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FINAL SECOND FIVE-YEAR REVIEW REPORT NSY PORTSMOUTH ME (PUBLIC DOCUMENT)
5/1/2012
TETRA TECH

Final
Second Five-Year Review Report

Portsmouth Naval Shipyard

Kittery, Maine

Naval Facilities Engineering Command
Mid-Atlantic
Contract Number N62470-08-D-1001
Contract Task Order WE14

May 2012

REVISION 0
MAY 2012

FINAL
SECOND FIVE-YEAR REVIEW REPORT

PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command Mid-Atlantic
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CONTRACT NO. N62470-08-D-1001
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MAY 2012

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REVISION LIST

Section	Revision	Description
Cover and Signature Page	Revision 0; May 2012	The Cover and Signature Page were updated to reflect the final document dated May 2012.
Navy Five-Year Review Signature Cover	Revision 0; May 2012	The Navy Cover was signed and included in the final document.
Section 4.5.2.1 – Monitoring Data Review, Page 4-30	Revision 0; May 2012	The last paragraph of this section was revised as provided in the response to comments on the draft final document, included in Appendix E.
Section 4.6 – Technical Assessment, Bullet for Opportunities for Optimization, Page 4-35	Revision 0; May 2012	The first paragraph was revised as provided in the response to comments on the draft final document, included in Appendix E.
Appendix E – Responses to Comments	---	The response to comments on the draft final document was included in Appendix E.

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Navy Five-Year Review Signature Cover

Key Review Information

<table>
<tr><th colspan="6">Site Identification</th></tr>
<tr><td colspan="5">Site Name: Portsmouth Naval Shipyard</td><td>EPA ID: ME7170022019</td></tr>
<tr><td colspan="2">Region: 1</td><td colspan="2">State: ME</td><td colspan="2">City/County: Kittery/York</td></tr>
<tr><th colspan="6">Site Status</th></tr>
<tr><td colspan="6">NPL Status: Final</td></tr>
<tr><td colspan="6">Remediation Status (under construction, operating, complete): Under Construction and Operating</td></tr>
<tr><td colspan="6">Multiple OUs* (highlight): Y N   Number of Sites/OUs: 11/7</td></tr>
<tr><td colspan="6">Construction Completion Date: To be determined</td></tr>
<tr><td colspan="3">Fund/PRP/Federal Facility
Lead: Federal Facility</td><td colspan="3">Lead Agency: Department of the Navy
Naval Facilities Engineering
Command (NAVFAC) Mid-Atlantic</td></tr>
<tr><td colspan="6">Has site been put into reuse? (highlight): Y N</td></tr>
<tr><th colspan="6">Review Status</th></tr>
<tr><td colspan="6">Who conducted the review (USEPA Region, State, Federal Agency): NAVFAC Mid-Atlantic</td></tr>
<tr><td colspan="3">Author Name: Linda Cole</td><td colspan="3">Author Title: Remedial Project Manager</td></tr>
<tr><td colspan="6">Author Affiliation: Department of the Navy, NAVFAC Mid-Atlantic</td></tr>
<tr><td colspan="3">Review Period: February 2007 to December 2011</td><td colspan="3">Date(s) of Site Inspection: April 11, 2011; April 19 - 21, 2001; August 10, 2011</td></tr>
<tr><td colspan="2">Highlight: Statutory</td><td colspan="2">Policy Type (name):
1. Pre-SARA
2. Ongoing
3. Removal Only
4. Regional Discretion</td><td colspan="2">Review Number (1, 2, etc)
2</td></tr>
<tr><td colspan="6">Triggering Action Event: Initiation of the remedial action for Site 8 – Jamaica Island Landfill (OU3)</td></tr>
<tr><td colspan="6">Trigger Action Date: June 2002</td></tr>
<tr><td colspan="6">Due Date: June 2012</td></tr>
</table>

* OU refers to Operable Unit

Issues:

No issues were identified for OU1, OU2, or OU4.

Two issues were noted at OU3: Some gas vents upslope from the access road east of the Jamaica Island Landfill (JILF) parking area and west of Building 357 are tilted and have settlement/heave at their bases. This may be associated with a minor shift in topographic contours, as noted based on a comparison of mapping between 2006 and 2011. Tilted gas vents and possible minor slope movement upslope of access road are indicators of potential future slope instability. During a video inspection of pipe in the cap's internal drainage layer, a portion of pipe was found to be partially buckled. The partially buckled portion was determined to allow adequate flow; however, the partially buckled pipe prevented video camera access to the remaining portion of pipe for inspection.

A ROD has not been signed for OU7, OU8, OU9, or Site 30; therefore, these locations were not required to be reviewed because a final remedy has not been selected.

Recommendations and Required Actions:

The Second Five-Year Review was performed on OUs with a ROD (OU1, OU2, and OU3) or interim ROD (OU4) that allow hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure.

No issues were identified at OU1, OU2, or OU4; therefore, no recommendations or actions are needed to address issues at those OUs.

It is recommended that the cause of the tilting of the vents and possible slope movement upslope of the access road east of the JILF parking area at OU3 be investigated. It is also recommended that inspections be conducted in the area of the partially buckled internal drainage pipe as part of the OU3 operation and maintenance program.

Protectiveness Statement(s):

The remedies selected at OU1 and OU2 are expected to be protective of human health and the environment upon completion of the remedies and implementation of land use controls (LUCs). Steps are being taken to implement the remedies selected in the OU1 and OU2 RODs. There are no imminent threats to human health or the environment under the current land use scenarios.

This Second Five-Year Review shows that the Navy is meeting the requirements of the ROD for OU3 and the Interim ROD for OU4. The review confirmed that the remedial action at OU3 at PNS remains protective of human health and that the interim action at OU4 is protective and is expected to remain protective of human health and the environment until a final remedy is selected.

This Second Five-Year Review shows that the Navy is meeting the requirements of the RODs for the sites at PNS.

Next Review:

The next five-year review of PNS sites will be completed by June 2017.

Signature of U.S. Department of the Navy and Date

L. Bryant Fuller III — Date: 5/31/12
Captain, United States Navy
Commanding Officer
Portsmouth Naval Shipyard, Kittery, Maine

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
AR	Administrative Record
ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CIA	Controlled Industrial Area
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	chemical of concern
COPC	chemical of potential concern
CSF	Cancer Slope Factor
CTO	Contract Task Order
DD	Decision Document
DoD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
EE/CA	Engineering Evaluation/Cost Analysis
EERA	Estuarine Ecological Risk Assessment
ER-L	Effects-Range Low
ER-M	Effects-Range Median
ESD	Explanation of Significant Differences
FCS	Final Confirmation Study
FDA	Food and Drug Administration
FFA	Federal Facility Agreement
FS	Feasibility Study
GCL	geosynthetic clay layer
HHRA	Human Health Risk Assessment
HI	hazard index
HMW	high molecular weight
HRS	Hazard Ranking System
HSWA	Hazardous and Solid Waste Amendments
IAS	Initial Assessment Study
IRG	Interim Remediation Goal

IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
JILF	Jamaica Island Landfill
LTMgt	Long-Term Management
LUC	land use control
MB	Mercury Burial
MEDEP	Maine Department of Environmental Protection
MS	Monitoring station
mg/kg	milligram per kilogram
NA	Not applicable
NAVFAC	Naval Facilities Engineering Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NRWQC	National Recommended Water Quality Criterion
O&M	operation and maintenance
OM&M	Operation, Maintenance, and Monitoring
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PHERE	Public Health and Environmental Risk Evaluation
PNS	Portsmouth Naval Shipyard
PRAP	Proposed Remedial Action Plan
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RA	remedial action
RAB	Restoration Advisory Board
RAO	remedial action objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFA	RCRA Facility Assessment
RfD	Reference Dose
RFI	RCRA Facility Investigation
RI	Remedial Investigation

ROD	Record of Decision
SAP	Sampling and Analysis Plan
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TBC	to-be-considered criterion
TCL	Target Compound List
TEQ	toxicity equivalent
TSD	treatment, storage, and disposal
TSS	total suspended solids
USC	United States Code
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WW	World War
μg/L	microgram per liter

EXECUTIVE SUMMARY

The Second Five-Year Review Report for Portsmouth Naval Shipyard (PNS), Kittery, Maine was prepared by Tetra Tech, for the United States Department of Navy, Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic under the Comprehensive Long-Term Environmental Action Navy (CLEAN) program, Contract Number N62470-08-D-1001, Contract Task Order (CTO) WE14. This report describes the results of the five-year review that was conducted for the current PNS Installation Restoration Program (IRP) sites where Records of Decision (RODs) have been completed that requires five-year reviews. As of December 31, 2011, RODs have been signed for Operable Units (OUs) 1, 2, 3, and 4. Table ES-1, below, provides a summary of the conclusions of the Second Five-Year Review for the IRP sites within these OUs.

TABLE ES-1: SECOND FIVE-YEAR REVIEW SUMMARY

OU	Site Name	General Remedial Objectives	Remedy Components	Issues, Recommend-ations, and Required Actions	Protectiveness Statement
1	Site 10 – Former Battery Acid Tank No. 24	Address lead and antimony contamination in soil under Building 238 and lead contamination in soil outside Building 238.	- Soil removal to industrial levels (under Building 238). - Restriction of residential use (entire site).	None. The remedy will be implemented in 2012.	Current site conditions and Shipyard policies provide protection of human health and the environment until the remedy is implemented. The remedy is expected to be protective upon implementation because contaminated soil removal will eliminate unacceptable risks for continued industrial use and land use controls (LUCs) preventing residential exposure will be implemented.
2	Site 6 – Defense Reutilization and Marketing Office (DRMO) Storage Yard; Site 29 – Former Teepee Incinerator Site	Address lead and other contaminants in soil in the waste disposal area (portion of Site 29) and DRMO area (Site 6 and remainder of Site 29).	- Surface soil removal and soil cover in the waste disposal area. - Soil removal to industrial levels in the DRMO area. - Restriction of residential use of the waste disposal area and DRMO area. - Long-term monitoring (LTM) for groundwater and sediment accumulation.	None. The remedies will be implemented in 2012/2013.	Current site conditions and Shipyard policies provide protection of human health and the environment until the remedies are implemented. The remedies are expected to be protective upon implementation because the soil cover will prevent exposure to contamination in the waste disposal area and contaminated soil removal will eliminate unacceptable risks for continued industrial use in the DRMO area. LUCs preventing residential exposure will be implemented. Monitoring will confirm that residual soil contaminants are not migrating to groundwater or the offshore area at unacceptable levels.

TABLE ES-1: SECOND FIVE-YEAR REVIEW SUMMARY					
OU	Site Name	General Remedial Objectives	Remedy Components	Issues, Recommend-ations, and Required Actions	Protectiveness Statement
	DRMO Impact Area	None.	No further action.	None. The area is available for unlimited use and unrestricted exposure.	No further action is necessary to maintain protectiveness of human health and the environment.
3	Site 8 – Jamaica Island Landfill (JILF); Site 9 – Former Mercury Burial Sites; Site 11 – Former Waste Oil Tanks Nos. 6 and 7	Address contaminated soil, waste material, and groundwater within the boundary of the JILF.	- Contaminated material removal from Jamaica Cove area. - Cap placement over remaining contamination, with operation and maintenance. - Restriction of residential and fresh groundwater uses. - LTM for groundwater.	Tilted gas vents and settlement around vent bases on the slope between the JILF parking area and Building 357 are indicators of potential future slope instability. It is recommended that the cause of the tilting and settlement be investigated (2013). Internal drainage pipes within the cap are damaged in at least one location as determined using video inspection. It is recommended that inspections be conducted in the area as part of the operation and maintenance program, with no further evaluation unless there is ponding in that area for extended period of time or unstable soil.	The remedy is functioning as intended and remains protective of human health and the environment because the cap and LUCs prevent exposure to materials and groundwater within the JILF boundary; contaminants in groundwater are not at levels that will adversely impact the offshore area; and operation, maintenance, and monitoring activities are ongoing to ensure continued protectiveness.
4	Site 5 – Former Industrial Waste Outfalls; Offshore Areas Potentially Impacted by PNS Onshore IRP Sites	Address contamination in PNS offshore Areas of Concern (AOCs) in the interim until final remedies for OU4 are implemented.	- Interim monitoring of sediment until final remedies.	None. The Navy is evaluating final remedial alternatives for OU4.	The interim remedy is functioning as intended and is protective of human health and the environment because monitoring provides data needed to determine final remedies for the offshore AOCs. Review of site conditions and implementation of this interim remedy will be ongoing as the Navy continues to develop final remedial alternatives for OU4.

1.0 INTRODUCTION

This Second Five-Year Review Report for Portsmouth Naval Shipyard (PNS), Kittery, Maine was prepared by Tetra Tech, for the United States Department of Navy, Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic under the Comprehensive Long-Term Environmental Action Navy (CLEAN) program, Contract Number N62470-08-D-1001, Contract Task Order (CTO) WE14. This report describes the results of the five-year review that was conducted for the current PNS Installation Restoration Program (IRP) sites where Records of Decision (RODs) have been completed that require five-year reviews. The report reflects the status of these IRP sites as of December 31, 2011. The report was prepared to fulfill the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as discussed in Section 1.1.

The national Superfund electronic database (Comprehensive Environmental Response, Compensation, and Liability Information System [CERCLIS]) identification number for PNS is ME7170022019.

1.1 PURPOSE AND SCOPE OF THE FIVE-YEAR REVIEW

The purpose of the five-year review is to evaluate the implementation and performance of the remedies at the sites to determine whether the remedies are protective of human health and the environment. The methods, findings, and conclusions of the reviews are documented in five-year review reports. In addition, five-year review reports identify deficiencies found during the review, if any, and provide recommendations to address them.

This five-year review is required by statute. The Navy must implement five-year reviews consistent with CERCLA [40 United States Code (USC) Sections §§9601 et seq.] and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) Part 300]. CERCLA Section §121(c), as amended, 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 every 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 Congress a list of facilities at which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."

The NCP, 40 CFR Part 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."

This is the second five-year review of PNS. The triggering action for the first five-year review was the initiation of the remedial action for Operable Unit (OU) 3 that began in June 2002. The First Five Year Review Report was signed in June 2007; therefore, this Second Five-Year Review Report will be completed in June 2012. Because the selected remedies for OUs 1, 2, 3, and 4 allow hazardous substances to remain in excess of levels that allow for unlimited use and unrestricted exposure, subsequent five-year reviews are required.

The review process was based on the Navy Policy Conducting Five-Year Reviews (June 2011) and the United States Environmental Protection Agency (USEPA) Comprehensive Five-Year Review Guidance (June 2001) and Recommended Evaluation of Institutional Controls: Supplement to the Comprehensive Five-Year Review Guidance (September 2011).

As discussed in the Comprehensive Five-Year Review Guidance (USEPA, June 2001), a five-year review determines whether the remedy at a site is protective of human health and the environment. When a remedial action is still under construction, a five-year review determines whether immediate threats have been addressed and whether the remedy is expected to be protective when all remedial actions are completed. In addition, a five-year review identifies any deficiencies and recommends steps to correct them. To do this, the technical assessment conducted during a five-year review examines the following three questions:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

To answer these questions, this five-year review included review of documents, discussions with personnel associated with the sites, site inspections, and review of newly promulgated standards and any changes in the standards identified as Applicable or Relevant and Appropriate Requirements (ARARs) and in the factors used to develop site-specific risk-based cleanup levels at the time the RODs were signed. This information was reviewed for each OU to determine whether changes since the time of the ROD or interim ROD may call into question the protectiveness of the remedy. It was determined that recalculation of risk or updated risk assessment was not necessary to determine whether a remedy is protective of human health and the environment, as will be discussed in later sections.

Where applicable, monitoring and sampling data and documentation of operation and maintenance (O&M) activities were also examined, and the information is included in the subsequent site-specific sections. In addition, as part of the five-year review, the PNS excavation restriction policy was also reviewed. The Shipyard's Solid Waste Operations Manual, Chapter 7, Control of Excavation Activities, provides instructions requiring authorization and approval from the PNS Environmental Division for all excavation through use of a permit. The current instruction is dated November 13, 2008, and is included in Appendix A.3. Groundwater at PNS is not used for drinking, irrigation, industrial processes, fire fighting, or any other purposes; therefore, the Shipyard has not developed a groundwater use policy.

There are 11 IRP sites at PNS. The Site Management Plan for PNS details the status and schedule for each IRP site and is updated annually (Navy, February 2012). A general site location map of PNS is presented as Figure 1-1, and the locations of the OUs and associated sites are shown on Figure 1-2. Ten of the IRP sites (Sites 5, 6, 8, 9, 10, 11, 29, 31, 32, and 34) are included within the seven OUs located at PNS. Site 30 is a site screening area and is not associated with an OU. Final decisions regarding remedial actions for Sites 8, 9, and 11 were documented in the OU3 ROD (Navy, August 2001a), for Site 10 in the OU1 ROD (Navy, September 2010), and for Sites 6 and 29 and Defense Reutilization and Marketing Office (DRMO) Impact Area in the OU2 ROD (Navy, September 2011). An interim ROD has been signed for Site 5, OU4 (Navy, May 1999). Sites in the Remedial Investigation (RI) and Feasibility Study (FS) stage include Sites 31 (OU8), 32 (OU7), and 34 (OU9). A non-time-critical removal action is being conducted at Site 30. Since the First Five-Year Review Report, no further action (NFA) was selected as the final remedy for the DRMO Impact Area within OU2 (Navy, September 2011). As indicated in Table 1-1, the OUs with final or interim remedies (OUs 1, 2, 3, and 4) were evaluated in this five-year review, as discussed in Sections 2.0 through 5.0, respectively.

