver surveys. The rest of the pipe is buried, however, the nearshore end of the pipe was repaired in 2001 due to a construction puncture and approximately 15 ft of pipe was uncovered and inspected. During that time, the pipe appeared to be in good condition.
5.	**Treatment Building(s)** _ N/A **x** Good condition (esp. roof and doorways) _ Needs repair **x** Chemicals and equipment properly stored Remarks: Plant Operations trailer currently meets objectives but will be replaced when the new treatment plant is completed.
6.	**Monitoring Wells** (pump and treatment remedy) **x** Properly secured/locked **x** Functioning _ Routinely sampled **x** Good condition **x** All required wells located _ Needs Maintenance _ N/A Remarks: Monitoring well 19 is below grade and is pumped before using it. An expansion plug was added to the well casing to seal the well pipe from filtration of surface water.
	D. Monitoring Data
1.	Monitoring Data **x** Is routinely submitted on time **x** Is of acceptable quality

2. Monitoring data suggests:

x Groundwater plume is effectively contained _ Contaminant concentrations are declining

Remarks: There is no plume at this site. Pump and treat will continue indefinitely to maintain hydraulic containment.

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

_ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition

_ All required wells located _ Needs Maintenance **x** N/A

Remarks____

____

____

____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. 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.).

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.

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. S&GWOU: Pieces of 1/8 inch thick and 4-8 inches in diameter rusted, corroded sheet pile were found on the beach during the site visit. EHOU: Observations of
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. S&GWOU: Hydraulic control optimization: It has been suggested that installation of an automated system could optimize individual well pumping rates. At this time, manual labor is required at each well for optimization. The labor could be decreased and efficiency increased with an automated system. Additional monitoring well rehabilitation (development, chemical treatment, etc.) should also occur to optimize well pumping rates prior to installation of an automated system. EHOU: West Beach Exposure Barrier System will be installed in fall 2007. All long-term monitoring will be included in the East Harbor Operations, Maintenance, and Monitoring Plan (OMMP) to be revised fall 2007/winter 2008.

2. Site Inspection Checklist – West Harbor OU

I. SITE INFORMATION	
Site name: Wyckoff/Eagle Harbor Superfund Site **West Harbor Operable Unit**	**Date of inspection: 13 Jun 2007**
Location and Region: Bainbridge Island, WA	**EPA ID:**
Agency, office, or company leading the five-year review: USACE, Seattle District Brenda Bachman, USACE Biologist Mary Jane Nearman, EPA RPM Tanya Peterson, WA DOT	**Weather/temperature: 65°F, Sunny, Windy**

Remedy Includes: (Check all that apply)

x Landfill cover/containment   _ Monitored natural attenuation

x Access controls   x Groundwater containment

x Institutional controls   _ Vertical barrier walls

_ Groundwater pump and treatment

x Surface water collection and treatment

_ Other: Containment consists of a tidal barrier system and an upland confined disposal facility covered with asphalt and utilized as a parking lot.

Attachments: x Inspection team roster attached   x Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** : Tanya Peterson   O&M Manager   13 June 2007

Name   Title   Date

Interviewed x at site _ at office _ by phone   Phone no. 360-570-6653

Problems, suggestions; _ Report attached: Tanya Peterson is the WA state Department of Transportation representative for this site. Kojo Fordjour is the environmental compliance manager for the WA state Ferry System and oversees the site daily. Mr. Fordjour was not interviewed.

2. **O&M staff** ______________________________ ________________________ _____________

Name Title Date

Interviewed _ at site _ at office _ by phone Phone no. _______________

Problems, suggestions; _ Report attached ____

____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________________________

Contact ______________________________ ___________________ ________ ____________

Name Title Date Phone no.

Problems; suggestions; G Report attached ____

____ _____

Agency ______________________________

Contact ______________________________ ___________________ ________ ____________

Name Title Date Phone no.

Problems; suggestions; _ Report attached ____

____ _____

Agency ______________________________

Contact ______________________________ ___________________ ________ ____________

Name Title Date Phone no.