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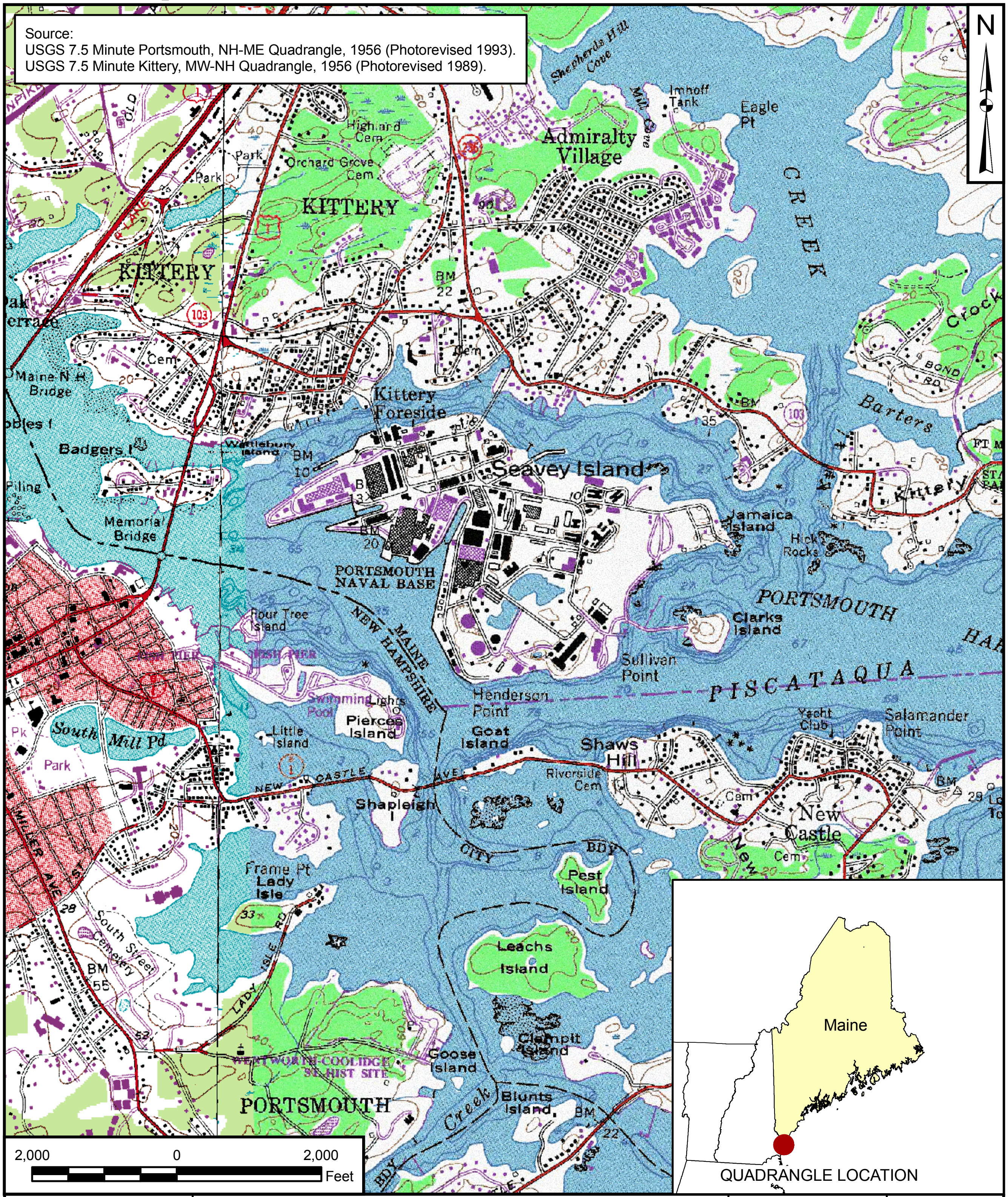

DRAWN BY J. ENGLISH	DATE 06/17/11	TETRA TECH	CONTRACT NUMBER 2103	CTO NUMBER WE14	
CHECKED BY M, BOERIO	DATE 9/30/11	PORTSMOUTH NAVAL SHIPYARD VICINITY MAP SECOND FIVE-YEAR REVIEW REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY ___	DATE ___	
REVISED BY ___	DATE ___		APPROVED BY ___	DATE ___	
SCALE AS NOTED			FIGURE NO. FIGURE 1-1		REV 0

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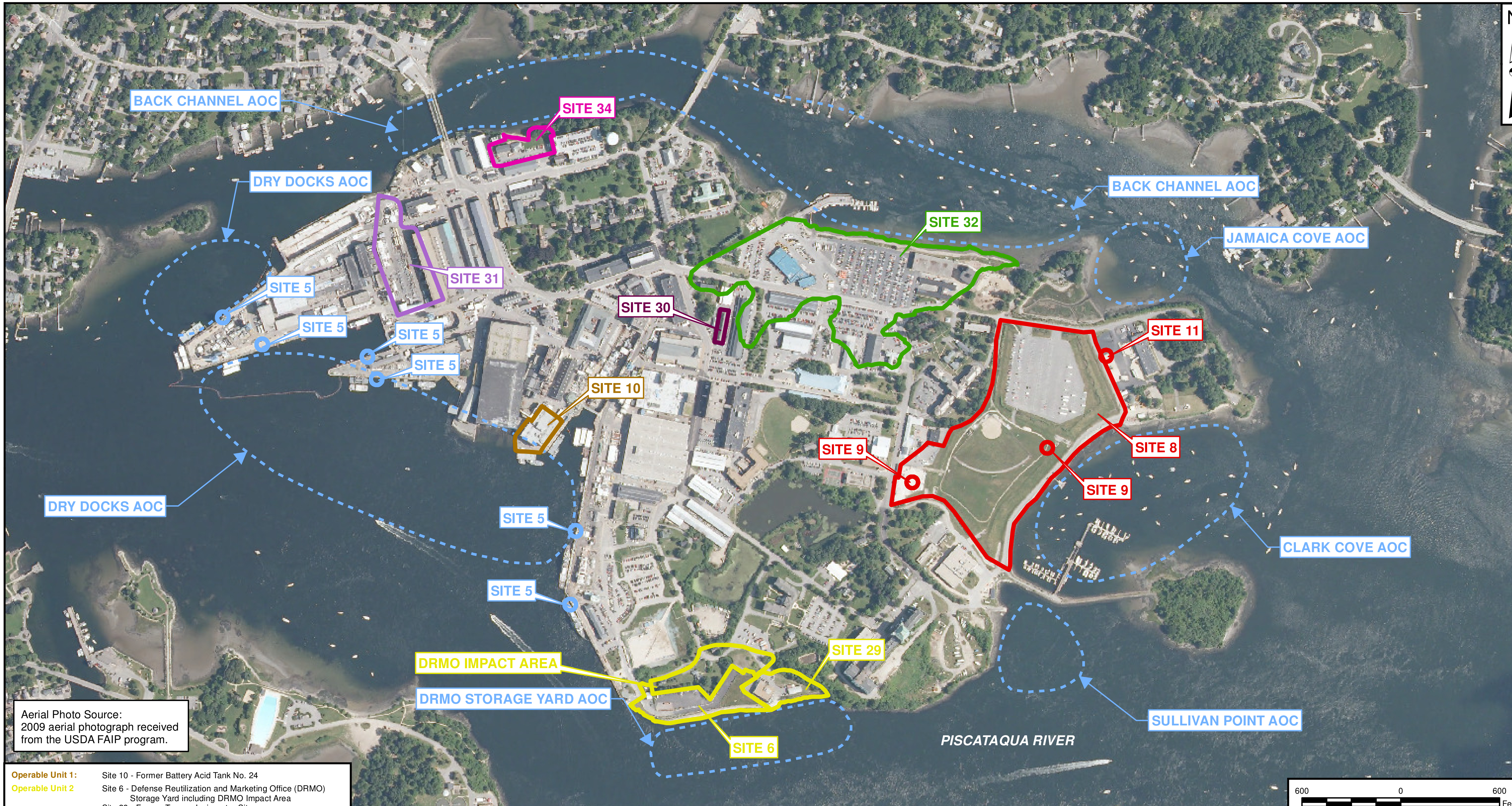


Operable Unit 1:	Site 10 - Former Battery Acid Tank No. 24
Operable Unit 2	Site 6 - Defense Reutilization and Marketing Office (DRMO) Storage Yard including DRMO Impact Area
	Site 29 - Former Teepee Incinerator Site
Operable Unit 3	Site 8 - Jamaica Island Landfill (JILF)
	Site 9 - Former Mercury Burial Site
	Site 11 - Former Waste Oil Tanks Nos. 6 & 7
Operable Unit 4	Site 5 - Former Industrial Waste Outfalls Offshore Areas potentially impacted by onshore IRP sites (Six Areas of Concern have been delineated)
Operable Unit 7	Site 32 - Topeka Pier Site
Operable Unit 8	Site 31 - West Timber Basin
Operable Unit 9	Site 34 - Former Oil Gasification Plant, Building 62
Site Screening Area	Site 30 - Galvanizing Plant, Building 184

DRAWN BY / DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH 11/03/11		2103	WE14
CHECKED BY / DATE: D. COHEN 02/01/12	FACILITY SITE MAP SECOND FIVE-YEAR REVIEW REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY: __	DATE: __
REVISED BY / DATE: S. PAXTON 02/01/12		APPROVED BY: __	DATE: __
SCALE: AS NOTED		FIGURE NO.: FIGURE 1-2	REV: 0

TABLE 1-1: STATUS OF IRP SITES

Operable Unit (Site)	Current Status	Evaluated in Five-Year Review Report?
OU1 (Site 10)	Post-ROD Remedial Action Work Plan (RAWP) complete.	Yes
OU2 (Sites 6 and 29 and DRMO Impact Area)	ROD signed.	Yes
OU3 (Sites 8, 9, and 11)	Long-Term Management (LTMgt) in progress.	Yes
OU4 (Site 5)	FS in progress and interim remedy (Interim Offshore Monitoring) ongoing.	Yes
OU7 (Site 32)	RI completed and FS in progress.	No
OU8 (Site 31)	RI to be conducted.	No
OU9 (Site 34)	RI in progress.	No
Site 30 Screening Area	Removal Action in progress.	No

1.2 OVERVIEW OF PNS

PNS is a military facility with restricted access on an island located in the Piscataqua River, as shown on Figure 1-1. PNS is referred to on National Oceanic and Atmospheric Administration (NOAA) nautical charts as Seavey Island, with the eastern tip given the name Jamaica Island. Clark's Island is to the east attached by a rock causeway to Seavey Island. The Piscataqua River is a tidal estuary that forms the southern boundary between Maine and New Hampshire. PNS is located in Kittery, Maine, north of Portsmouth, New Hampshire, at the mouth of the Great Bay Estuary (commonly referred to as Portsmouth Harbor).

1.2.1 Land Use

PNS is engaged in the conversion, overhaul, and repair of submarines for the Navy. The long history of shipbuilding in Portsmouth Harbor dates back to 1690, when the first warship launched in North America, the Falkland, was built. PNS was established as a government facility in 1800, and it served as a repair and building facility for ships during the Civil War. The first government-built submarine was designed and constructed at PNS during World War (WW) I, and a large number of submarines have been designed, constructed, and repaired at this facility since 1917. PNS continues to service submarines as its primary military focus.

Military activities are concentrated in the western portion of the facility in the Controlled Industrial Area (CIA). This area includes all of the dry docks and submarine berths and numerous buildings that house trade shops related to maintenance activities. Access to the area is tightly controlled and limited to individuals having appropriate clearances. The CIA is covered with buildings and asphalt to support military operations at PNS. Uses of other portions of PNS include administration offices, officers' residences, equipment storage, parking, and recreational facilities. Outside the CIA, areas are covered with asphalt, grass, and/or buildings, depending on the use of the area. Wetlands were constructed adjacent to Jamaica Cove, and a parking lot and recreational area were constructed on top of OU3.

Water for operations and drinking at the Shipyard is supplied by the Kittery Water District. Kittery's water supply originates from surface reservoirs located in the vicinity of York, Maine. Groundwater at PNS is not used for drinking, irrigation, industrial processes, fire fighting, or any other purposes.

A portion of PNS is on the National Register of Historic Places. The area between the two bridges connecting PNS to Kittery, Maine, was placed on the Register by the National Park Service in 1977. Based on a Cultural Resources Survey of PNS (Louis Berger Group, Inc., April 2003), the boundary of the PNS Historic District was expanded and includes the majority of the CIA. Two other PNS historic districts were also identified (Portsmouth Naval Hospital and Portsmouth Naval Prison Historic Districts).

1.2.2 Regulatory History and Overview of Environmental Investigations

Prior to CERCLA and Resource Conservation and Recovery Act (RCRA) regulation at PNS, years of shipbuilding and submarine repair work at PNS resulted in hazardous substances being released into the soil, groundwater, surface water, and sediment on and around Seavey Island. As a result, investigation and remediation activities have been performed under the Department of Defense (DoD) IRP. The purpose of the IRP is to identify, investigate, assess, characterize, and clean up or control releases of hazardous substances, and to reduce the risk to human health and the environment from past waste disposal operations and hazardous material spills associated with Navy activities. An overview of PNS historical events and documents related to environmental investigations, and their relevant dates, and Administrative Record (AR) number (if applicable) are shown below. The identified events are illustrative, not comprehensive. Additional information on site- or OU-specific investigations is provided in the Site Management Plan discussions related to the specific OU or study area.

TABLE 1-2: OVERVIEW OF PNS ENVIRONMENTAL INVESTIGATIONS

Event/Document	Date	Activities	AR Number
Initial Assessment Study (IAS) (Weston)	1983	Investigations of hazardous substance releases at PNS began in 1983 when the Navy completed the IAS that identified and assessed sites posing a potential threat to human health and the environment.	N00102.AR. 000002
USEPA involvement began	1985	USEPA became involved when the agency requested information on hazardous wastes at PNS and conducted a visual site inspection under the authority of RCRA.	Not Applicable (NA)
Final Confirmation Study (FCS) (LEA)	1986	Based on the IAS, environmental samples were collected at several sites to verify the presence and potential migration of contamination. Further investigation and corrective measures under RCRA were recommended.	N00102.AR. 000012 N00102.AR. 000013
RCRA Facility Assessment (RFA) (Kearney & Baker/TSA)	1986	During the investigation, 28 potential Solid Waste Management Units (SWMUs) located onshore and offshore of PNS were identified. Fifteen were eliminated from further investigation, leaving 13 SWMUs that required investigation and appropriate corrective action. These 13 sites were listed in the HSWA Permit.	N00102.AR. 000014
Maine Department of Environmental Protection (MEDEP) oversight began	1988	MEDEP provides oversight of investigation and remediation at PNS.	NA
USEPA Corrective Action Permit for PNS under the RCRA Hazardous and Solid Waste Amendments (HSWA) of 1984	1989	Based on the RFA, SWMUs 5, 6, 8, 9, 10, 11, 12, 13, 16, 21, 23, 26, and 27 were listed in the HSWA Permit, which required PNS to investigate and take appropriate corrective action at these SWMUs. Remedial action was conducted under RCRA authority until the mid-1990s, when the Federal Facility Agreement (FFA) was signed.	N00102.AR. 000019
RCRA Facility Investigation (RFI) Report and Addendum to RFI Report and Onshore Ecological Risk Assessment (McLaren/Hart)	1992/1993	SWMUs identified in the HSWA Permit were investigated in the RFI and the results presented in the RFI Report and Addendum. The RFI data were used as part of human health risk assessments. Onshore ecological risks were evaluated for SWMUs 6 and 8.	N00102.AR. 000117 to 000122, N00102.AR. 000169, and N00102.AR. 000125

TABLE 1-2: OVERVIEW OF PNS ENVIRONMENTAL INVESTIGATIONS			
Event/Document	**Date**	**Activities**	**AR Number**
PNS placed on the National Priorities List (NPL)	1994	PNS sites were evaluated by USEPA under Superfund's Hazard Ranking System (HRS) to determine the relative threats posed to the public health and environment by sites contaminated with hazardous substances. Based on the ranking, PNS was included on the NPL on May 31, 1994, and subsequent studies have been conducted under the authority of CERCLA. Consistent with the transition from RCRA to CERCLA, the SWMU terminology was replaced with "site."	NA
Onshore and offshore components of investigation separated	1994	USEPA directed that the onshore and offshore components of work required by the HSWA Permit be separated because the onshore portion of the study was being delayed by the more complex offshore investigation. Therefore, RI investigations for onshore and offshore areas were conducted separately. Potential impacts from onshore sites to offshore areas were evaluated as part of the onshore studies.	NA
Public Health and Environmental Risk Evaluation (PHERE) (McLaren/Hart)	1994	A human health risk assessment of onshore media (soil and groundwater) was conducted using RFI data.	N00102.AR. 000211
Offshore Human Health Risk Assessment (McLaren/Hart)	1994	A human health risk assessment of offshore media was conducted for PNS.	N00102.AR. 000229
RFI Data Gap Report (Halliburton NUS)	1995	A facility-wide investigation was conducted to resolve data gaps to address deficiencies in the RFI.	N00102.AR. 000328
Four rounds of groundwater and intertidal seep and sediment monitoring	1996/1997	A facility-wide monitoring program was conducted to resolve data gaps to address deficiencies in the RFI.	NA
NFA Decision Documents (DDs) for Sites 12, 13, 16, and 23 (Navy)	1997	NFA was selected as remedies for these sites.	N00102.AR. 000447
FFA signed, superseding the HSWA Permit (Navy)	1999	The FFA for PNS was signed by USEPA and the Navy in September 1999, became effective February 2000, and supersedes the HSWA Permit. The FFA includes 14 sites and the offshore area. The sites include the remaining sites in the HSWA Permit (Sites 5, 6, 8, 9, 10, 11, 21, 26, and 27), a portion of Site 6 separated and given a separate number (Site 29), and four newly identified sites (Sites 30, 31, 32, and 34). (As of December 31, 2011, Sites 21, 26, and 27 have NFA decisions.)	N00102.AR. 000726

TABLE 1-2: OVERVIEW OF PNS ENVIRONMENTAL INVESTIGATIONS			
Event/Document	**Date**	**Activities**	**AR Number**
Interim ROD for OU4 (Navy), Interim Offshore Monitoring Plan (Tetra Tech)	1999	Offshore monitoring was selected as an interim remedy for the PNS offshore area, and a monitoring plan was prepared as required by the Interim ROD. Monitoring began in 1999.	N00102.AR. 000676 and N00102.AR. 000750
Estuarine Ecological Risk Assessment (EERA) for offshore Areas of Concern (AOCs) (NCCOSC)	2000	An ecological risk assessment for the PNS offshore area was conducted.	N00102.AR. 000838
ROD for OU3 (Navy)	2001	A remedy for Sites 8, 9, and 11 within OU3 was selected in August 2001. Implementation of the remedy began in June 2002.	N00102.AR. 001018
NFA DDs for Sites 26 and 27 (Navy)	2001	NFA under CERCLA was selected for these sites, and the sites were removed from the IRP. Site 26 was formerly part of OU4, and Site 27 was the only site in OU5.	N00102.AR. 001019 N00102.AR. 001020
First Five-Year Review Report for PNS (Tetra Tech)	2007	As required by the ROD for OU3, the First Five-Year Review was completed in June 2007, 5 years after the start of implementation of the OU3 remedy.	N00102.PF. 001601
NFA DDs for Site 21 and Jamaica Island Landfill (JILF) Impact Area (Navy)	2008	NFA was selected for Site 21 and the site was removed from the IRP. Site 21 was formerly within OU1. With selection of NFA for the JILF Impact Area, this area was removed from Site 8 (OU3).	N00102.AR. 001647 and N00102.AR. 001648
ROD for OU1 (Navy)	2010	A remedy for Site 10 within OU1 was selected in September 2010, and implementation began in November 2011.	N00102.AR. 002495
ROD for OU2 (Navy)	2011	Remedies for Sites 6 and 29 and NFA for the DRMO Impact Area within OU2 were selected in September 2011.	N00102.AR. 002620

The locations of the IRP sites under investigation or at which remedial action is ongoing are shown on Figure 1-2. The sites listed in the FFA were grouped into five OUs (OU1 through OU5). Since the FFA, four additional OUs (OU6 through OU9) were subsequently identified. As of December 31, 2011, two of the nine OUs have been deleted. Between 2000 and 2005, OU6 was identified to address management of migration of groundwater from OU3; however, as of October 2005, OU6 was recombined with OU3. OU5 was removed from the CERCLA program based on the NFA under CERCLA determination for Site 27 in 2001. There is one study area at PNS, Site 30. Site 30 is included in the IRP but is not part of an OU.

1.3 FIVE-YEAR REVIEW PROCESS

The five-year review was led by Linda Cole, the Navy Remedial Project Manager. The following team members assisted in the review:

- Matt Audet, USEPA Region 1 Remedial Project Manager
- Iver McLeod, MEDEP Remedial Project Manager
- Lisa Joy, PNS Environmental Division Head
- Matt Thyng, PNS IRP Manager
- Deborah Cohen, Tetra Tech Facility Coordinator/Project Manager (Navy CLEAN contractor)
- Nina Balsamo, Tetra Tech Lead Engineer (Navy CLEAN contractor)

The five-year review consisted of a review of relevant documents and site inspections conducted by the Navy contractor. PNS personnel also attended the site visit on August 11, 2011. Photographs from the site visit are included in Appendix B. No official interviews were conducted as part of the five-year review. Current site information was obtained during discussions with Navy personnel as part of planning, implementation, and reporting of activities and investigations. USEPA and MEDEP input will be as provided through review and comment on the draft and draft final Five-Year Review Report.

The draft report will be submitted to the members of the Restoration Advisory Board (RAB) and presented at a RAB meeting. Community RAB members typically provide input to environmental activities conducted as part of the IRP through RAB presentations. The RAB members are included on the distribution of correspondence, meeting minutes, technical memoranda, and reports that are prepared as part of the IRP. An announcement about the review was provided at the May 17, 2011, RAB meeting. Public notices announcing the dates, times, and locations of RAB meetings are placed in the Portsmouth Herald and Fosters Daily Democrat the week before the RAB meetings. A 1-to 2-page RAB update fact sheet is typically prepared for each RAB meeting and distributed to the project team and the Portsmouth Public Library and Rice Library, as shown below. A public notice of the availability of the final Second Five-Year Review Report will be provided in the Portsmouth Herald and Fosters Daily Democrat when the document has been finalized.

The final report will be placed in the Information Repositories for PNS at the following locations:

Rice Public LIbrary
8 Wentworth Street
Kittery, ME 03904
Telephone: (207) 439-1633

Portsmouth Public Library
175 Parrott Street
Portsmouth, NH 03801
Telephone: (603) 427-1540

1.4 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND SITE-SPECIFIC ACTION LEVEL CHANGES

The Second Five-Year Review is being conducted for two purposes:

- To determine if the remedial actions are being implemented as specified in the RODs to protect human health and the environment.

- To determine if there have been changes in the ARARs or site-specific action levels that call into question the protectiveness of the remedies.

The chemical-specific ARARs and to-be-considered criteria (TBCs) identified in the OU1 ROD (Navy, September 2010), OU2 ROD (Navy, September 2011), and OU3 ROD (Navy, August 2001a) and the OU4 Interim ROD (Navy, May 1999) were reviewed, as were new federal and state regulations that have been promulgated since the previous Five-Year Review or RODs. TBCs that relate to development of site-specific action levels identified in the RODs were also reviewed. The ARARs and TBCs from each ROD are included in Appendix C. This section describes the overall impacts of the new or changed ARARs and TBC on the determination of the protectiveness of the remedies. It was determined that recalculation of risk or updates to risk assessments were not necessary to determine whether the remedies are protective of human health and the environment. The OU2 ROD was completed in September 2011; therefore, OU2 ROD ARARs are current. This section also indicates changes in site-specific action levels. Based on the changes discussed herein, remedies at the OUs continue to be protective of human health and the environment.

There are no chemical-specific ARARs for OU1. The chemical-specific TBCs for OU1 are as follows:

- Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-12 lead soil screening level for residential use.

- Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil (USEPA, January 2003).

- USEPA Risk Reference Doses (RfDs) from the Integrated Risk Information System (IRIS).

Of the above-listed TBCs, the two USEPA TBCs were used to develop remediation goals for OU1 chemicals of concern (COCs) (Navy, September 2010), and the OSWER Directive was used to establish appropriate land use control (LUC) boundaries in preparing the LUC Remedial Design (RD).

There are no chemical-specific ARARs for OU2. The chemical-specific TBCs for OU2 are as follows:

- OSWER Directive 9355.4-12.

- Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil (USEPA, January 2003).

- USEPA Risk RfDs from IRIS.

- USEPA Human Health Assessment Group Cancer Slope Factors (CSFs) from IRIS.

- Guidelines for Carcinogen Risk Assessment (USEPA, March 2005a).

- Supplemental Guidance for Assessing Susceptibility from Early-Life Exposures to Carcinogens, EPA/630/R-03/003F (USEPA, March 2005b).

Of the above-listed TBCs, all but the OSWER Directive were used to develop risk-based cleanup levels for OU2 COCs (Navy, September 2011). The OSWER Directive is being used to establish appropriate LUC boundaries in preparing the LUC RD.

The chemical-specific ARARs and TBCs for OU3 are as follows:

- Clean Water Act, Section 304 (a), National Recommended Water Quality Criteria (NRWQCs) (Relevant and Appropriate) and Maine Surface Water Toxics Control Program, Chapter 530.5, Statewide Water Quality Criteria (Applicable).

- USEPA Risk RfDs and USEPA Human Health Assessment Group CSFs (TBCs).

- USEPA health advisories for drinking water, risk RfDs, and CSFs (TBCs).

- State of Maine Guidance Manual for Human Health Risk Assessments at Hazardous Substance Sites (June 1994 updated July 2009) (TBC).

These national and statewide water quality criteria are being used as action levels for the groundwater monitoring program as part of the updated Post-Remedial Operation, Maintenance, and Monitoring (OM&M) Plan for OU3 (Tetra Tech, December 2011). The water quality criteria are updated periodically, and any updates that affect the monitoring program are taken into account during evaluation of groundwater data as part of the monitoring program. In addition, updates to risk assessment guidance are taken into account as part of the OM&M program, as discussed further in Section 4.3.3 and 4.5.2.

The human health risk assessment for OU3 was completed in 2000 using the TBCs identified in the ROD, as presented in Appendix C.3. Except for monitoring, the components of the remedial action for OU3 (capping, shoreline controls, and LUCs) are not chemical specific, and therefore any updates to risk assessment guidance, RfDs, and/or CSFs would not impact the protectiveness of these components of the OU3 remedy. The human health action levels for the groundwater monitoring program developed after the ROD as part of the OU3 OM&M plan were calculated using the RfDs and CSFs along with other guidance documents. The RfDs and CSFs are updated periodically, and any updates that affect the monitoring program are taken into account during evaluation of groundwater data as part of the monitoring program. In addition, updates to risk assessment guidance are taken into account as part of the OM&M program, as discussed further in Sections 4.3.3 and 4.5.2.

The chemical-specific ARAR and TBCs for OU4, as identified in the Interim ROD, are as follows:

- Clean Water Act, Section 304(a), NRWQCs (Relevant and Appropriate) and Maine Surface Water Toxics Control Program, Chapter 530.5, Statewide Water Quality Criteria (Relevant and Appropriate).

- Food and Drug Administration (FDA) Action Levels and NOAA National Status and Trends Program Mussel Watch Data (TBCs).

- NOAA Incidence of Adverse Biological Effects within Ranges of Chemical Concentration in Marine and Estuarine Sediments [Effects-Range Low (ER-L) and Effects-Range Median (ER-M) concentrations] (Long et al., 1995) and USEPA Proposed Sediment Quality Criteria (TBCs).

Of the above-listed ARARs and TBCs, the water quality criteria and ER-L and ER-M concentrations were used to develop Preliminary Remediation Goals (PRGs) for COCs for OU4 (Tetra Tech, November 2001). The PRGs are used as part of the interim offshore monitoring program, as discussed in the Interim Offshore Monitoring Plan (Tetra Tech, October 1999), Revision 1 (Tetra Tech, November 2010a), and related documents. The NRWQCs were revised in 2009, but none of the criteria for the OU4 COCs changed. The ER-L and ER-M concentrations have not changed since the PRGs were developed, and there is no new sediment guidance that would affect the PRGs. At the time the FS for OU4 is conducted, ARARs and TBCs will be re-evaluated and changes to the PRGs made as necessary for use in the FS.

1.5 REPORT ORGANIZATION

Section 1.0 presents an overview of PNS and the five-year review process and a discussion of changes in ARARs and site-specific action levels. Sections 2.0 through 5.0 summarize the five-year reviews conducted for OUs 1, 2, 3, and 4, respectively. Section 6.0 provides a general summary, conclusions, and protectiveness statement for PNS and this section also identifies when the next five-year review is required and the other tasks that are expected to be performed as part of that five-year review. Appendix A contains the five-year review inspection checklists for OUs 1 through 4 and Navy instructions related to LUCs (Instructions 5090.6D and 5090.2), Appendix B contains photographs of the sites, Appendix C contains ARARs tables from the RODs and interim ROD and relevant discussion about criteria changes, and Appendix D contains data evaluation and trend plots for data collected at OU3 and OU4. Appendix E contains the responses to comments on the draft document.

2.0 OPERABLE UNIT 1

OU1 consists of Site 10 – Former Battery Acid Tank No. 24. The OU1 ROD was signed in 2010. This five-year review of OU1 is required by statute because hazardous substances, pollutants, or contaminants remain on site that do not allow for unlimited use and unrestricted exposure. The location of OU1 at PNS is shown on Figure 1-2 and the layout of OU1 is shown on Figure 2-1.

2.1 SITE CHRONOLOGY

The following table provides the site chronology for pre-ROD and post-ROD activities and includes a brief summary of the activities at OU1.

TABLE 2-1: OU1 SITE CHRONOLOGY AND DOCUMENTATION			
PRE-ROD EVENT/DOCUMENT	DATE	ACTIVITIES	AR NUMBER
Tank Closure	1986	A leak was discovered in 1984 in an underground storage tank located outside of Building 238. The tank and surrounding soil were removed in 1986, and a 2-inch hole was discovered in the tank bottom. The drain lines to the tank are believed not to have been exhumed. Activities were performed under MEDEP supervision.	NA
RFI	1991	Four soil samples were collected from three soil boring locations around the former tank as part of the RFI.	NA
Field Investigation	1998	Two soil borings (one upgradient and one near the former tank) were installed and later converted to groundwater monitoring wells as part of the Site 10 Field Investigation. Two subsurface soil samples were collected from the on-site borings. In addition, five surface soil samples were collected from the earthen floor of the Building 238 crawl space, beneath the overhead drain lines and from a depression in the earthen floor associated with the buried portion of the drain lines. One round of groundwater samples was collected from the two monitoring wells.	NA
Additional Investigation	2001	Based on RFI and 1998 Field Investigation data, further investigation was required to determine the nature and extent of residual inorganic (metals) contamination in soil and groundwater and to evaluate associated site risks. Organic contamination associated with the site was not found. The investigation also included evaluation of whether contaminants in groundwater could migrate to the offshore to create current or future unacceptable impacts. Soil and groundwater samples were collected and analyzed for metals. Four surface and subsurface soil samples were collected in the area of the acid drain pipeline and at 12 randomly selected locations elsewhere at the site. Two groundwater samples were collected from each of three newly installed monitoring wells and two existing monitoring wells. The Additional Investigation showed that lead was the primary contaminant associated with site releases and that the extent of high-level lead contamination [greater than 10,000 milligram per kilogram (mg/kg)] was not sufficiently delineated.	NA

TABLE 2-1: OU1 SITE CHRONOLOGY AND DOCUMENTATION			
PRE-ROD EVENT/DOCUMENT	DATE	ACTIVITIES	AR NUMBER
Data Gap Investigation	2006	The Data Gap Investigation was conducted to collect data to determine the nature and extent of high-level lead contamination from past battery operations and to collect additional information to evaluate the potential for lead migration from onshore soil to the offshore area. Groundwater monitoring wells were sampled over three rounds at different tidal levels. Soil samples were collected at 35 locations on a grid-based plan and at an additional 22 locations under the building. Thirteen soil borings were installed and sampled outside of the building. Three new downgradient monitoring wells were installed, and 17 soil samples were collected from the borings during installation.	NA
RI Report (Tetra Tech)	2007	Prepared to assess the nature and extent of contamination and risks associated with contamination at OU1 and concluded that the nature and extent of contamination in soil and groundwater were adequately defined. The risk assessment showed that, under current site conditions, risks for construction worker exposure to lead in soil under Building 238 were unacceptable based on USEPA risk goals. Risks under future potential site conditions (if Building 238 was removed or modified, or if the site was developed for non-industrial uses) were unacceptable for exposure to lead in soil under Building 238 for occupational workers, recreational users, and residential users, for antimony in soil under Building 238 for residential users, and for lead in soil outside Building 238 for residential users. Because the site is and has historically been in an industrial area of PNS, residential land use and recreational exposure are not considered likely future exposure pathways for OU1. Based on the evaluations of human health risk and migration potential, groundwater was determined not to be a medium of concern.	N00102.AR. 001606
FS Report (Tetra Tech)	2010	Based on the nature and extent of soil contamination determined during the RI, an FS was conducted to develop and evaluate soil remedial alternatives.	N00102.AR. 001754
Proposed Plan (Navy)	2010	Presented the Navy's Preferred Alternative to address contamination. A 30-day public comment period was held from June 17 to July 16, 2010. No modification to the proposed remedy was necessary based on comments received during the public comment period.	N00102.AR. 001759
ROD (Navy)	2010	The ROD was signed in September 2010, and the selected remedy includes limited soil excavation and disposal with LUCs and monitoring.	N00102.AR. 002495
Post-ROD Event/Document	**Date**	**Activities**	**AR Number**
RAWP (Shaw)	2011	The RAWP was completed in October 2011 (Revision 1) and the remedial action construction began in November 2011.	Not Yet Assigned

2.2 BACKGROUND

OU1 is in an industrial area, near the southern shore of PNS (see Figure 1-2). The layout of OU1 is shown on Figure 2-1, and a conceptual model of the site is shown on Figure 2-2.

PGH P:\GIS\PORTSMOUTH_NSY\MAPDOCS\MXD\OU1_SITE_LAYOUT_NOV2011.MXD 12/29/11 JEE

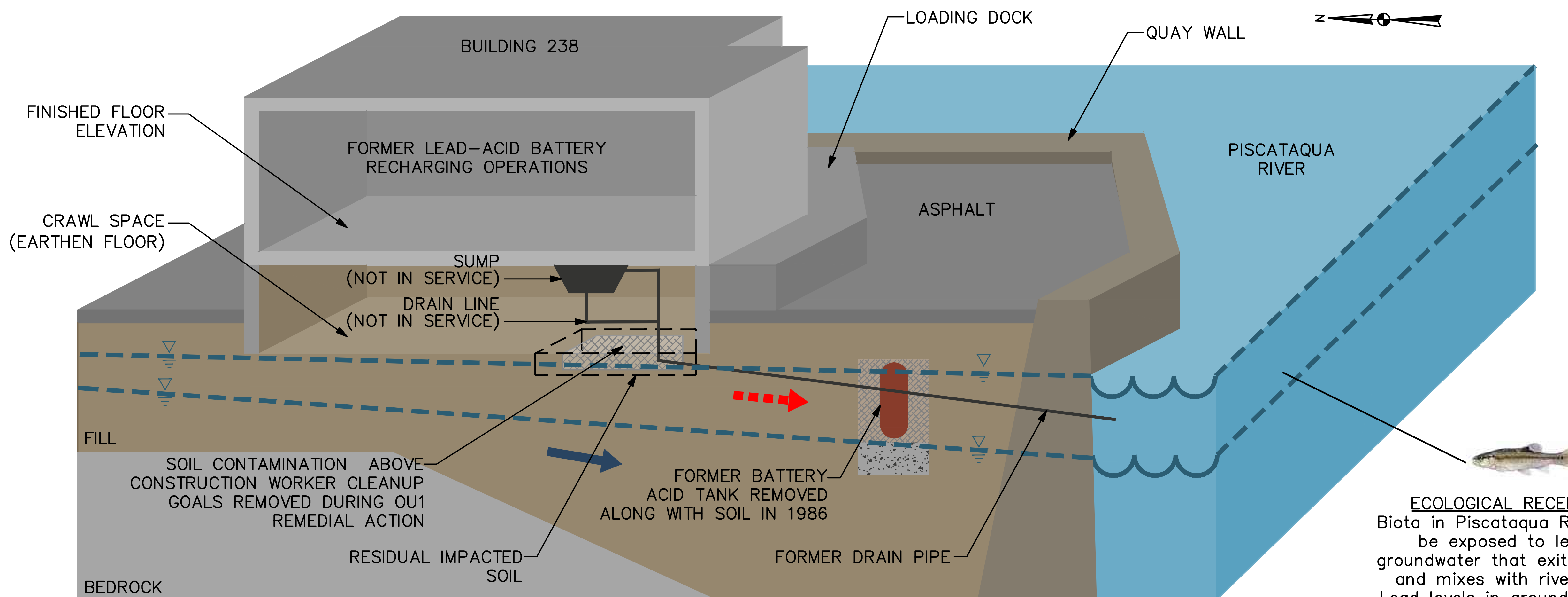
DRAWN BY J. ENGLISH	DATE 11/03/11	TETRA TECH	CONTRACT NUMBER 2103	CTO NUMBER WE14
CHECKED BY D. COHEN	DATE 12/29/11	OU1 LAYOUT MAP SECOND FIVE-YEAR REVIEW REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY ___	DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___	DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 2-1	REV 0

CURRENT/FUTURE RECREATIONAL USER
Exposure to lead in soil if asphalt or Building 238 is removed will not pose an unacceptable risk post remediation.

CURRENT/FUTURE CONSTRUCTION WORKER
Exposure to lead in soil will not pose an unacceptable risk post remediation. Exposure to lead in groundwater during subsurface construction does not pose an unacceptable risk.

CURRENT/FUTURE OCCUPATIONAL WORKER
Exposure to lead in soil if asphalt or Building 238 is removed will not pose an unacceptable risk post remediation.

CURRENT/FUTURE RESIDENT
Residents could be exposed to unacceptable levels of lead in soil if land use is changed to residential and asphalt or Building 238 is removed.



ECOLOGICAL RECEPTORS
Biota in Piscataqua River could be exposed to lead in groundwater that exits the site and mixes with river water. Lead levels in groundwater are not at levels that will adversely impact biota.

LEGEND

- CONTAMINANT RELEASES
- NET GROUNDWATER FLOW DIRECTION
- POTENTIAL CONTAMINANT MIGRATION PATHWAY IN GROUNDWATER (REMEDIAL CONSTRUCTION COULD POTENTIALLY DISTURB CURRENT STABLE GROUNDWATER CONDITIONS)

TETRA TECH
WWW.TETRATECH.COM
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921–7090 | F: (412) 921–4040

PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

CONCEPTUAL SITE MODEL
OPERABLE UNIT 1
SCALE: NOT TO SCALE

DATE:	3/22/11
PROJECT NO.:	112G02224
DESIGNED BY:	
DRAWN BY:	MF
CHECKED BY:	
SHEET:	1 OF 1

FIGURE 2–2

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Physical Characteristics

OU1 is located on fill material that was placed prior to the 1920s. Building 238, located within the boundary of OU1, was built in 1955 and was used for battery recharging operations that previously resulted in releases of contaminated wastewater. Currently, the building consists mostly of office space; some minor battery recharging work is still performed, but the current process does not generate chemical waste. The area surrounding Building 238 is covered by asphalt. A loading dock is located on the southern and eastern sides of the building. The site is bounded by the Piscataqua River on the east, south, and southwest. Buildings 303 and 178 are west and additional operational buildings are north of the site. The site shoreline along the Piscataqua River from the west to the southeast is bounded by a quay wall of granite blocks. Berths 4 and 5 are located south and east of Building 238, respectively, and barges are commonly docked at these berths. A crawl space with an earthen floor exists beneath a portion of Building 238 and the loading dock. The ground elevation of the earthen floor is approximately 5 to 6 feet below the ground elevation outside the building and loading dock. The site fill material is rocky and ranges in thickness from 10 feet to 40 feet (particularly closer to the shoreline). Gravel, bricks, and other building materials were also found in the fill material.

The offshore area of OU1 is part of the Dry Dock AOC that was investigated as part of the EERA (NCCOSC, May 2000) and is part of the more recent interim offshore sampling at monitoring station MS-12. Sampling locations at MS-12 are in a depositional area west of Site 10 and south of Building 178 (Tetra Tech, November 2004; February 2010; and November 2010a). The offshore area is discussed as part of OU4 in Section 5.0.

Land and Resource Use

The site is currently and has historically been located within an industrial area and has no onshore ecological habitats. Groundwater at the site is tidally influenced, is saline or brackish, and is not used as a potable water supply.