Problems; suggestions; G Report attached ____

____ _____

Agency ______________________________

Contact ______________________________ ___________________ ________

4. **Other interviews** (optional) _ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

x O&M manual — **x** Readily available — **x** Up to date — _ N/A

x As-built drawings — **x** Readily available — **x** Up to date — _ N/A

x Maintenance logs — **x** Readily available — **x** Up to date — _ N/A

Remarks: Quarterly and Annual maintenance and monitoring reports are available through the EPA information repository at the library on Bainbridge Island and at the WA Ferry System environmental office. WA DOT also has copies.

2. **Site-Specific Health and Safety Plan** — **x** Readily available — **x** Up to date — _ N/A

x Contingency plan/emergency response plan — **x** Readily available — **x** Up to date — _ N/A

Remarks: WA Ferry System has facility maintenance records on site. CERCLA health and safety records exist for all remedy maintenance and monitoring exist at the EPA repository and at DOT.

3. **O&M and OSHA Training Records** — **x** Readily available — **x** Up to date — _ N/A

Remarks: Each agency and contractor on this site is responsible for their own training records. The training records are reviewed and updated as necessary by each agency and are included as necessary for remedy work.

4. **Permits and Service Agreements**

_ Air discharge permit — _ Readily available — _ Up to date — **x** N/A

x Effluent discharge — _ Readily available — _ Up to date — _ N/A

_ Waste disposal, POTW — _ Readily available — _ Up to date — **x** N/A

_ Other permits______________________ — _ Readily available — _ Up to date — **x** N/A

Remarks: The site has a NPDES permit.

5. **Gas Generation Records** — _ Readily available — _ Up to date — **x** N/A

Remarks____

____

6.	**Settlement Monument Records**	_ Readily available	_ Up to date	x N/A
	Remarks____			
7.	**Groundwater Monitoring Records**	x Readily available	x Up to date	_ N/A
	Remarks: Quarterly and Annual maintenance and monitoring reports are available through the EPA information repository at the library on Bainbridge Island and at the WA Ferry System environmental office. WA DOT also has copies.			
8.	**Leachate Extraction Records**	_ Readily available	_ Up to date	x N/A
	Remarks____			
9.	**Discharge Compliance Records**			
	_ Air	_ Readily available	_ Up to date	_ N/A
	x Water (effluent)	x Readily available	x Up to date	_ N/A
	Remarks: Quarterly and Annual maintenance and monitoring reports are available through the EPA information repository at the library on Bainbridge Island and at the WA Ferry System environmental office. WA DOT also has copies.			
10.	**Daily Access/Security Logs**	x Readily available	x Up to date	_ N/A
	Remarks: Maintained by the WA Ferry System.			

IV. O&M COSTS
1. **O&M Organization** _ State in-house _ Contractor for State _ PRP in-house _ Contractor for PRP _ Federal Facility in-house _ Contractor for Federal Facility Other____ __ ____ ______

2. **O&M Cost Records**

_ Readily available _ Up to date

_ Funding mechanism/agreement in place

Original O&M cost estimate____________________ _ Breakdown attached

Total annual cost by year for review period if available

From__________ To__________ __________________ _ Breakdown attached

Date Date Total cost

From__________ To__________ __________________ _ Breakdown attached

Date Date Total cost

From__________ To__________ __________________ _ Breakdown attached

Date Date Total cost

From__________ To__________ __________________ _ Breakdown attached

Date Date Total cost

From__________ To__________ __________________ _ Breakdown attached

Date Date Total cost

3.	**Unanticipated or Unusually High O&M Costs During Review Period**
	Describe costs and reasons: ____
	____
	____
	____
	____
	____

V. ACCESS AND INSTITUTIONAL CONTROLS _ Applicable _ N/A

A. Fencing

1.	**Fencing damaged**	x Location shown on site map	x Gates secured	_ N/A
	Remarks: Fence maintained by WA Ferry System			

B. Other Access Restrictions

1.	**Signs and other security measures**	_ Location shown on site map	x N/A
	Remarks____		
	____		

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	_ Yes **x** No _ N/A
Site conditions imply ICs not being fully enforced	_ Yes **x** No _ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) ______________________________

Frequency ______________________________

Responsible party/agency ______________________________

Contact ______________________ ______________ ______ ________

Name Title Date Phone no.