History of Contamination

Large lead-acid storage batteries were drained inside Building 238 as part of lead-acid recharging operations, and until 1974, the acidic discharges drained directly to the offshore through an industrial waste outfall (Site 5) (Tetra Tech, June 2006a; Weston, June 1983). In 1974, the acidic discharges were directed into a lead-acid drain pipeline, which exited the building and entered the crawl space, and then dropped vertically into the earthen floor of the crawl space. The acidic discharge then flowed through the drain line to a steel underground storage tank (Battery Acid Tank No. 24) with a 9,680-gallon capacity. Use of the piping and tank was discontinued when a leak was discovered in the tank in 1984. During tank closure in 1986, the tank and surrounding contaminated soil were removed (Tetra Tech, June 2006a). Testing of the soil during tank excavation indicated no exceedances of hazardous waste criteria for metals. MEDEP did not require additional cleanup action at the time of the tank removal (Tetra Tech, March 2000). The primary chemical associated with CERCLA releases to soil and groundwater at OU1 is lead from releases (prior to approximately 1984) from lead-acid battery operations conducted in Building 238. The releases occurred under the crawl space of the building (by a former acid drain line) and from a former battery acid tank located outside the building. Antimony contamination was found collocated with the greatest levels of lead contamination.

Initial Response

Activities that resulted in contaminant releases were discontinued in 1984. The leaking tank and surrounding contaminated soil were removed in 1986.

Basis for Taking Action

As provided in Section 2.1, lead-contaminated soil at the site and antimony-contaminated soil within the crawl space are present that result in potential unacceptable risks for current and potential future human receptors at OU1. Groundwater is not to be a medium of concern, and OU1 is not a current source of contamination to the offshore area. Potential offshore impacts from past releases of contamination from OU1 to the offshore are being addressed under OU4 (offshore area) through MS-12.

2.3 REMEDIAL ACTIONS

A remedy for OU1 was selected as documented in the OU1 ROD (Navy, September 2010), and is summarized in Section 2.3.1. Remedy implementation activities are discussed in Section 2.3.2.

2.3.1 Remedy Selection

Table 2-2 presents a summary of the identified risks at OU1, the RAO established in the ROD to address each risk, the remedy component to meet each RAO, the metric and cleanup level used, and the expected outcome of each remedy component.

The OU1 cleanup levels, provided below, are based on average exposure concentrations in soil, with consideration given to current and potential future land uses of the sites.

TABLE 2-2

SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU1
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PAGE 1 OF 2

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
Human exposure to lead-contaminated soil within the crawl space of Building 238.	Prevent construction worker and future potential recreational user and occupational worker exposure through ingestion, dust inhalation, and dermal contact to unacceptable levels of lead-contaminated soil under Building 238.	Excavation of soil in two areas within the crawl space of Building 238 based on construction worker exposure risks for lead.	Soil with lead concentrations greater than 2,000 mg/kg will be removed from the two excavation areas provided in the Remedial Action Work Plan to reduce the average lead concentration in soil within the crawl space to less than cleanup levels for construction workers (2,000 mg/kg), occupational workers (1,600 mg/kg), and recreational users (4,600 mg/kg).	Removal of lead-contaminated soil as provided in the Remedial Action Work Plan will result in unrestricted use for construction workers, occupational workers, and recreational users.
Human exposure to lead-contaminated soil within the crawl space of Building 238 and outside Building 238.	Prevent hypothetical future residential exposure through ingestion, dust inhalation, and dermal contact with unacceptable levels of lead-contaminated soil under and outside of Building 238.	Implementation of LUCs to prevent future residential use of OU1.	Implement and maintain LUCs into the foreseeable future and confirm protectiveness during periodic inspections and five-year reviews as long as average concentrations of lead in soil exceed the cleanup level for residential use (400 mg/kg).	Implementation of LUCs will prevent residential exposure to unacceptable levels of lead-contaminated soil under and outside of Building 238. Lead concentrations are not anticipated to attenuate to less than residential clean-up levels for the foreseeable future.

TABLE 2-2

**SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU1
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PAGE 2 OF 2**

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
Human exposure to antimony-contaminated soil within the crawl space of Building 238	Prevent hypothetical future residential exposure through ingestion, dust inhalation, and dermal contact to unacceptable levels of antimony-contaminated soil under Building 238.	Excavation of soil in two areas within the crawl space of Building 238 based on construction worker exposure risks for lead.	Excavation of soil in the crawl space under Building 238 based on construction worker exposure for lead will reduce antimony concentrations in soil within the crawl space to less than the cleanup level for residential use (73 mg/kg).	Excavation of lead-contaminated soil in the two areas of the crawl space of Building 238 will also remove soil with unacceptable levels of antimony.

TABLE 2-3: OU1 CLEANUP LEVELS

COC	Construction Worker (mg/kg)	Occupational Worker (mg/kg)	Recreational User (mg/kg)	Resident (mg/kg)	Basis
Antimony	---	---	---	73	For soil within crawl space; site-specific risk based, hazard index (HI) = 1.
Lead	2,000	1,600	4,600	400	Non-residential: For soil within crawl space, site-specific risk based. Residential: For soil within crawl space and outside building, based on OSWER soil screening level.

-- Existing concentrations did not result in unacceptable risk for this receptor

The major components of the remedy selected to address these RAOs and remediation goals for OU1 include the following:

- Excavation of contaminated soil with lead concentrations greater than acceptable levels for construction workers and hypothetical future recreational users and occupational workers around the drain lines within the crawl space of Building 238.
- Offsite disposal of excavated soil at an appropriate treatment, storage, and disposal (TSD) facility.
- Restoration of excavated areas to pre-existing elevations with clean soil.
- Implementation of LUCs through a LUC RD to ensure maintenance of current site features and to prevent future residential site use.
- Groundwater monitoring to confirm the lack of groundwater impacts from the soil removal action.
- Five-year site reviews to confirm that the remedy remains protective of human health and the environment.

The selected remedy eliminates unacceptable human health risks associated with contaminated soil in the crawl space of Building 238 for construction workers, occupational workers, and hypothetical future recreational users. There are no unacceptable risks to these receptors outside of Building 238. The selected remedy is expected to achieve substantial long-term risk reduction and allow the site to be used for the current and reasonably anticipated future industrial use. The ROD documents the final remedial action for OU1. Implementation of this remedy will be consistent with current use and the overall cleanup strategy for PNS to restore sites to support base operations.

2.3.2 Remedy Implementation

Implementation of the remedy selected in the ROD has not yet been completed. The RAWP that describes activities required to meet project objectives, health and safety requirements, and reporting requirements and includes a tentative schedule for excavation, disposal, and site restoration has been prepared (Shaw, October 2011). Prior to excavation, hand digging will be conducted to locate all identified utilities within the site. After all utilities have been exposed, the 3,500-square-foot lead-contaminated soil area beneath Building 238 will be excavated. The excavated soil will be transported to Site 6, the DRMO Storage Yard, for stockpile and load-out. After all excavation and confirmatory sampling has been completed, excavated soil will be sent to an appropriately permitted facility, and the site will be backfilled to pre-existing elevations. Mobilization for excavation began at the end of November 2011.

A post-remediation groundwater monitoring Sampling and Analysis Plan (SAP) is being prepared detailing the groundwater sampling that will follow the soil excavation at OU1. Post-excavation groundwater sampling for lead will be conducted to confirm the lack of groundwater impacts from the soil remedial actions. Monitoring will be conducted until the Navy, as lead agency, and USEPA, as support agency, determine that potential migration of lead-contaminated soil post remediation does not result in groundwater concentrations greater than acceptable levels for human health and the environment. Groundwater will be analyzed for total and dissolved lead, and the results will be compared to human health and ecological risk values [800 and 22,680 micrograms per liter (µg/L), respectively]. Initially, two rounds of groundwater samples will be collected, and if lead concentrations in groundwater appear to have increased after remedy implementation, the project team will determine whether additional groundwater monitoring is necessary to confirm that groundwater concentrations will not exceed the human health and ecological risk values.

A LUC RD is being prepared, as required by the ROD, to implement LUCs with the following objectives:

- Prohibit residential reuse of the site unless additional action is undertaken to prevent residential exposure to lead-contaminated soil throughout OU1. Prohibited residential uses shall include, but are not limited to, any form of housing, child-care facilities, pre-schools, elementary schools, secondary schools, playgrounds, and convalescent or nursing care facilities.

- Maintain current site features including Building 238 and asphalt pavement to prevent exposure to underlying contaminated soil.

- Institute requirements for proper management of excavated soil as part of any future construction and maintenance activities at OU1.

The OU1 LUC area is shown on Figure 2-3.

2.4 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The table below indicates the status of recommendations made during the first five-year review for OU1.

TABLE 2-4: STATUS OF RECOMMENDATIONS FOR OU1

Recommendation from First Five-Year Review	Status
Complete RI/FS	RI finalized July 2007 FS finalized June 2010
Complete DD	Proposed Remedial Action Plan (PRAP) finalized July 2011 ROD finalized September 2011
Maintenance items • Monitoring well BA-MW4 was missing a bolt and was in a depression surrounded with water. • One of the crawl space covers/signs on Building 238 was not attached. The Navy should replace covers/signs for the crawl space openings.	• It was not confirmed that the bolt was replaced, but all wells will be inspected after the remedy is implemented. • Signs cover all crawl space openings.
Continue to enforce the Shipyard excavation policy	The excavation policy remains in place and will be included as part of the LUC RD, under preparation.

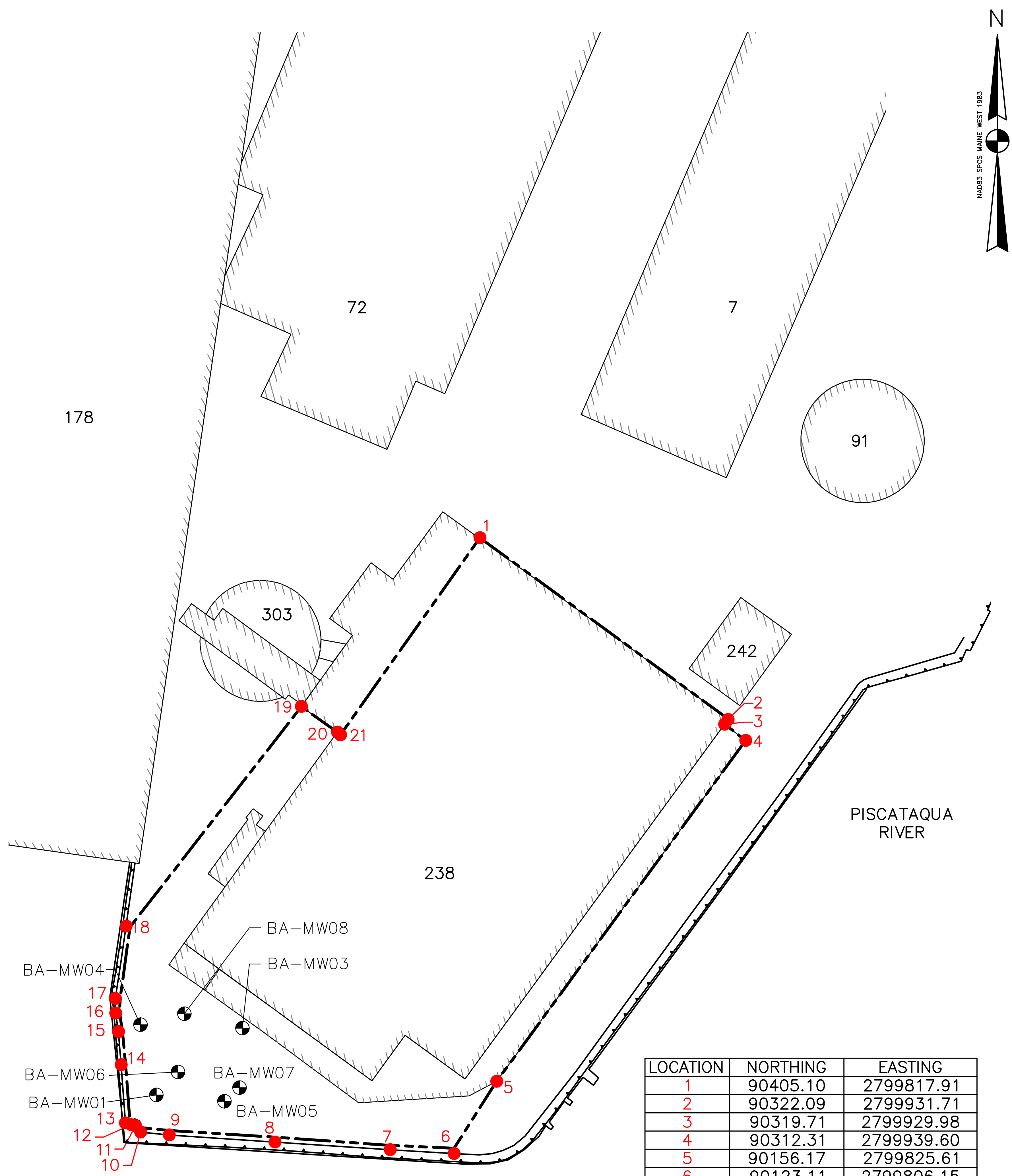
The RAWP was finalized in October 2011, and the remedial action implementation began in November 2011.

2.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

2.5.1 Document and Data Review

The following documents for OU1 were reviewed for the Second Five-Year Review:



LOCATION	NORTHING	EASTING
1	90405.10	2799817.91
2	90322.09	2799931.71
3	90319.71	2799929.98
4	90312.31	2799939.60
5	90156.17	2799825.61
6	90123.11	2799806.15
7	90124.82	2799776.82
8	90128.37	2799724.12
9	90131.64	2799675.67
10	90132.91	2799662.60
11	90135.74	2799660.28
12	90136.31	2799658.39
13	90137.13	2799655.72
14	90163.79	2799653.73
15	90178.96	2799652.44
16	90187.42	2799651.17
17	90194.10	2799651.02
18	90227.25	2799655.96
19	90327.82	2799736.23
20	90316.08	2799752.65
21	90314.82	2799754.12

LEGEND

- OU1 BOUNDARY
- SEAWALL
- 242 BUILDING
- 1 NORTHING/EASTING LOCATION, NAD SPCS MAINE WEST 1983 (SEE TABLE)
- BA-MW01 MONITORING WELL LOCATION AND DESIGNATION

0 50 100
SCALE: 1" = 50'

TETRA TECH
WWW.TETRATECH.COM
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

OU1 LAND USE CONTROL AREA
SECOND FIVE-;YEAR REVIEW REPORT

SCALE: 1"=50'

DATE:	10/27/10
PROJECT NO.:	112G02224
DESIGNED BY:	
DRAWN BY:	MF
CHECKED BY:	
SHEET:	1 OF 1

FIGURE 2-3

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- RI Report (Tetra Tech, July 2007)
- FS Report (Tetra Tech, June 2010)
- PRAP (Navy, June 2010)
- ROD (Navy, September 2010)
- RAWP (Shaw, October 2011)
- LUC RD for OU1 (draft final)
- SAP for post-remediation groundwater monitoring at OU1 (draft)

In the past 5 years, the RI, FS, PRAP, and ROD were finalized, and documents have been prepared to detail the steps and requirements for implementing the selected remedial action. The OU1 ROD presented the selected remedy, as discussed in Section 2.3. The RAWP, groundwater monitoring SAP, and LUC RD, discussed in Section 2.3.2, present more specific details about the activities required to properly implement the selected remedy. No data has been collected, but data will be evaluated according to the RAWP and groundwater monitoring SAP, and the results of the data evaluation will be discussed in the next five-year review.

2.5.2 ARAR and Site-Specific Action Level Changes

ARARs and TBCs were reviewed to determine whether there have been changes since the ROD was signed. There have been no changes since the September 27, 2010, OU1 ROD signature date. The ARAR table from the OU1 ROD is provided in Appendix C.1.

2.5.3 Site Inspection

Site 10 was visually inspected on August 10, 2011. Tetra Tech personnel conducted the inspection and were escorted by Shipyard personnel who took photographs. No conditions presenting an immediate threat or unacceptable risk were observed. Minor cracks and potholes in the asphalt were identified during the site inspection, as noted on the Site Inspection Checklist (Appendix A.2), which do not affect current protectiveness but could pose a threat if they become wider/deeper and expose contamination. The Shipyard has no plans to change the current use of the site. A photograph of the crawl space at Site 10 (Photograph 15) taken during the July 2006 sampling event, and photographs outside Building 238 taken in August 2011 (Photographs 12, 13, and 14) are provided in Appendix B.

2.5.4 Site Interviews

No interviews were conducted as part of the Second Five-Year Review.

2.6 TECHNICAL ASSESSMENT

The remedy has not yet been implemented at OU1. The ROD was signed in September 2010. Remedy implementation including removal of contaminated soil within the crawl space and repaving of asphalt outside of Building 238 will be conducted in 2011 and 2012. Remedial action (RA) construction work is being conducted in accordance with the RAWP following the appropriate health and safety protocols for the remediation work. Post-remedial groundwater sampling and LUC inspections are anticipated to begin in 2012. Because the selected remedy has not yet been implemented, its performance; operations, O&M, and costs; early indicators of potential remedy failure; opportunities or optimization; and implementation of institutional controls and other measures cannot be discussed. There are no current unacceptable exposures to current users at OU1 because crawl space entryways are covered, the soil outside the building is in a controlled access area, and digging is controlled at OU1 under the Shipyard excavation policy. Asphalt will be repaired or replaced as necessary as part of the remedy, but soil outside the building does not pose an unacceptable risk to current users. The monitoring wells included in the LTMgt program will be inspected and any repairs will be completed as necessary after the asphalt work is complete.

2.7 ISSUES

No deficiencies or issues were identified. A final remedy has been selected at OU1, but implementation is not expected to be complete until 2012. Minor cracks and potholes in the asphalt were identified during the site visit, which could affect future protectiveness; however, the asphalt will be replaced or repaired as part of the RA, as described in the RAWP. There are no immediate threats to human health or the environment before the RA construction activities are completed.

2.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No issues were identified; therefore, no recommendations or actions are needed to address issues.

2.9 PROTECTIVENESS STATEMENT

A remedy for OU1 has not yet been implemented. The results of investigations do not indicate any imminent threats to human health or the environment under current land use scenarios. Current site conditions and Shipyard policies provide for protection of human health and the environment until the remedy is implemented. The remedy at OU1 is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

3.0 OPERABLE UNIT 2

OU2 consists of Site 6 – DRMO Storage Yard, Site 29 – Former Teepee Incinerator Site, and the DRMO Impact Area – Quarters S, N, and 68. A ROD was prepared and signed for OU2 in September 2011 for remedial action at Sites 6 and 29 and NFA for the DRMO Impact Area. A five-year review is being conducted for Sites 6 and 29 because hazardous substances, pollutants, or contaminants remain on site in excess of levels that allow for unlimited use and unrestricted exposure. Five-year reviews are not required for the DRMO Impact Area because contamination has been removed to allow for unlimited use and unrestricted exposure. The location of OU2 at PNS and the boundaries of Site 6, Site 29, and the DRMO Impact Area are shown on Figure 1-2. The layout of OU2 is shown on Figure 3-1.

3.1 SITE CHRONOLOGY

The following table provides the site chronology for pre-ROD activities and includes a brief summary of the activities at OU2.

TABLE 3-1: OU2 SITE CHRONOLOGY AND DOCUMENTATION

PRE-ROD EVENT/DOCUMENT	DATE	ACTIVITIES	AR NUMBER
FCS	1984	Environmental samples were collected at Site 6 to verify the presence of contamination and potential migration of contamination from open battery storage activities. Further investigation and corrective measures under RCRA were recommended for Site 6.	NA
RFI	1989-1992	Surface and subsurface soil samples within and around the DRMO Storage Yard (including the area later identified as Site 29) were collected and analyzed to support evaluation of the nature and extent of contamination and site risks. Approximately 40 samples were collected from nine surface soil locations and 15 soil borings. Approximately 50 surface soil samples were collected from 27 locations in the DRMO Impact Area to assess the potential for wind dispersal of contaminants from DRMO Storage Yard activities. Analyses included volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), inorganics, and cyanide. Fourteen monitoring wells were installed in overburden and bedrock (10 at Site 6 and four at Site 29). The RFI showed contamination in the DRMO Storage Yard but no apparent impact in the DRMO Impact Area from wind dispersal. Data gaps were identified during the RFI that required subsequent investigation.	NA
Onshore Ecological Risk Assessment (McLaren/Hart)	1992	Conducted for three areas at PNS including the DRMO Storage Yard to determine risks to onshore ecological receptors. Tissue and vegetation sampling and vegetation, small mammal population, and bird population surveys were conducted to support the risk assessment. The risk assessment concluded that there were no onshore ecological concerns for OU2 because there is little habitat for ecological receptors. No further evaluation of OU2 onshore ecological risks was conducted.	N00102.AR.000125

TABLE 3-1: OU2 SITE CHRONOLOGY AND DOCUMENTATION			
PRE-ROD EVENT/DOCUMENT	**DATE**	**ACTIVITIES**	**AR NUMBER**
Interim Corrective Measures at the DRMO Storage Yard (McLaren/Hart)	1993	Conducted to cover (with cap or pavement) two areas of exposed contaminated soil in the DRMO Storage Yard to minimize migration of soil contaminants via surface runoff. An impermeable interim cap was installed over the area with the highest levels of lead and other contamination, and pavement was placed in the other area. Storm water controls and concrete curbs were also installed to address stormwater runoff.	N00102.AR. 000154
RFI Data Gap Investigation	1994	The scope of the RFI Data Gap work related to OU2 was a facility-wide hydrogeologic investigation. At OU2, a deep bedrock well was installed (DW-7DB) at an existing monitoring well cluster (DW-7, DW-7B) and the three wells were sampled for analysis of VOCs, SVOCs, and inorganics. In addition to the groundwater investigation conducted at OU2, facility-wide maps were prepared for topography, bedrock surface, groundwater elevations at low and high tide, tidal influence, and salinity. The information was used as part of the evaluation of contaminant migration through groundwater.	NA
Groundwater Monitoring	1996-1997	A facility-wide groundwater monitoring program was conducted to resolve data gaps from the RFI. The purpose of the program was to present a snapshot of overall groundwater quality at PNS based on four rounds of quarterly groundwater data from monitoring wells at PNS. All except one (DW-2) of the OU2 monitoring wells were included in the monitoring program. DW-2 was found to be damaged and was not sampled. Groundwater samples were analyzed for SVOCs, pesticides, PCBs, and inorganics. The 1996 and 1997 groundwater monitoring data were used as part of contaminant fate and transport modeling and human health risk assessment for OU2. The data were also used to understand the hydrogeology at OU2.	NA
Contaminant Fate and Transport Modeling (Tetra Tech)	1996-1999	Conducted to evaluate migration of onshore contaminants to the offshore environment. Two phases of modeling were conducted, with the second phase conducted to refine the input parameters used in the first phase of modeling. The model results for OU2 were used to support initial understanding of contaminant fate and transport for OU2.	N00102.AR. 000419 and N00102.AR. 000760
Field Investigation at Site 29	1998	Conducted to define the nature and extent of contamination and support risk assessment for Site 29. Seven soil borings at Site 29 and an upgradient soil and groundwater sampling location were included in the investigation. Sample analyses included VOCs, SVOCs, pesticides, PCBs, dioxins/furans, inorganics, and cyanide.	NA
Emergency Removal Action (Shoreline Stabilization) at Site 6 (FWENC)	1999	Conducted to stabilize the shoreline along Site 6 where soil erosion was observed. Existing concrete blocks and other materials were removed, the embankment regraded with existing rock, and a shoreline stabilization structure (including geotextile and riprap) installed over the existing soil along the shoreline.	N00102.AR. 000995
Revised OU2 Risk Assessment (Tetra Tech)	2000	Calculated and evaluated human health risks for different land use scenarios for Site 6, Site 29, and the DRMO Impact Area using updated risk assessment guidance and data collected since the initial risk assessment using only RFI data.	N00102.AR. 000923 and 000924

TABLE 3-1: OU2 SITE CHRONOLOGY AND DOCUMENTATION			
PRE-ROD EVENT/DOCUMENT	DATE	ACTIVITIES	AR NUMBER
Building 298 Trenching	2002	Soil sampling conducted on the western and northern sides of Building 298 to support Shipyard utility trenching activities for the building. Eleven samples were collected from five soil borings, and analyzed for polycyclic aromatic hydrocarbons (PAHs), inorganics, and dioxins/furans. The data were used to support the nature and extent of contamination evaluation in the RI.	NA
Soil Washing Treatability Study for OU2 (Tetra Tech)	2004-2006	Large-volume soil samples were collected from five test pits in areas with highly elevated contaminant concentrations, and a soil washing treatability study was conducted on the soil samples to support evaluation of a potential treatment option as part of an FS for OU2. Three test pits were in the interim capped area, one test pit was in the waste disposal area, and one test pit was along the shoreline in the western portion of the DRMO Storage Yard. The results indicated that contamination associated with fine-grained materials could be separated from large-grained materials.	N00102.AR. 001524
Emergency Removal Action (Shoreline Stabilization) at Site 29 (Tetra Tech EC)	2005, 2006, and 2008	Conducted to stabilize the shoreline between the DRMO Storage Yard and the area west of the seawall, and east of the seawall at Site 29, where shoreline controls were not present. West of the seawall, debris on the shoreline slope was removed, the embankment regraded, and a shoreline stabilization structure similar to the 1999 structure was placed. Signs of potential failure of the shoreline controls placed in 2005 (sloughing of riprap and exposure of underlying filter fabric) were observed in 2007. In 2008, interlocking precast concrete slabs (A-Jacks) were placed at the bottom of the slope to provide additional slope stability. East of the seawall, surficial debris was removed in the wooded area and the area was covered with gravel. The area prone to erosion was stabilized with geotextile and rock.	N00102.AR. 001665 and 1670

TABLE 3-1: OU2 SITE CHRONOLOGY AND DOCUMENTATION			
PRE-ROD EVENT/DOCUMENT	DATE	ACTIVITIES	AR NUMBER
Additional Investigation	2007-2008	Conducted to refine the nature and extent of contamination for delineation of remediation areas at Sites 6 and 29 and in the portion of the DRMO Impact Area immediately adjacent to Site 6 and further evaluate contaminant migration in groundwater to the offshore. Soil, groundwater, and surface water samples were collected in 2007. The investigation of soil focused on the COCs identified in the 2000 risk assessment and included lead, copper, nickel, PAH, and PCB analyses. Antimony analysis was not included because the contamination was collocated with lead and additional antimony data were not needed. Field and laboratory-based analyses were conducted. Grid-based borings were located on 50-foot centers across Site 6 (excluding the capped area) and Site 29, and on approximate 25-foot centers where additional borings were needed to refine the extent of contamination. Surface and subsurface soil samples were collected from approximately 180 borings in the Sites 6 and 29 areas, and surface soil samples were collected from 20 hand auger locations in the portion of the DRMO Impact Area adjacent to Site 6. The groundwater and surface water investigation focused on the COCs for potential offshore impact, which are copper, lead, and nickel. Six new monitoring wells were installed, and these new and existing overburden wells were sampled. Three rounds of sampling were conducted at the 14 wells. Twelve surface water samples were also collected from the OU2 offshore area to support the groundwater evaluation. The sampling in 2008 was conducted to delineate the extent of lead- and copper-contaminated soil detected in the backyards of Quarters S and N (within the DRMO Impact Area) in 2007, where surface soil samples from approximately 100 hand auger locations were collected and analyzed for lead and copper.	NA
DRMO Impact Area Action Memorandum including Engineering Evaluation/Cost Analysis (EE/CA) (Navy)	2009	The EE/CA was prepared to compare non-time-critical removal action alternatives to address risks resulting from lead- and copper-contaminated soil at Quarters S and N within the DRMO Impact Area. The Action Memorandum documents the selection of excavation of the lead- and copper-contaminated soil to eliminate potential unacceptable human health and environmental risks.	N00102.AR. 001351

TABLE 3-1: OU2 SITE CHRONOLOGY AND DOCUMENTATION

PRE-ROD EVENT/DOCUMENT	DATE	ACTIVITIES	AR NUMBER
Supplemental RI Report (Tetra Tech)	2010	Summarized the results of previous investigations and risk assessments and updated the site characterization, nature and extent of contamination, and site risks for contaminant migration to the offshore based on the 2007/2008 Additional Investigation and shoreline removal action activities since 2005. The conclusion of the Supplemental RI Report was that the nature and extent of contamination and site risks associated with exposure to soil and groundwater at OU2 were sufficiently defined to support the FS. Lead and other COC concentrations in soil at Sites 6 and 29 indicated potential unacceptable risks if the soil would be exposed or excavated. Lead and copper concentrations in soil in the backyards of Quarters S and N indicated potential unacceptable risks. Uncertainty in the extent of contamination was identified for the area west of the DRMO that was later investigated as part of the Pre-Design Investigation. Exposure to groundwater does not pose unacceptable risks for human receptors. Contaminant fate and transport modeling and groundwater sampling at OU2 indicated that migration of groundwater to the offshore was not anticipated to cause adverse impacts based on current conditions. However, lead, copper, and nickel contamination in soil at Site 6 in the interim capped area may pose an unacceptable future risk to the offshore if the contaminants migrate to groundwater. In addition, lead, copper, and nickel contamination in soil may pose an unacceptable future risk to the offshore if these contaminants erode to the offshore area.	N00102.AR. 001743
Non-Time-Critical Removal Action for DRMO Impact Area	2010	Conducted to remove lead- and copper-contaminated soil from the DRMO Impact Area portion of OU2 to allow for unlimited use and unrestricted exposure. Post-excavation confirmation sampling confirmed that soil associated with unacceptable risks was removed.	NA
FS Report (Tetra Tech)	2011	Conducted to develop and evaluate potential cleanup alternatives for Sites 6 and 29. The types and concentrations of contaminants at Site 6 and in the western portion of Site 29 are similar; therefore, the areas were combined and referred to as the DRMO area for development of remedial alternatives. The remainder of Site 29 was evaluated as the waste disposal area. Remedial options for the DRMO Impact Area were not included in the FS Report because the 2010 removal action eliminated all unacceptable risks in this area.	N00102.AR. 002554
Proposed Plan (Navy)	2011	Presented the Navy's Preferred Alternative to address contamination at the DRMO area (Site 6 and western portion of Site 29) and waste disposal area (eastern portion of Site 29) and NFA for the DRMO Impact Area.	N00102.AR. 001689
Pre-Design Investigation	2011	Conducted to delineate the extent of soil contamination in an area west of the DRMO Storage Yard to support any remedial action selected for OU2. The results will be used as part of the remedial design to delineate remediation areas.	NA

TABLE 3-1: OU2 SITE CHRONOLOGY AND DOCUMENTATION			
PRE-ROD EVENT/DOCUMENT	DATE	ACTIVITIES	AR NUMBER
ROD (Navy)	2011	The ROD was signed in September 2011. The selected remedies for DRMO area and waste disposal area include soil excavation, soil cover (for waste disposal area), LUCs, and monitoring. NFA is the selected remedy for the DRMO Impact Area.	N00102.AR. 002620

3.2 BACKGROUND

OU2 is located in the south-central portion of PNS (see Figure 1-2). The layout of OU2 is shown on Figure 3-1, and a conceptual model of the site is shown on Figure 3-2.

Physical Characteristics

Most of Sites 6 and 29, within OU2, are located on fill material placed either in the early 1900s as part of Henderson's Point excavation or placed as part of the filling in the waste disposal area at Site 29. The DRMO Impact Area, included in OU2 because this area was thought to be impacted by particulate deposition from DRMO activities, has been a residential (military) area since before 1900.

The former DRMO Storage Yard is a fenced area south of Quarters S and N and west of Building 298. The DRMO was responsible for the reuse, transfer, donation, sale, or disposal of excess and surplus DoD property in New England until 2010. DRMO storage operations were conducted in the paved portion of the fenced area; the area that was capped in 1993 is covered with grass and barricaded from use for any activities. The DRMO storage operations used temporary trailers and buildings. Building 348, located west of the former DRMO Storage Yard, was built in the 1990s as a paper shredder and is currently used for equipment storage. Two buildings are located in the Site 29 area; Building 298 is used for office space, and Building 310 is the hose handling facility. There are no hazardous waste-related activities, and hazardous chemicals are not used as part of any of the current site operations.

Site 6 and much of Site 29 (in the area filled in the early 1900s as part of Henderson's Point excavation), consists of angular rock fragments overlain by general fill material composed of sand and gravel with minor amounts of wood and metal debris and cinders. In the remaining filled area of OU2 (waste disposal area), sand, gravel, and silt overlie waste fill that includes cinders, ash, plastic, glass, wire, and other waste materials. Fill thickness generally ranges from approximately 6 feet to 23 feet; however, maximum fill thickness is approximately 40 feet (along the shoreline in the waste disposal area).

OU2 is located along the Piscataqua River, and the shoreline along OU2 is steeply sloped and has erosion controls (riprap and a seawall). Riprap was placed along portions of the shoreline in 1999, 2005,

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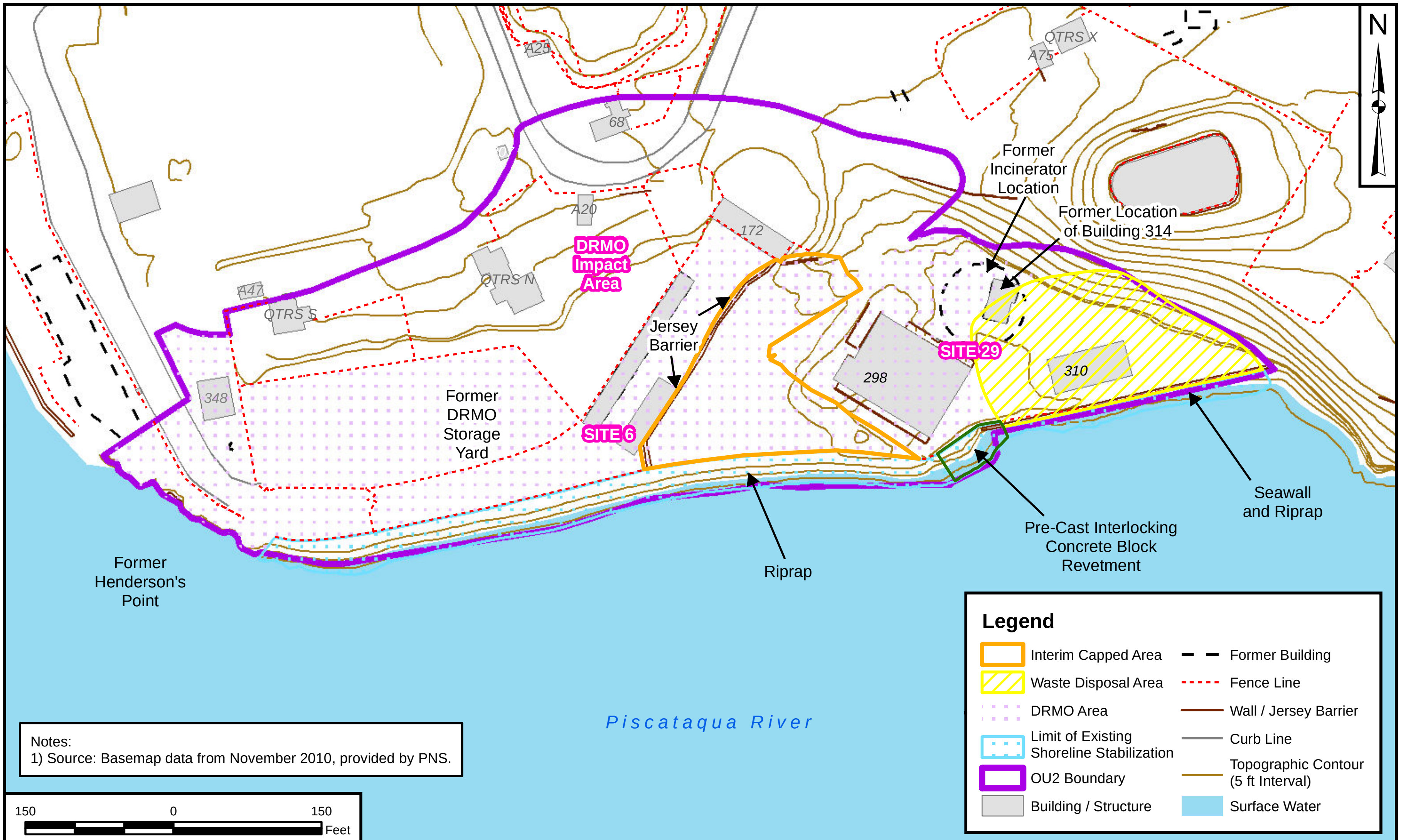
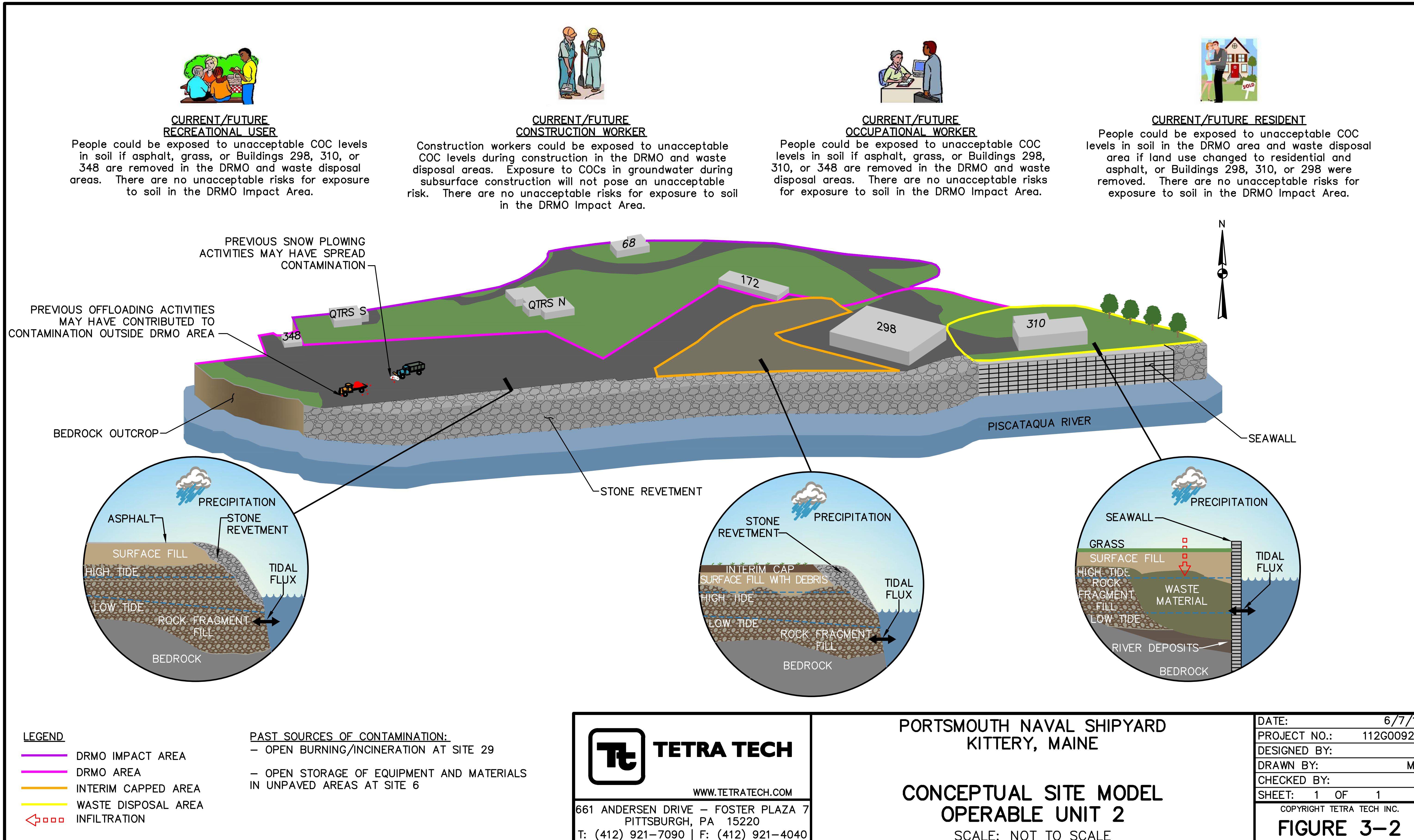


DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
J. ENGLISH	11/04/11		2103	WE14
CHECKED BY	DATE	OU2 LAYOUT MAP	APPROVED BY	DATE
M. BOERIO	04/19/12	SECOND FIVE-YEAR REVIEW REPORT	—	—
REVISED BY	DATE	PORTSMOUTH NAVAL SHIPYARD	APPROVED BY	DATE
J. NOVAK	04/19/12	KITTERY, MAINE	—	—
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE 3-1	0



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2006, and 2008. The OU2 shoreline is difficult and dangerous to access because of strong river currents and the steep embankment from onshore to the river. There is a small intertidal sediment area adjacent to the OU2 eastern shoreline where there is potential ecological exposure to sediment. The offshore area of OU2 is part of the DRMO Storage Yard AOC that was investigated as part of the EERA (NCCOSC, May 2000) and is part of more recent interim offshore sampling at monitoring station MS-11. The sediment sampling location (Location 3) at MS-11 is in the small intertidal area. The offshore area is discussed as part of OU4 in Section 5.0 and shown on Figure 5-1.