Reporting is up-to-date	**x** Yes _ No _ N/A
Reports are verified by the lead agency	**x** Yes _ No _ N/A
Specific requirements in deed or decision documents have been met	**x** Yes _ No _ N/A
Violations have been reported	_ Yes **x** No _ N/A

Other problems or suggestions: _ Report attached

The consent decree defines that no intrusion of the asphalt or CDF may occur.

2.	**Adequacy**	_ ICs are adequate	_ ICs are inadequate	_ N/A
		Remarks______________________________		
	D. General			
1.	**Vandalism/trespassing**	_ Location shown on site map	x No vandalism evident	
		Remarks______________________________		
2.	**Land use changes on site** x N/A			
		Remarks______________________________		
3.	**Land use changes off site** x N/A			
		Remarks:		

VI. GENERAL SITE CONDITIONS				
A. Roads	x Applicable	_ N/A		
1.	**Roads damaged**	x Location shown on site map	x Roads adequate	_ N/A
		Remarks______________________________		

B. Other Site Conditions

Remarks ____

____

____

____

____

____

VII. LANDFILL COVERS _ Applicable **x** N/A

A. Landfill Surface

1. **Settlement** (Low spots) _ Location shown on site map _ Settlement not evident

Areal extent_______________ Depth_____________

Remarks____

____

2.	**Cracks** _ Location shown on site map _ Cracking not evident Lengths_____________ Widths____________ Depths__________ Remarks____ ___ ____ ___	
3.	**Erosion** _ Location shown on site map _ Erosion not evident Areal extent_______________ Depth_____________ Remarks____ ____ ____ ____	
4.	**Holes** _ Location shown on site map _ Holes not evident Areal extent_______________ Depth_____________ Remarks____ ____ ____ ____	
5.	**Vegetative Cover** _ Grass _ Cover properly established _ No signs of stress _ Trees/Shrubs (indicate size and locations on a diagram) Remarks____ ____ ____ ____	
6.	**Alternative Cover (armored rock, concrete, etc.)** _ N/A Remarks____ ____ ____ ____	

7. **Bulges** _ Location shown on site map _ Bulges not evident Areal extent_______________ Height_____________ Remarks____ ____ ____ ____	
8. **Wet Areas/Water Damage** _ Wet areas/water damage not evident _ Wet areas _ Location shown on site map Areal extent_______________ _ Ponding _ Location shown on site map Areal extent_______________ _ Seeps _ Location shown on site map Areal extent_______________ _ Soft subgrade _ Location shown on site map Areal extent_______________ Remarks____ ____ ____ ____	
9. **Slope Instability** _ Slides _ Location shown on site map _ No evidence of slope instability Areal extent_______________ Remarks____ ____ ____ ____	
B. Benches _ Applicable **x** N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)	

1.	**Flows Bypass Bench**	_ Location shown on site map	_ N/A or okay
	Remarks____ ____		
2.	**Bench Breached**	_ Location shown on site map	_ N/A or okay
	Remarks____ ____		
3.	**Bench Overtopped**	_ Location shown on site map	_ N/A or okay
	Remarks____ ____		
C. Letdown Channels	_ Applicable	**x** N/A	
	(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement**	_ Location shown on site map	_ No evidence of settlement
	Areal extent_______________ Depth_____________		
	Remarks____ ____		
2.	**Material Degradation**	_ Location shown on site map	_ No evidence of degradation
	Material type________________ Areal extent______________		
	Remarks____ ____		

3. **Erosion** _ Location shown on site map _ No evidence of erosion

Areal extent_______________ Depth_____________

Remarks____

____

____

____

4.	**Undercutting** _ Location shown on site map _ No evidence of undercutting Areal extent______________ Depth____________ Remarks____ ____
5.	**Obstructions** Type_____________________ _ No obstructions _ Location shown on site map Areal extent______________ Size____________ Remarks____ ____
6.	**Excessive Vegetative Growth** Type____________________ _ No evidence of excessive growth _ Vegetation in channels does not obstruct flow _ Location shown on site map Areal extent______________ Remarks____ ____
D. Cover Penetrations	_ Applicable **x** N/A

1.	**Gas Vents** _ Active _ Passive _ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition _ Evidence of leakage at penetration _ Needs Maintenance _ N/A Remarks____ ____ ____ ____	
2.	**Gas Monitoring Probes** _ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition _ Evidence of leakage at penetration _ Needs Maintenance _ N/A Remarks____ ____ ____ ____	
3.	**Monitoring Wells** (within surface area of landfill) _ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition _ Evidence of leakage at penetration _ Needs Maintenance _ N/A Remarks____ _ ____ _	

4.	**Leachate Extraction Wells** _ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition _ Evidence of leakage at penetration _ Needs Maintenance _ N/A Remarks____ ____ ____ ____
5.	**Settlement Monuments** _ Located _ Routinely surveyed _ N/A Remarks____ ____ ____ ____

E. Gas Collection and Treatment _ Applicable **x** N/A

1. **Gas Treatment Facilities**

_ Flaring _ Thermal destruction _ Collection for reuse

_ Good condition _ Needs Maintenance

Remarks____

____

2. **Gas Collection Wells, Manifolds and Piping**

_ Good condition _ Needs Maintenance

Remarks____

____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)

_ Good condition _ Needs Maintenance _ N/A

Remarks____

____

F. Cover Drainage Layer _ Applicable **x** N/A

1. **Outlet Pipes Inspected** _ Functioning _ N/A

Remarks____

____

2. **Outlet Rock Inspected** _ Functioning _ N/A Remarks____ ____ ____ ____		
G. Detention/Sedimentation Ponds _ Applicable **x** N/A		
1. **Siltation** Areal extent______________ Depth____________ _ N/A _ Siltation not evident Remarks____ ____ ____ ____		
2. **Erosion** Areal extent______________ Depth____________ _ Erosion not evident Remarks____ ______ ____ ______		
3. **Outlet Works** _ Functioning _ N/A Remarks____ ______ ____ ______		
4. **Dam** _ Functioning _ N/A Remarks____ ______ ____ ______		

H. Retaining Walls	_ Applicable	x N/A
1. **Deformations**	_ Location shown on site map	_ Deformation not evident
Horizontal displacement____________	Vertical displacement_______________	
Rotational displacement____________		
Remarks____		
2. **Degradation**	_ Location shown on site map	_ Degradation not evident
Remarks____		
I. Perimeter Ditches/Off-Site Discharge	Applicable	x N/A
1. **Siltation**	_ Location shown on site map	_ Siltation not evident
Areal extent______________	Depth____________	
Remarks____		
2. **Vegetative Growth**	_ Location shown on site map	_ N/A
_ Vegetation does not impede flow		
Areal extent______________	Type____________	
Remarks____		

3.	**Erosion**	_ Location shown on site map	_ Erosion not evident
	Areal extent______________ Depth____________		
	Remarks____ ____ ____ ____		
4.	**Discharge Structure**	_ Functioning _ N/A	
	Remarks____ ____ ____ ____		
	VIII. VERTICAL BARRIER WALLS _ Applicable **x** N/A		
1.	**Settlement**	_ Location shown on site map	_ Settlement not evident
	Areal extent______________ Depth____________		
	Remarks____ ____ ____ ____		
2.	**Performance Monitoring**	Type of monitoring__________________________	
	_ Performance not monitored		
	Frequency_______________________________ _ Evidence of breaching		
	Head differential__________________________		
	Remarks____ ____ ____ ____		