Land and Resource Use

Sites 6 and 29 are and have been industrial/commercial areas. In 2010, DRMO Storage Yard activities were moved to another location, and a portion of the former area is used now for Shipyard contractor's trailer parking. The remaining portion of the former DRMO Storage Yard is not in use; however, the Shipyard plans to use the property for industrial activities. Buildings 298 and 310 were built in 1975 and around 1980, respectively, and are used for industrial/commercial activities (office space and hose handling facility, respectively). The DRMO Impact Area is used for military residences.

OU2 has little natural area that could provide habitat for onshore ecological receptors. Groundwater at OU2 is tidally influenced, is brackish or saline, and is not used as a potable water supply.

History of Contamination

After Site 6 and the majority of Site 29 were filled in the early 1900s, the area was used for DRMO operations from approximately 1920 until 2010. Materials reportedly stored at the DRMO included lead and nickel-cadmium battery elements, motors, typewriters, paper products, and scrap metal. The lead battery cells and plates and nickel-cadmium batteries were stockpiled on uncovered pallets. It is thought that historical DRMO operations occurred primarily in the current fenced area of the DRMO, but operations could have occurred in areas directly adjacent to the DRMO. Open storage of batteries and other materials that could have resulted in releases of contaminants was discontinued in approximately 1983. In 1993, interim corrective measures were conducted for a portion of DRMO and included capping and paving, installation of storm water controls, and installation of a new concrete curb (McLaren/Hart, April 1993).

The main activities at Site 29 were related to open burning, waste disposal, and industrial incineration. Filling of the remaining portion of OU2 may have begun in the 1920s. This area was apparently filled with paper, wood, rubbish, and ash and is referred to as the waste disposal area. The ash is reportedly from open burning of trash that was conducted in the waste disposal area from approximately 1918 until 1965, when the teepee incinerator was built. Ash from the teepee incinerator was also disposed of in the waste disposal area. Onsite disposal ended between 1975 and 1979 when trash began being taken off yard for disposal. Materials identified in soil borings located in the waste disposal area are generally consistent with the background information and include ash, cinders, wire, glass, wood, and metal pieces. Asbestos was also found during excavation of the Building 310 foundation, which is located over the waste disposal area.

The teepee incinerator was built in 1965 and was used to burn waste material until 1975. The teepee incinerator (Building 290) was used primarily for disposal of wood, paper, and rubbish, with occasional burning of cans of paint and solvents. Ash from the incinerator was deposited south of the incinerator until 1971 when the residue began to be landfilled in the JILF (at OU3, located approximately 1,000 feet northeast of OU2) and the Kittery municipal landfill. The incinerator was apparently demolished soon after operations ended in 1975.

Initial Response

Activities that resulted in contaminant releases in the DRMO area were discontinued in approximately 1983. Filling in the waste disposal area ended between 1975 and 1979. As provided in Section 3.1, an Interim Corrective Measure to cover contaminated material was conducted in the DRMO Storage Yard in 1993 and shoreline stabilization actions were conducted in 1999, 2005, 2006, and 2008.

In 2010, the Navy conducted a removal action for the DRMO Impact Area to remove lead- and copper-contaminated soil from the backyards of Quarters S and N, adjacent to the DRMO Storage Yard. The removal action included excavation of contaminated soil, offsite disposal, and site restoration. The soil excavation eliminated potential unacceptable risks from OU2 contamination in the DRMO Impact Area. Site restoration activities were completed in spring 2011, and a Construction Completion Report is being prepared. The residual risks calculated for the OU2 ROD showed that residual lead and copper concentrations in Quarters S and N were at acceptable levels. Five-year reviews are not required for the DRMO Impact Area because contamination has been removed to allow for unlimited use and unrestricted exposure. The removal action included soil excavation up to the DRMO Storage Yard fence, in the southernmost portion of the backyards of Quarters S and N. Confirmation samples collected under the fence showed lead contamination may remain under the fence. A geotextile separates the clean soil placed during the removal action and this remaining contamination. The contamination is within the DRMO area and will be addressed as part of the remedial action for the DRMO area.

Basis for Taking Action

As provided in Section 3.1, lead and other COC concentrations in soil in the DRMO and waste disposal areas are at levels that result in potential unacceptable risks for current and potential future human receptors at OU2. Exposure to groundwater does not pose unacceptable risks for human receptors, and groundwater is not a source of contamination to the offshore area based on current conditions. Lead, copper, and nickel contamination in soil in the capped area in the DRMO area may pose an unacceptable future risk to the offshore if the contaminants migrate to groundwater. In addition, lead, copper, and nickel contamination in soil may pose an unacceptable future risk to the offshore if these contaminants erode to the offshore area.

3.3 REMEDIAL ACTIONS

The remedies selected for OU2 are documented in the OU2 ROD (Navy, September 2011). The remedial actions for Sites 6 and 29 have not yet been implemented. NFA is the selected remedy for the DRMO Impact Area. Remedy selection is summarized in Section 3.3.1, and remedy implementation activities are discussed in Section 3.3.2.

3.3.1 Remedy Selection

Table 3-2 presents a summary of the identified risks at OU2, the RAO established in the ROD to address each risk, the remedy component that will be conducted to meet each RAO, the metric and cleanup level considered, and the expected outcome of the implemented remedy component.

Results of site investigations indicated that antimony, copper, lead, nickel, PAHs, and PCBs are present in Sites 6 and 29 surface and subsurface soil at potentially unacceptable concentrations. The risk-based cleanup levels for Sites 6 and 29 are based on average exposure concentrations in soil, with consideration given to current and potential future land uses of the sites.

TABLE 3-2

SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU2
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PAGE 1 OF 5

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
WASTE DISPOSAL AREA				
Potential unacceptable risks to human health from exposure to contaminated material.	Prevent human exposure through ingestion, dust inhalation, and dermal contact with contaminated soil with COC concentrations that exceed cleanup levels.	Excavation of surface soil and debris (to 2 feet bgs) within the proposed soil cover limits and adjacent debris areas and construction of a soil cover to reduce risks to acceptable levels for current industrial (construction and occupational) workers and future recreational users.	All surface material (to 2 feet bgs) within the planned soil cover limits will be removed and a 2-foot-thick soil cover will be placed over the area. Excavation in the adjacent debris areas will be conducted until all of the debris has been removed. Confirmation soil samples will be collected from the exposed ground surface and sidewalls, where soil is present, of any excavation that is outside of the proposed cover system to determine whether COC concentrations greater than construction worker cleanup levels remain, in accordance with the evaluation method specified in the Remedial Action Work Plan.	Removal of surface material, placement and long-term management of soil cover, and implementation of LUCs will prevent unacceptable current and future exposure to contaminated material with COC concentrations that exceed cleanup levels. COC concentrations are not anticipated to attenuate, and it is expected that they will exceed cleanup levels for the foreseeable future. Building 310 (which covers potentially contaminated soil beneath the building footprint) will be surrounded by the soil cover area; therefore, the building and soil cover will be included as part of the LUCs unless additional action is undertaken to prevent exposure to contamination remaining under these features.
		Implementation of LUCs to provide requirements to ensure that site features integral to the remedy are present to prevent exposure to underlying contaminated material and to restrict residential use of the site.	Maintain LUCs into foreseeable future and confirm protectiveness during periodic inspections and five-year reviews as long as average concentrations of COCs in soil exceed cleanup levels for residential use.	

TABLE 3-2

**SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU2
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PAGE 2 OF 5**

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
Potential future unacceptable offshore risks to ecological receptors from erosion of contaminated material.	Protect the offshore environment from erosion of contaminated soil from the OU2 shoreline.	Implementation of LUCs to ensure that site features integral to the remedy are present to minimize erosion. Sediment accumulation monitoring will provide confidence that contamination is not eroding to the offshore area.	Maintain LUCs into the foreseeable future and confirm protectiveness during periodic inspections and five-year reviews as long as average concentrations of COCs in soil exceed cleanup levels for residential use. Although there is not a current risk because shoreline controls prevent erosion and the fast current of the Piscataqua River prevents sediment accumulation offshore of OU2, post-remedial monitoring will be conducted in accordance with a monitoring plan that will be prepared as part of the remedy. The plan will provide frequency of monitoring, how to determine whether sediment is accumulating, and what actions would be taken.	Implementation of LUCs to ensure that site features are present to minimize erosion will protect the offshore environment from erosion. Sediment accumulation monitoring will provide an evaluation method to ensure that sediment is not accumulating in the area offshore of OU2 that could result in potential future unacceptable ecological risks to the offshore.

TABLE 3-2

SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU2
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PAGE 3 OF 5

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
DRMO AREA				
Unacceptable risks to human health from exposure to contaminated material.	Prevent human exposure through ingestion, dust inhalation, and dermal contact with contaminated soil with COC concentrations that exceed cleanup levels.	Excavation of soil will reduce risks to acceptable levels for industrial (occupational and construction) workers and future recreational users.	Excavation will consist of removal of contaminated soil associated with potentially unacceptable construction worker risk. The initial excavation area will be delineated based on lead concentrations exceeding 4,000 mg/kg and will include the portion on the western side of the DRMO area as necessary. Excavation of lead concentrations in excess of 4,000 mg/kg will result in post-remedial average exposure concentrations (i.e., EPCs) that are less than construction worker, occupational worker, and recreational user cleanup levels (2,000, 1,600 and 4,600 mg/kg, respectively). Excavation of contaminated soil will extend to a depth where there is very little soil and mostly rock (i.e., the rock fragment fill layer) or where contaminant concentrations are at acceptable levels for industrial land use. Pre-design investigation data will be used to refine the western limits of the excavation area for the DRMO area as part of the RD.	Excavation of contaminated soil based on lead concentrations exceeding 4,000 mg/kg will reduce all COC concentrations to less than cleanup levels for industrial workers and future recreational users and will reduce all COC concentrations except for lead to less than the cleanup levels for future residential users. It is anticipated that the lead concentration in the DRMO area will still exceed the residential cleanup levels of 400 mg/kg and will not attenuate to less than the cleanup level in the foreseeable future. Potentially contaminated soil may be present under Buildings 298 and 348; therefore, the buildings will be included as part of the LUCs unless additional action is

TABLE 3-2

SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU2
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
		Implementation of LUCs to ensure that site features integral to the remedy are present to prevent exposure to underlying contaminated material (beneath Buildings 298 and 348) and to restrict residential use of the site.	Maintain LUCs into foreseeable future and confirm protectiveness during periodic inspections and five-year reviews as long as average concentrations of COCs in soil exceed cleanup levels for residential use.	undertaken to prevent exposure to contamination remaining under these buildings.
Potential future unacceptable offshore risks to ecological receptors from erosion of contaminated soil.	Protect the offshore environment from erosion of contaminated soil from the OU2 shoreline.	Implementation of LUCs to provide requirements to ensure that site features integral to the remedy are present to minimize erosion. Sediment accumulation monitoring will provide confidence that contamination is not eroding to the offshore area.	Maintain LUCs into foreseeable future and confirm protectiveness during periodic inspections and five-year reviews as long as average concentrations of COCs in soil exceed cleanup levels for residential use. Although there is not a current risk because shoreline controls prevent erosion and the fast current of the Piscataqua River prevents sediment accumulation offshore of OU2, post-remedial monitoring will be conducted in accordance with a monitoring plan that will be prepared as part of the remedy. The plan will provide frequency of monitoring, how to determine whether sediment is accumulating, and what actions would be taken.	Implementation of LUCs to ensure that site features are present to minimize erosion will protect the offshore environment from erosion. Sediment accumulation monitoring will provide an evaluation method to ensure that sediment is not accumulating in the area offshore of OU2 that could result in potential future unacceptable ecological risks to the offshore.

TABLE 3-2

**SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU2
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PAGE 5 OF 5**

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
Potential future unacceptable risks to ecological receptors and human health from groundwater migration.	Prevent unacceptable risk from future potential migration of copper, lead, and nickel from unsaturated zone soil in the capped area at Site 6 to groundwater.	Contaminated soil in the unsaturated zone in the capped area is in the excavation area.	Excavation in the capped area will extend to the top of the rock fragment fill layer or where contaminant concentrations are at acceptable industrial. Although groundwater concentrations are at acceptable levels based on current conditions, post-remedial groundwater monitoring will be conducted to provide confidence that copper, lead, and nickel do not migrate to groundwater at unacceptable levels. As part of a long-term management plan, a groundwater monitoring plan will be prepared that will provide the requirements for monitoring, including sampling frequency, locations of wells, action levels, and monitoring exit strategy.	Contaminated soil that could potentially migrate to groundwater will be removed, and groundwater monitoring will provide confidence that groundwater has not been adversely impacted.

TABLE 3-3: OU2 SOIL CLEANUP LEVELS

COC	Construction Worker (mg/kg)	Occupational Worker (mg/kg)	Recreational User (mg/kg)	Resident (mg/kg)	Basis
Antimony	516	681	3,930	73	Site-specific risk based, HI = 1
Copper	--	--	--	7,300	Site-specific risk based, HI = 1
Lead	2,000	1,600	4,600	400	Residential is based on OSWER soil screening level; others are site-specific risk based.
Nickel	--	--	--	3,650	Site-specific risk based, HI = 1
PAHs (evaluated as benzo(a)pyrene equivalents)	--	2	5	0.7	Site-specific risk based, cancer goal less than 5 x 10^{-6}
PCBs (total)	--	6	34	1	Site-specific risk based, cancer goal less than 5 x 10^{-6}

-- Existing concentrations did not result in unacceptable risk for this receptor.

The major components of the selected remedy for the waste disposal area are as follows:

- Excavation of soil and waste material from 0 to 2 feet below ground surface (bgs) within the waste disposal area and disposal of excavated soil in an off-yard landfill.

- Excavation from 0 to 2 feet bgs and off-yard disposal of soil and waste material in the debris area adjacent to the waste disposal area.

- Construction of a 2-foot-thick soil cover over the area where waste material remains below 2 feet bgs. The cover will consist of a geotextile, common fill, topsoil, and in some locations pavement. Excavation of soil from 0 to 2 feet bgs within the waste disposal area before placement of the cover will reduce the impact to final site elevations, thereby reducing the impact to site operations.

- Implementation of LUCs via a LUC RD to require the continued presence of site features to prevent erosion, to require maintenance of the soil cover, to restrict unauthorized digging within the proposed soil cover limits, to identify inspection requirements, to establish signage requirements, to restrict residential land use, and to document responsible parties.

- Groundwater monitoring to provide confidence that copper, lead, and nickel in waste material does not migrate to groundwater at unacceptable levels.

- Sediment accumulation monitoring to provide confidence that contaminated material does not erode and migrate to the offshore area and accumulate in the intertidal area immediately east of Site 29 (where there is potential ecological exposure to sediment).

- Five-year site reviews to ensure that the remedy remains protective of human health and the environment.

The selected remedy for the waste disposal area removes contamination in the top 2 feet of soil and provides a physical barrier to prevent potential industrial and recreational exposure to underlying contamination. LUCs will prevent residential site use. The selected remedy for the waste disposal area is expected to achieve substantial long-term risk reduction and allow the property to be used for the current and reasonably anticipated future land use, which is industrial.

The major components of the selected remedy for the DRMO area are as follows:

- Excavation and off-yard disposal of soil associated with potentially unacceptable risks to construction workers. Excavation based on construction worker exposure will also address potential unacceptable risks for occupational and hypothetical recreational exposure. Excavation of contaminated soil will extend to a depth where there is very little soil and mostly rock (i.e., the rock fragment fill layer) or where contaminant concentrations are at acceptable levels for industrial land use.

- Restoring excavated areas to establish pre-construction grades, elevations, and surface types using clean soil and pavement, where necessary.

- Implementing LUCs via a LUC RD to require the continued presence of site features to minimize erosion, to prevent exposure to soil beneath Building 298 for all receptors, to restrict residential land use, to identify inspection requirements, to establish signage requirements, and to document responsible parties.

- Groundwater monitoring to provide confidence that copper, lead, and nickel contamination does not migrate to groundwater at unacceptable levels.

- Sediment accumulation monitoring to provide confidence that contaminated soil does not erode and migrate to the offshore area and accumulate in a potential sediment accumulation area offshore of

OU2 (an intertidal area immediately east of Site 29 where there is potential ecological exposure to sediment).

- Five-year site reviews to ensure that the remedy remains protective of human health and the environment.

The selected remedy for the DRMO area removes contaminated soil associated with potentially unacceptable industrial and recreational risks in the DRMO area and implements LUCs to prevent all future exposure to contaminated soil beneath buildings in the DRMO area and to prevent residential exposure to contaminated soil in the remainder of the DRMO area. The selected remedy for the DRMO area is expected to achieve substantial long-term risk reduction and allow the property to be used for the current and reasonably anticipated future land use, which is industrial.

3.3.2 Remedy Implementation

The remedies selected in the ROD for Sites 6 and 29 have not yet been implemented. An RD for the waste disposal area and the DRMO area will be completed, and remedy implementation will follow. Pre-design sampling has been completed and the results (Tetra Tech, July 2011a) are being used with the goals of defining the western limit of soil contamination, conducting a wetlands functional value and habitat assessment of the OU2 intertidal zone, and conducting topographic mapping of OU2 to support the RD. Groundwater monitoring and sediment accumulation monitoring are also a component of the remedies and will be conducted to ensure that contamination is not migrating via erosion to the offshore area. A post-remediation monitoring plan will be prepared as part of remedy implementation.

A LUC RD is being prepared that will present the LUC objectives and implementation actions to be completed to ensure that LUCs are in place as specified in the ROD. The LUC objectives are as follows:

- To prohibit residential reuse of the site unless additional action is undertaken to prevent residential exposure to contamination. Prohibited residential uses shall include, but are not limited to, any form of housing, child-care facilities, pre-schools, elementary schools, secondary schools, playgrounds, convalescent, or nursing care facilities.