IX. GROUNDWATER/SURFACE WATER REMEDIES _ Applicable _ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines _ Applicable x N/A

1. **Pumps, Wellhead Plumbing, and Electrical**

_ Good condition _ All required wells properly operating _ Needs Maintenance _ N/A

Remarks____

____

____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

_ Good condition _ Needs Maintenance

Remarks____

____

3. **Spare Parts and Equipment**

_ Readily available _ Good condition _ Requires upgrade _ Needs to be provided

Remarks____

____

B. Surface Water Collection Structures, Pumps, and Pipelines _ Applicable x N/A

1. **Collection Structures, Pumps, and Electrical**

_ Good condition _ Needs Maintenance

Remarks____

____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

_ Good condition _ Needs Maintenance

Remarks____

___
3. **Spare Parts and Equipment** _ Readily available _ Good condition _ Requires upgrade _ Needs to be provided Remarks____ ____

C. Treatment System	_ Applicable **x** N/A

1. **Treatment Train** (Check components that apply)

_ Metals removal _ Oil/water separation _ Bioremediation

_ Air stripping _ Carbon adsorbers

_Filters____

_ Additive (*e.g.*, chelation agent, flocculent)____

_Others____

_ Good condition _ Needs Maintenance

_ Sampling ports properly marked and functional

_ Sampling/maintenance log displayed and up to date

_ Equipment properly identified

_ Quantity of groundwater treated annually_________________________

_ Quantity of surface water treated annually_________________________

Remarks____

____

2. **Electrical Enclosures and Panels** (properly rated and functional)

_ N/A _ Good condition_ Needs Maintenance

Remarks____

____

3.	**Tanks, Vaults, Storage Vessels** _ N/A _ Good condition_ Proper secondary containment _ Needs Maintenance Remarks____ ____ ____ ____
4.	**Discharge Structure and Appurtenances** _ N/A _ Good condition_ Needs Maintenance Remarks____ ____ ____ ____
5.	**Treatment Building(s)** _ N/A _ Good condition (esp. roof and doorways) _ Needs repair _ Chemicals and equipment properly stored Remarks____ ____ ____ ____
6.	**Monitoring Wells** (pump and treatment remedy) _ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition _ All required wells located _ Needs Maintenance _ N/A Remarks____ ____ ____ ____
	D. Monitoring Data
1.	Monitoring Data x Is routinely submitted on time x Is of acceptable quality

2. Monitoring data suggests:

_ Groundwater plume is effectively contained _ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

_ Properly secured/locked _ Functioning _ Routinely sampled _ Good condition

_ All required wells located _ Needs Maintenance _ N/A

Remarks____

____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. 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.).

____

WHOU remedy includes a subtidal sediment cap to contain contaminated sediments, a contained disposal facility utilized to contain subtidal sediments removed during the dredge and cap remedy (overlain by an asphalt parking lot), and an intertidal barrier system used to minimize tidal intrusion into and leaching from the contained disposal facility. Observations indicate that the remedy is intact and functioning.

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.

Site visit observations corroborate previous monitoring reports that the remedy is effective.

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.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. The remedy has been implemented by WA DOT as required in the consent decree.

APPENDIX E

Site Inspection Photographic Documentation

Photo 1. Typical fence section.

Photo 2. Public signs along the West Beach showing currently contaminated areas.

Photo 3. Crab and Shellfish harvesting warning signs along the

Photo 4. P1010076 Fence with significant gap above the ground

outside of the fence.

along north side of site.

Photo 5. Public access path along outside of fence.

Photo 6. New gate added for treatment plant construction.

Photo 7. Locked gate typical of all fenced areas.

Photo 9. Corrosion on outside of sheet pile wall.

Photo 8. Vegetative growth on the site.