- To maintain current site features including Building 310, installed soil cover, and shoreline stabilization features in the waste disposal area and Buildings 298 and 348 and the shoreline features in the DRMO area unless additional action is undertaken to prevent exposure to contamination in the waste disposal area, under buildings, or to prevent erosion from the waste disposal and DRMO areas.

- To institute dig restrictions and provide requirements for proper management of excavated soil as part of any future construction and maintenance activities at the waste disposal area. Signage would be used as needed to alert the public to the presence of contamination and dig restrictions.

- To provide requirements for proper management of excavated soil from the DRMO area as part of any future construction or maintenance activities.

The anticipated LUC area is shown on Figure 3-3.

3.4 PROGRESS SINCE LAST FIVE-YEAR REVIEW

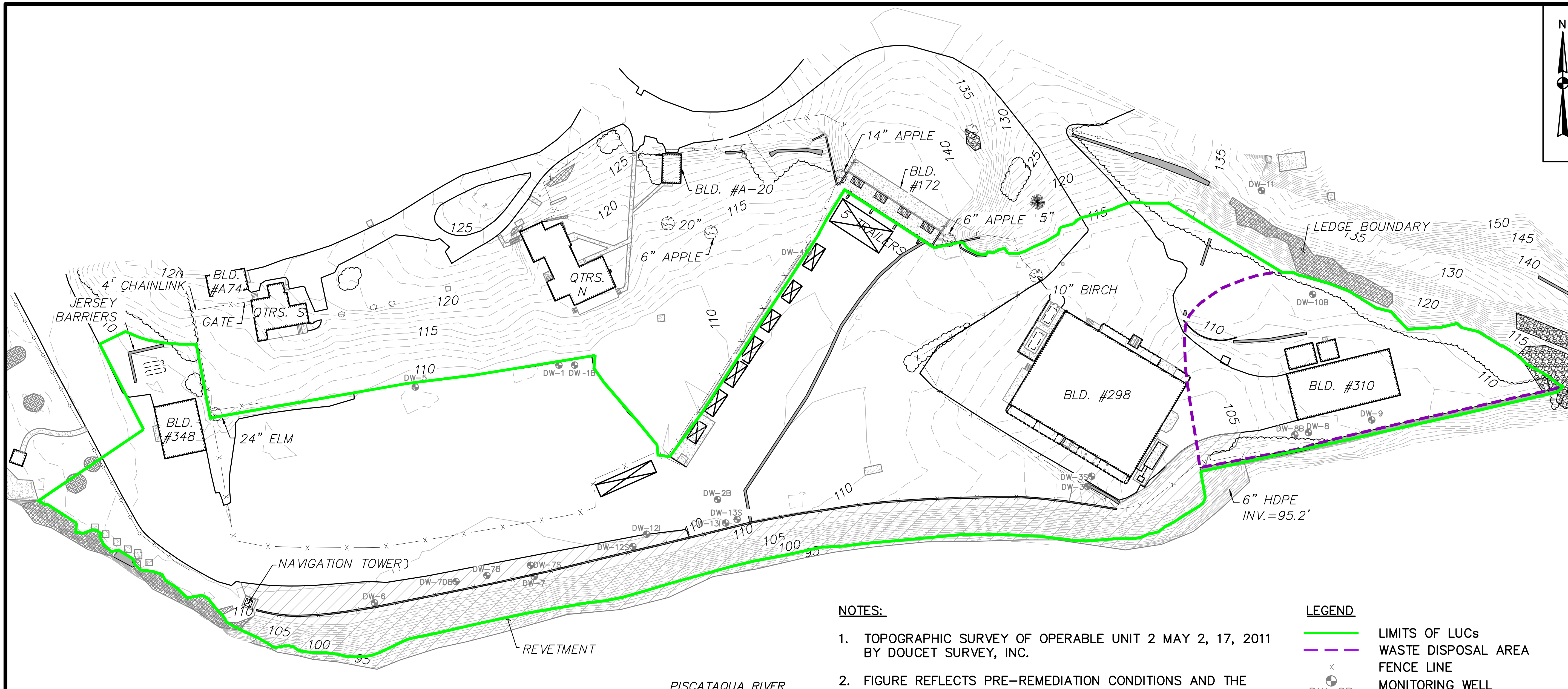
The table below indicates the status of the recommendations made during the first five-year review for OU2.

TABLE 3-4: STATUS OF RECOMMENDATIONS FOR OU2

Recommendation from First Five-Year Review	Status
Complete RI/FS	Supplemental RI finalized March 2010 FS finalized April 2011
Complete PRAP/ROD	PRAP finalized July 2011 ROD finalized September 2011
Maintenance items • Wells should be checked and repaired as needed. • Additional rip-rap should be placed over the fabric in the eastern portion of Site 29 to completely cover it (particularly by the shoreline).	• Wells were inspected and necessary repairs were made as part of the OU2 Additional Investigation in 2007, as discussed in the OU2 Additional Investigation Data Package (Tetra Tech, August 2008) • Additional rip-rap was placed in 2008. Fabric is completely covered by rip-rap.
Continue to enforce the Shipyard excavation policy	The excavation policy remains in place and will be included as part of the LUC RD.

3.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.



NOTES:

1. TOPOGRAPHIC SURVEY OF OPERABLE UNIT 2 MAY 2, 17, 2011 BY DOUCET SURVEY, INC.
2. FIGURE REFLECTS PRE–REMEDIATION CONDITIONS AND THE FIGURE WILL BE UPDATED AFTER CONSTRUCTION. THE SOIL COVER, WARNING SIGNS, AND AS–BUILT FEATURES WILL BE ADDED AFTER CONSTRUCTION. (COORDINATES WILL BE ADDED POST–CONSTRUCTION)
3. THE DRMO AREA IS THE LUC BOUNDARY MINUS THE WASTE DISPOSAL AREA.
4. ELEVATIONS IN PNS 2002 VERTICAL DATUM (FEET)

LEGEND

- LIMITS OF LUCs
- WASTE DISPOSAL AREA
- FENCE LINE
- DW–8B MONITORING WELL

0 80 160

SCALE: 1" = 80'

DRAWN BY MF DATE 12–22–11 CHECKED BY NJB DATE 12/22/11 REVISED BY DATE SCALE 1"=80'	TETRA TECH	OU2 LAND USE CONTROL AREA MAP SECOND FIVE–YEAR REVIEW REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	CONTRACT NO. 2103 OWNER NO. WE14 APPROVED BY DATE DRAWING NO. FIGURE 3–3 REV. 0

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3.5.1 Document and Data Review

The following OU2 documents were reviewed for the Second Five-Year Review:

- Supplemental RI Report (Tetra Tech, March 2010)
- Removal Action Work Plan for DRMO Impact Area (Shaw, May 2010)
- Pre-Design Investigation SAP (Tetra Tech, November 2010b)
- Pre-Design Investigation Data Package (Tetra Tech, July 2011a)
- FS (Tetra Tech, April 2011a)
- PRAP (Navy, July 2011)
- ROD (Navy, September 2011)

In the past 5 years, the RI, FS, PRAP, and ROD were finalized, and documents are being prepared to detail the steps and requirements for implementing the selected remedial actions. The OU2 ROD presents the selected remedies, as discussed in Section 3.3. The pre-design investigation in the western portion of OU2 included sampling to delineate potential lead contamination from the DRMO Storage Yard. The investigation was conducted in April 2011, and the data are being used as part of the RD to delineate excavation and LUC boundaries in this area. An RD, LUC RD, and monitoring plan for groundwater and sediment accumulation will be prepared.

3.5.2 ARAR and Site-Specific Action Level Changes

The ROD was signed on September 29, 2011, and no actions have been initiated. ARARs and TBCs were reviewed to determine whether there have been changes since the ROD was issued, and there have been no changes since the September 29, 2011 signature date. ARARs tables from the OU2 ROD are provided in Appendix C.2. Action levels for soil excavation will be provided in the RD and RAWP. Action levels for groundwater and sediment accumulation monitoring will be provided in the monitoring plan.

3.5.3 Site Inspection

OU2 was visually inspected on August 10, 2011. The inspection was performed by Tetra Tech personnel escorted by Shipyard personnel who took photographs. No conditions presenting an immediate threat or unacceptable risk were observed. No exposed soil was observed in the DRMO area. The paved parking area was being used at the time of the inspection for storage by the contractor supporting the removal action at Site 30. The cap area near the eastern side at Site 6 was not being used. The fencing was down in some areas, and there were some small areas where wooden pallets and wire spools were being stored.

The inspection showed no change in land use at Site 29 since signature of the ROD. The asphalt in the area had some shallow potholes. Also, some operation equipment was in a laydown area by the entrance to Building 310.

Photographs of the inspected areas were taken by Shipyard personnel, and photographs of the shoreline were taken by Tetra Tech during sampling activities for OU4 in 2011. The photographs are provided in Appendix B.

3.5.4 Site Interviews

No interviews were conducted as part of the Second Five-Year Review.

3.6 TECHNICAL ASSESSMENT

Contaminated soil within the DRMO Impact Area (adjacent to the DRMO Storage Yard) was removed in 2010, thereby eliminating potentially unacceptable risks from exposure to contamination in this portion of OU2. Therefore, further action is not required to protect human health and the environment in the DRMO Impact Area. This area will be removed from OU2 and will not be included in future five-year reviews.

The ROD identified that the western limits of the DRMO area is completely defined and that the pre-design investigation data will be used to refine the limits of the excavation area in the pre-design investigation area. The RD will reflect any changes in excavation areas based on pre-design investigation results. The excavation restriction policy in place at PNS ensures current protectiveness in the period before the final remedies are implemented.

The final remedies have been selected but have not yet been implemented for Sites 6 and 29; therefore the implementation of the remedy cannot yet be evaluated.

3.7 ISSUES

Final remedies have not been implemented for Site 6 and 29; therefore, deficiencies cannot be determined at this time.

3.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No issues were identified; therefore, no recommendations or actions are needed to address issues.

3.9 PROTECTIVENESS STATEMENT

The remedies at Sites 6 and 29 have not yet been implemented. The results of investigations and removal/interim actions for Sites 6 and 29 do not indicate any imminent threats to human health or the environment under current land use scenarios. The primary use of Sites 6 and 29 is industrial, the future planned land use is anticipated to remain the same, and much of the area is capped or paved. Current site conditions and Shipyard policies provide for protection of human health and the environment until the final remedies are implemented.

The removal action for DRMO Impact Area has been completed, and further action it not required to protect human health and the environment. The DRMO Impact Area is available for unlimited use and unrestricted exposure.

4.0 OPERABLE UNIT 3

OU3 consists of Site 8 - JILF, Site 9 - Former Mercury Burial (MB) Sites (MBI and MBII), and Site 11 - Former Waste Oil Tanks Nos. 6 and 7. The OU3 ROD was signed in 2001, and Explanation of Significant Differences (ESDs) were prepared in 2003 and 2005 to modify the remedy. Based on the initiation of remedial activities at OU3 in June 2002, the First Five-Year Review Report for PNS was submitted in June 2007 (Tetra Tech). Five-year reviews of OU3 are required by statute because hazardous substances, pollutants, or contaminants remain that do not allow for unlimited use and unrestricted exposure.

4.1 SITE CHRONOLOGY

The following table provides the site chronology for pre-ROD and post-ROD activities and includes a brief summary of the activities at OU3.

TABLE 4-1: OU3 PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION

PRE-ROD INVESTIGATION	DATE	ACTIVITIES	AR NUMBER
FCS, RFI, RFI Data Gap Investigation, Groundwater and Seep and Sediment Monitoring	1984 to 1997	Environmental samples were collected at Sites 8, 9, and 11 as part of various investigations and the data were used as part of the evaluation of nature and extent of contamination and human health risks for OU3. Investigations began with the FCS in 1984. From 1989 to 1992, as part of the RFI, surface and subsurface soil, groundwater (bailer sampling method), and seep samples were collected from the sites within OU3. During the RFI Data Gap investigation conducted in 1994, hydrogeology and tidal influences were further investigated. In 1996/1997, four rounds of groundwater monitoring (using low-flow sampling method) were conducted for the OU3 monitoring wells, and four rounds of seep and sediment monitoring were conducted from locations in the OU3 intertidal area.	NA
Onshore Ecological Risk Assessment (McLaren/Hart)	1992	Conducted for three areas at PNS including the JILF to determine risks to onshore ecological receptors. Specific activities included vegetation population survey, vegetation tissue sampling, small mammal population survey, rodent tissue sampling, and bird population survey. The assessment concluded that the ecological habitat and communities present were representative of disturbed settings. The vegetation observed at the JILF did not appear to be stressed and was considered representative of that typically found in a natural field in primary succession. In summary, no onshore ecological risks were attributed to the JILF.	N00102.AR. 000125

TABLE 4-1: OU3 PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION			
PRE-ROD INVESTIGATION	DATE	ACTIVITIES	AR NUMBER
Geophysical survey and test pitting investigation	1998 to 2000	Geophysical surveying was conducted in 1998 to determine whether there were buried metallic objects in the landfill. Test pitting within portions of the JILF was conducted in 2000 at 25 locations selected based on survey results to investigate the possibility of the presence of a large number (nearly 10,000) of 55-gallon (or similar capacity) drums reportedly buried above the water table in the landfill between 1945 and 1965. Forty-one drums containing non-hazardous material were located, and 40 of these drums were removed from one location and disposed of offsite and one of these drums, containing a Portland cement-type material, from another location was replaced in the landfill. Subsurface soil samples were collected as part of the investigation and used to support the understanding of the nature and extent of contamination.	NA
Removal action for Site 9 (Halliburton NUS and FWENC)	1994 to 2000	The MBI and MBII consisted of poured concrete blocks and a precast concrete pipe (also referred to as concrete vaults) containing mercury-contaminated wastes that were reportedly buried between 1973 and 1975 at two locations. The concrete vaults at MBI and MBII have been removed (portions of MBI in 1994 and the rest in 1997 and MBII in 2000). All the contents of MBI and MBII were disposed of properly at a licensed offsite disposal facility, and no exceedances of regulatory criteria for mercury were found in the excavated soil. The area was backfilled and seeded.	N00102.AR. 000328, N00102.AR. 000471, and N00102.AR. 000797
Contaminant Fate and Transport Modeling (Tetra Tech)	1996-1999	Conducted to evaluate migration of onshore contaminants to the offshore environment. Two phases of modeling were conducted, with the second phase conducted to refine the input parameters used in the first phase. Model results were used to support initial understanding of contaminant fate and transport at OU3.	N00102.AR. 000419 and N00102.AR. 000760
Revised OU3 Risk Assessment (Tetra Tech)	2000	Calculated and evaluated human health risks for different land use scenarios for Sites 8, 9, and 11 using data collected since the initial risk assessment using only RFI data. OU3 media (soil/fill material and groundwater) were evaluated for onshore exposure (human health and ecological). Risks were acceptable for human exposure to brackish/saline groundwater at OU3 (based on construction worker exposure scenario); therefore, no COCs were identified for brackish/saline groundwater for source control. Onshore ecological risks were acceptable; therefore, no COCs were identified for onshore ecological exposure. Potentially unacceptable risks for all site users were identified for soil/fill material COCs including PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene), arsenic, and lead. Potentially unacceptable risks were identified for fresh groundwater, and the COCs identified were antimony, arsenic, benzene, cadmium, lead, nickel, and thallium.	N00102.AR. 000835
OU3 FS (Tetra Tech)	2000	Conducted to develop and evaluate potential cleanup alternatives to address exposure to materials within the JILF boundary. Because future residential exposure to drinking water (fresh water) is a highly unlikely scenario (most of the groundwater at OU3 is brackish or saline), active remediation of groundwater was not evaluated.	N00102.AR. 000922

TABLE 4-1: OU3 PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION

PRE-ROD INVESTIGATION	DATE	ACTIVITIES	AR NUMBER
OU3 ROD (Navy)	2001	The ROD was signed in August 2001. The selected remedy included installation of a hazardous waste landfill cover and implementation of LUCs, erosion controls, and monitoring.	N00102.AR. 001018
POST-ROD INVESTIGATION	**DATE**	**ACTIVITIES**	**AR NUMBER**
OU3 RD (US Army)	2002	Phase I of the RD included excavation of the landfill adjacent to Jamaica Cove and consolidation within other portions of the landfill, and construction of a salt marsh wetland within the excavated area. Phase II of the RD included landfill cover construction.	N00102.PF. 001139, 001143, 001149, and 001195
OU3 ESD (Navy)	2003 and 2005	An ESD was signed in September 2003 and described excavation and consolidation of material within the limits of the JILF, which was completed in 2002, and construction of a wetland within the excavated area, which was completed in 2003. Landfill cover construction was completed in September 2004. A second ESD was issued in October 2005 to recombine management of groundwater migration (formerly OU6) with the source control remedy (OU3).	N00102.PF. 001293 and 001493
Remedial Action Construction Report (Tetra Tech EC)	2006	Remedy construction was conducted from June 2002 to 2004. The remedial action construction report documents the remedy construction activities.	N00102.PF. 001561
Post-Remedial OM&M Plan (Tetra Tech)	2006	Provides the OM&M program for OU3, which includes groundwater and landfill gas monitoring, landfill inspections, and maintenance. The program was initiated in 2006 and is discussed further in Section 4.3.	N00102.PF. 001566 and 001567
OU3 Rounds 1 through 4 Data Evaluation Report (Tetra Tech)	2009	Provides the evaluation of Rounds 1 through 4 data to determine an appropriate reduction in the groundwater analytical program. Based on the report conclusions, the program was reduced to analysis of PAHs and metals after Round 5.	N00102.PF. 00910
OU3 Rounds 1 through 9 Data Evaluation Report (Tetra Tech)	2011	Provides the evaluation of Rounds 1 through 9 data and provides recommendations for modification to the OM&M program after Round 9.	N00102.PF. 002563
OU3 LUC RD (Navy)	2011	Provides the RD for LUCs for OU3. The LUC objectives are to: • Maintain the landfill cover to prevent human exposure to contaminated soils and/or waste within the landfill. • Prevent the use of groundwater as a potable water source. • Maintain shoreline erosion control measures abutting the boundary of the landfill with the Piscataqua River or the Back Channel. • Provide for continued uses of the landfill that are consistent with the remedy to include, but not be limited to, organized and unorganized sports, equipment storage, and parking.	N00102.PF. 002574
Updated (Revision 1) Post-Remedial OM&M Plan (Tetra Tech)	2011	Provides the updated OM&M program for OU3 based on the Rounds 1 through 9 data evaluation. The updated program was initiated in Round 10 in 2011 and is discussed further in Section 4.3.	Not Yet Assigned

4.2 BACKGROUND

OU3 is located in the eastern portion of PNS, as shown on Figure 1-2. The current OU3 layout is shown on Figure 4-1, and a conceptual model of the sites is shown on Figure 4-2.

Physical Characteristics

The current (post-remedy) OU3 area is approximately 22 acres and is used for parking, occupational activities in buildings and adjacent areas, and recreational activities (including baseball and soccer fields). Wetlands are located adjacent to the northern end of OU3 by Jamaica Cove. The hazardous waste storage facility, Building 357, is located to the northeast, and waste material extends under a portion of the paved area to the west of the building. Clark Cove is to the east of the landfill. The solid waste storage facility (Building 337) is located to the south, and the Automotive Hobby Shop (Building 320) and hospital are located to the west.

Groundwater exiting OU3 flows through sediment or small seeps in the intertidal area. The intertidal portion of the Clark Cove shoreline is mostly covered with shoreline controls; however, there are some areas of with exposed sediment in the low tide portion of the shoreline.