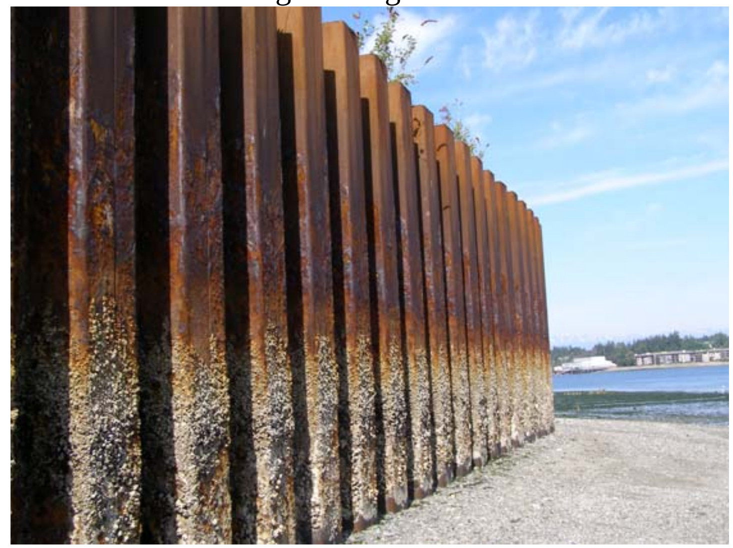


Photo 10. Current state of sheet pile wall on East Beach.

Photo 11. Corrosion and seep on outside of sheet pile wall.

Photo 12. West Beach buffer area.

APPENDIX F

Ongoing Human Health and Ecological Risk Assessment Research for the East Harbor OU

APPENDIX F

Ongoing Human Health and Ecological Risk Assessment Research for the East Harbor OU

Effects on Benthos — Toxicity Equivalence Approach for PAHs

The U.S. Environmental Protection Agency (EPA, 2003 and 2007[1]) developed procedures to evaluate ecological risks to invertebrates and for deriving protective benchmarks. These methods rely upon predictions based on summation of benzo(a)pyrene toxicity equivalence factors (TEFs) in sediment interstitial water. They use a larger suite of polycyclic aromatic hydrocarbons (PAHs) (up to 34) than considered in the ROD for the Eagle Harbor OU or in Washington State Sediment Management Standards (13). However, this guidance does not take precedence over the Apparent Effects Threshold (AET) approach used to set the Minimum Cleanup Levels (MCULs), which were adopted as sediment cleanup levels, and which are based upon empirical observations of sediment-based toxicity. Therefore, these guidance-level developments do not suggest that the remedy cleanup levels are not protective for benthic invertebrates. This review resulted in no recommendation for further programmatic action.

Effects on Fish from Dissolved PAHs

The National Oceanic and Atmospheric Administration's (NOAA's) Northwest Fisheries Science Center research (documented in the article by Incardona et al., 2005) suggests that freely-dissolved, 3-ring PAHs (anthracene, acenaphthene, fluorene, and phenanthrene) derived from weathered crude oil (which creosote resembles) may cause disruption of cardiovascular function and morphogenesis for zebrafish embryos and larvae at low environmental levels. This toxic response is distinct from the better-known aryl hydrocarbon receptor ligand response associated with toxicity of high-molecular-weight PAHs (HPAHs) such as pyrene and chrysene. The article concludes that 3-ring PAHs are considerably more toxic than previously understood for early life stages of fish. Although the authors of the article paper do not formulate a 3-ring PAH value protective concentration in water, critical effects appear to occur near the groundwater cleanup values. Recent investigations into surface water concentrations of some of these 3-ring PAHs have found it difficult to determine whether some of these compounds, which are abundant in groundwater affected by non-aqueous phase liquid (NAPL), were present in surface water.

[1] The references cited in this appendix are listed in full in Appendix B of the Second Five-Year Review Report.

Other ongoing research is also relevant to this suite of compounds. Magar et al. (2007) conducted field and laboratory experiments on cap permeation and recontamination at the West Beach, and a Strategic Environmental Research and Development Program (SERDP) briefing paper was available for review. Nearshore areas that have groundwater permeation were identified and some of these were studied. Using an experimental sediment column representing contaminated nearshore sediments, low-organic-carbon materials similar to those used for the Wyckoff/Eagle Harbor cap, and an upward 30 cm/day Darcy velocity, breakthrough occurred within 5 days for all PAHs. Lower-molecular-weight PAHs predominated in concentrations in this experiment. Thus, although it is not a field observation conducted at the site, this research suggests the potential for significant pore-water flux into the surface water along the West Beach.

The briefing concluded that there may be significant PAH breakthrough in pore-water phase to surface water that is not reflected in solid-phase measurement of the cap PAH concentrations. This appears to be due to the low (0.4%) organic carbon content in the barrier materials. The researchers plan to conduct near-surface pore-water measurements to test the experimental PAH migration results shown.

It is recommended that EPA consider the future in-situ pore-water measurements and determine whether additional, open-water, high-volume sampling would be warranted to determine whether the groundwater cleanup levels and the cap remedy is protective for sensitive early stages of fish near the mudline. (High-volume sampling would also reduce the detection and quantitation limits and could improve the resolution of surface water freely-dissolved PAHs for human health.) Also, it is recommended that a cleanup level for phenanthrene (which is currently lacking) be considered for inclusion to provide protectiveness.

Dietary and Total-Intake Effects on English Sole

The National Marine Fisheries Service (NMFS) has undertaken long-term studies involving short-term biomarkers of PAH exposure and effects on English sole in Eagle Harbor and adjacent waters. Biliary fluorescent aromatic compounds, hepatic CYP1A induction, as aryl hydrocarbon hydroxylase are included in this category. Longer-term biomarkers included hepatic DNA adducts and toxicopathic liver lesions. Studies have shown declining trends in biomarkers of PAH exposure and effects. Home-range studies of English sole are also being conducted by NMFS. Risk reduction was most obvious three years after capping, and has stayed low since 1997.

Johnson et al. (2002) analyzed a large set of data on English sole, with much of these data arising from Eagle Harbor investigations. The authors used a “hockey stick” regression technique to compare the severity of effects and sediment PAH concentrations. They estimated the sediment concentrations by observing the sediment stations nearest the transect in which the fish were caught. They suggest that ≤1 mg/kg (dry) total PAHs in sediment would protect estuarine fish such as English sole from degenerative liver lesions, inhibited spawning, and reduced egg viability. Above this sediment value, these effects occur with increasing severity.

The 1 mg/kg value represents the break in the "hockey stick" regression from a background of effects, and the values plotted at this break are not conceptually similar to the MCUL, which is it is based upon several joint responses in bioassays and community measures for benthos. For comparison to the 1 mg/kg total PAH level, the MCULs at 0.5% organic carbon (typical of the cap materials) are 3.9 mg/kg for LPAHs and 26.5 mg/kg for HPAHs.

Although the data and this species are highly relevant to the Eagle Harbor environment, the means by which these data may be used to evaluate the protectiveness of MCULs for fish is not evident at this time. The authors did not state the sediment concentrations at which significant population-level effects would commence, nor did they derive a Threshold Reference Value (TRV) or tissue-level benchmark for effects. There may be issues with the approach that uses near-transect stations to represent the entire sediment exposure for PAHs.

It is recommended that this be further researched, discussed with the principal investigators, and the consequences documented in the next Five-Year Review.

Dietary Effects for Juvenile Salmonids

Another recent publication (Meador et al., 2006) suggests that PAH dietary uptake by juvenile salmonids may damage their survivorship during the transition from freshwater to marine water. The symptom was an induced starvation-like state. While this article does not propose a sediment protection level, it does suggest dietary PAH content that would pose a threat, and may offer a means of determining significance of exposure. The article is significant in that it regards listed Evolutionarily Significant Units that could be present in the area, and because a designed function of the beach is to provide forage for such species.

It is recommended that further literature evaluation be conducted to ensure the protection of such fish during the next Five-Year Review period, and (if warranted) analysis of tissues of site-related benthic tissue that could comprise the diet of a juvenile salmonid.

No other information has been identified that could call into question the protectiveness of the remedy for the East Harbor OU.