The offshore area of OU3 is part of the OU4 Jamaica Cove and Clark Cove AOCs that were investigated as part of the EERA and are part of interim offshore sampling at monitoring stations MS-5 through MS-9. Sampling locations are within the intertidal and subtidal areas of Jamaica and Clark Coves (Tetra Tech, November 2004, August 2005, February 2010, and November 2010a). The offshore monitoring results are discussed in Section 5.0.

Land and Resource Use

The site is used for parking, and occupational and recreational activities. A boat marina is in Clark Cove and people at the Shipyard can access boats in the marina from a ramp along Clark Cove shoreline or from a road that goes to Clark Island. Most of the groundwater within the OU3 boundary is brackish or saline, and near the shorelines is tidally influenced. There are some small pockets of fresh groundwater; however, groundwater is not used as a potable water supply.

History of Contamination

Site 8 is the landfill (JILF), and Sites 9 and 11 were located within the JILF boundary. The JILF is one of the initial sites identified in the 1983 IAS. The Navy used the JILF, which previously consisted of tidal mudflats, as a disposal area from 1945 to 1978 for disposal of general refuse, trash, construction rubble, dredged sediment, and various industrial wastes. The boundary of OU3 is defined by the boundary of the

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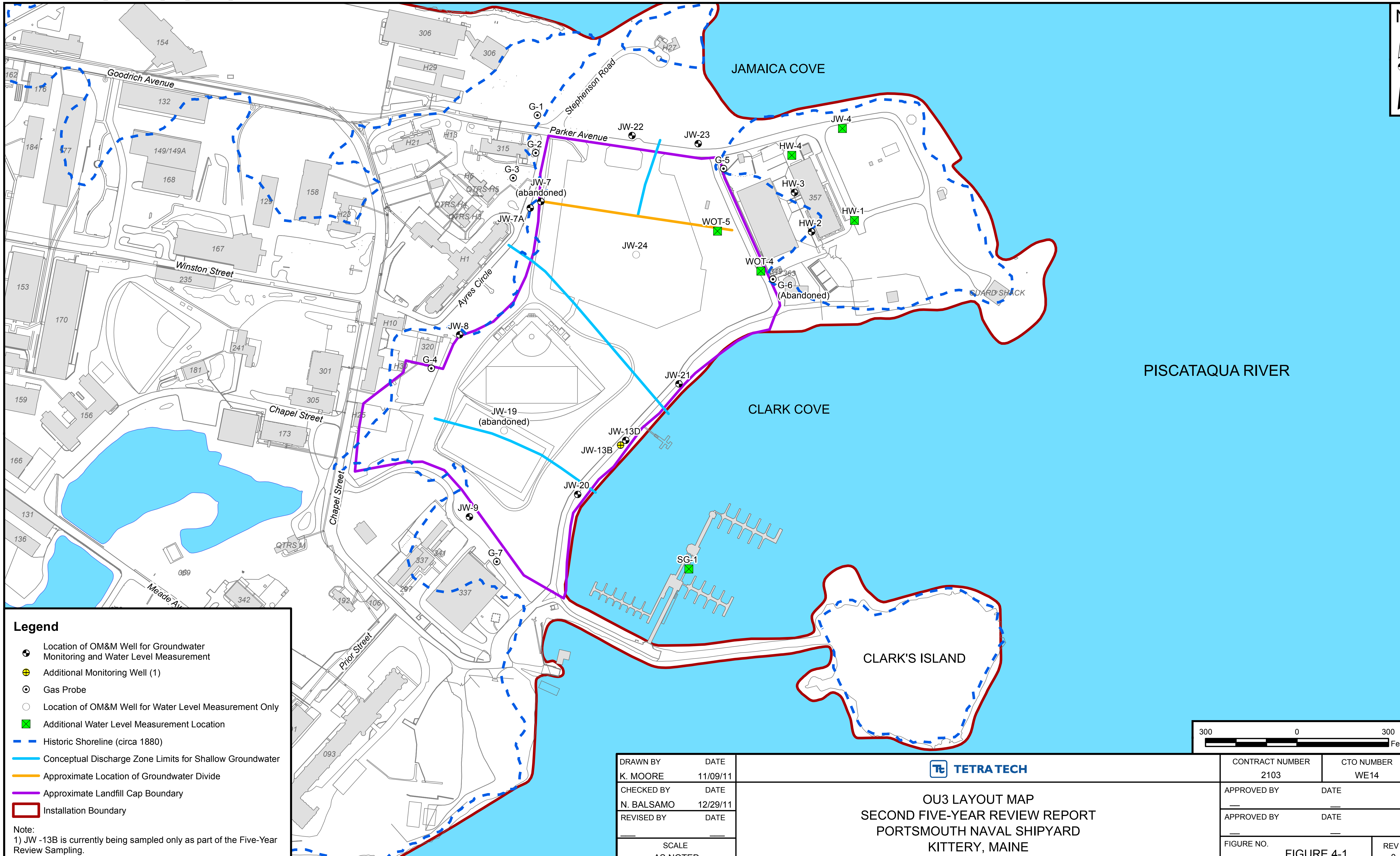
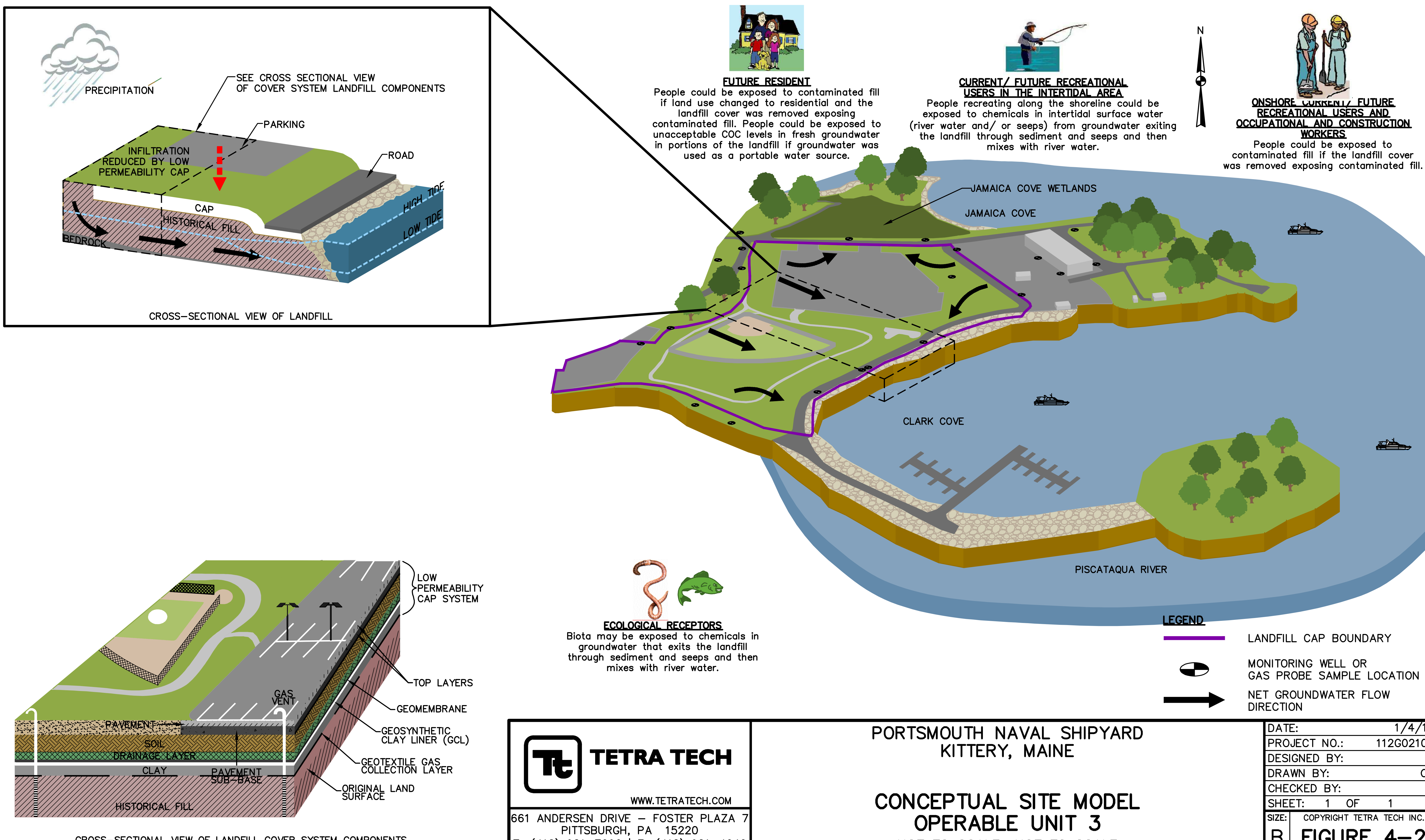


DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
K. MOORE	11/09/11		2103	WE14
CHECKED BY	DATE	OU3 LAYOUT MAP SECOND FIVE-YEAR REVIEW REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY	DATE
N. BALSAMO	12/29/11		APPROVED BY	DATE
REVISED BY	DATE		FIGURE NO.	REV
SCALE AS NOTED			FIGURE 4-1	0



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PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

CONCEPTUAL SITE MODEL
OPERABLE UNIT 3

NOT TO SCALE: NOT TO SCALE

DATE:	1/4/12
PROJECT NO.:	112G02103
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SIZE: B	COPYRIGHT TETRA TECH INC. FIGURE 4–2

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landfill. Prior to the OU3 remedy, the landfill was 25 acres; however, landfill material from 3 acres adjacent to Jamaica Cove was excavated as part of the remedy, and this area was removed from the landfill footprint. Site 9 MB vaults (poured concrete blocks and precast concrete pipes containing mercury-contaminated wastes) were placed in two locations (MBI and MBII) within the landfill in the 1970s and then removed (intact) and disposed of offsite in the 1990s/early 2000. There was no indication that mercury from the vaults contaminated surrounding soil or groundwater. The waste oil tanks at Site 11, which were used from 1943 to 1989, were removed intact along with surrounding soil in 1989. Soil contamination remaining in the vicinity of Site 11 appears to be landfill material (Site 8) mixed with petroleum that may have originated from spills during filling of the tanks formerly at Site 11. Therefore, the soil contamination remaining in the vicinity of Site 11 is considered Site 8 contamination.

As discussed in the OU3 ROD (Navy, August 2001a), OU3 is characterized as containing a large volume of low-level hazardous materials. Soil and groundwater data for Sites 8, 9, and 11 indicate similar chemical contamination throughout the area of the landfill. A variety of organic and inorganic constituents were detected in soil and groundwater, including VOCs, SVOCs, PCBs, pesticides, metals, and petroleum hydrocarbons. During the 2000 test pitting investigation at the JILF, dioxin analysis of selected subsurface soil samples was conducted, and low levels of dioxins were detected. The contamination distribution at the three sites is consistent with the heterogeneous nature of the materials that were landfilled at the JILF (i.e., a range of concentrations of a variety of chemicals was detected in the JILF, suggesting a heterogeneous mixture of wastes in the landfill).

Initial Response

Waste disposal at the JILF ended in 1978. MBI and MBII were removed in the 1990s/early 2000, and the waste oil tanks and surrounding soil at Site 11 were removed in 1989.

Basis for Taking Action

Contaminated soil and waste material are present with the JILF that represents a potential unacceptable risk to people if they are exposed to soil and waste material. Potentially unacceptable risks were identified for fresh groundwater if people used the groundwater for drinking. Potentially unacceptable risks may be present for people and/or biota exposed to unacceptable levels of COCs in groundwater exiting the JILF in the intertidal area. Potentially unacceptable risks to human health and the environment may be present from erosion of contaminated material from the JILF.

4.3 REMEDIAL ACTIONS

The selected remedy as documented in the OU3 ROD (Navy, August 2001a) is a hazardous waste landfill cover, LUCs, erosion controls, and monitoring. The remedy was modified based on ESD documents in 2003 (Navy, September 2003) and 2005 (Navy, October 2005).

4.3.1 Remedy Selection

Table 4-2 presents a summary of the identified risks at OU3, the RAO established in the ROD to address each risk, the remedy component to meet each RAO, the metric and cleanup level considered, and the expected outcome of each implemented remedy component.

The selected remedy for source control for the JILF (OU3) includes the following components:

- A multiple layer cover over the landfill surface to prevent receptors on the surface from coming into contact with contaminated soil and/or waste and to minimize infiltration of water to the landfill material. Portions of the JILF that have buildings and structures were not covered by the hazardous waste landfill cover.

- LUCs to restrict land and fresh water groundwater uses within the JILF boundary to prevent unacceptable human exposure to site contaminants. LUCs will also be used to prevent unrestricted disturbance of the hazardous waste landfill cover, shoreline erosion controls, and buildings and structures within the boundary of the JILF.

- Shoreline erosion controls, including rip-rap and/or wetlands created along the shoreline, to minimize the potential for washing away of soil and/or waste materials from the edge of the JILF.

- Monitoring of site media to assess the effectiveness of the remedy over the long term.

- Routine inspections and maintenance of the cover, shoreline erosion controls, and LUCs to ensure continued effectiveness.

- Five-year site reviews to confirm that RAOs are being achieved and that the remedy remains protective.

As part of the ROD, the Navy agreed to re-evaluate the feasibility of consolidating portions of the landfill, the Jamaica Cove area, and the area surrounding the former MBII into the remaining portions of the landfill. Removal of waste material from both areas and consolidation in the remaining landfill area would

TABLE 4-2

SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU3
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PAGE 1 OF 3

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
Potential unacceptable risks to human health from exposure to contaminated material in the landfill.	Prevent human exposure through ingestion, dust inhalation, and dermal contact with contaminated soils and/or waste within the landfill at unacceptable levels.	Excavation of all contaminated material from an approximately 3-acre area north of Parker Avenue and consolidation of the material within the landfill limits south of Parker Avenue, construction of an impermeable cap over the remaining landfill material south of Parker Avenue, implementation of OM&M for the landfill cap, and implementation of LUCs including activities to maintain the cap as provided in the LUC RD.	Placed multilayer landfill cover over contaminated soil and waste material within the landfill boundary; therefore, chemical-specific cleanup level were not developed. Prepared OM&M Plan to detail OM&M requirements for the landfill cover. Developed LUCs into foreseeable future and verifying protectiveness during periodic inspections and five-year reviews as long as landfill material remains on site.	Will need to continue to conduct OM&M in accordance with the OM&M Plan and implement LUCs in accordance with the LUC RD that allows for restricted industrial and recreational use and continue to perform five-year reviews.
Potential unacceptable risks to human health from ingestion of contaminated fresh groundwater in the landfill.	Prevent human exposure through ingestion of contaminated groundwater at unacceptable levels.	Implementation of LUCs to prevent use of groundwater as a potable water source.	Groundwater COCs for fresh groundwater are antimony, arsenic, 1,4-dichlorobenzene, benzene, antimony, cadmium, lead, nickel, and thallium. Groundwater at PNS is not used for drinking; most of the groundwater within OU3 is brackish/saline, and LUCs are required to maintain the cap. In addition, monitoring of fresh groundwater is not conducted as part of the OM&M program; therefore, cleanup levels were not developed for freshwater COCs.	Will need to maintain LUCs to restrict land use and disturbance of the cap as long as the cap is in place.

TABLE 4-2

SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU3
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PAGE 2 OF 3

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
Potential unacceptable risks to human health and the environment from erosion of contaminated material from the landfill.	Prevent erosion of contaminated soils and/or waste on the edge of the landfill to the Piscataqua River or the Back Channel.	Excavation of all contaminated material from an approximately 3-acre area north of Parker Avenue (adjacent to the Back Channel) and consolidation of the material within the landfill limits south of Parker Avenue, implementation of OM&M, and LUCs to maintain shoreline erosion control measures abutting the boundary of the landfill.	Removed all contaminated material abutting the boundary of the landfill adjacent to the Jamaica Cove portion of the Back Channel, constructed shoreline erosion controls abutting the boundary of the landfill in Clark Cove portion of the Piscataqua River, and maintaining LUCs as long as the shoreline erosion controls are in place; therefore, contaminated materials are protected from erosion. Chemical-specific cleanup levels are not applicable.	With removal of contaminated material, erosion of contaminated material to the Back Channel is no longer a concern. Will need to continue to conduct OM&M in accordance with the OM&M Plan and implement LUCs in accordance with the LUC RD to maintain shoreline controls and prevent erosion of contaminated material to the Piscataqua River.
Potential unacceptable risks to human health and the environment from exposure to contaminated material in the landfill if land is used improperly.	Provide for JILF's current and future uses (organized and unorganized sports, equipment storage, and parking) while providing sufficient protection of human health and the environment.	Implementation of LUCs to provide for continued uses of the landfill consistent with the remedy, as provided in the LUC RD.	Maintaining LUCs as long as the cap is in place. Chemical-specific cleanup levels are not applicable.	Will need to continue to implement LUCs in accordance with the LUC RD to restrict land uses.

TABLE 4-2

SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU3
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PAGE 3 OF 3

Risk	RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
Potentially unacceptable risks from exposure to chemicals in groundwater that becomes surface water in the intertidal area when it exits the landfill through sediment and seeps. Potential human health exposure from incidental ingestion of and dermal contact with chemicals in surface water in the intertidal area. Potential ecological exposure to seeps that create furrows above mid-tide in the intertidal area (acute exposure) and to surface water in the intertidal area (chronic exposure).	Ensure that the migration of groundwater contaminants does not adversely impact the offshore environment.*	Monitoring groundwater in accordance with an OM&M plan.	The OM&M Plan provides the monitoring program and criteria for protection of human health and the environment. Upgradient monitoring wells and monitoring wells along the downgradient boundary of the landfill are monitored for the COCs identified in the OM&M Plan, and decisions are made in accordance with the decision process provided in the OM&M Plan.	Continue to conduct monitoring in accordance with the OM&M Plan.

* RAO added in the 2005 ESD.

reduce the extent of the hazardous waste landfill cover and reduce the quantity of waste in contact with groundwater. Based on the evaluation, it was decided that waste would be removed from the Jamaica Cove area but not from the MBII area. Removal of waste material in the vicinity of Jamaica Cove provided the additional benefit of removing landfill material from a tidally influenced area and provided area for the construction of wetlands.

The 2003 ESD modified the remedy by reducing the area over which the landfill cover was installed, and required the following: (1) excavation of contaminated soil/waste from an approximately 2.6-acre area bounded by Parker Avenue, Stephenson Road, and Jamaica Cove; (2) consolidation of the excavated material within the limits of the JILF south of Parker Avenue; and (3) construction of wetlands within the excavated area. In addition, it was determined that the waste in the area of the Automotive Hobby Shop (Building 320 on Figure 4-1) was to be removed to the groundwater table, and the excavation area was to be backfilled with clean material and paved with asphalt. This area was not included under the landfill cover; however, a geotextile separates the clean fill from any waste present beneath the water table in this area.

The selected remedy addressed source control for OU3 (i.e., soil and groundwater within the boundary of the JILF). In addition, the ESD signed in October 2005 modified the ROD by adding an RAO regarding management of migration (formerly the purpose of OU6) and an ARAR to address groundwater migration (Navy, October 2005).

The selected remedy for OU3 addresses current and future potential threats to human health and the environment by

- Providing a cover to prevent human exposure to landfill materials
- Implementing LUCs
  - to prevent use of site groundwater for drinking, and
  - to prevent land use that is not compatible with the cover
- Providing shoreline erosion controls to prevent erosion of landfill material from the edge of the landfill, and
- Monitoring site media
  - to assess the effectiveness of the remedy, and
  - to determine the need for additional action, if warranted, based on the monitoring results.

4.3.2 Remedy Implementation

The United States Army prepared the OU3 Phase I Remedial Design (June 2002a, June 2002b, and June 2002c), and Phase II Remedial Design (US Army, November 2002). In Phase I of the RA, the portion of the landfill adjacent to Jamaica Cove was excavated and consolidated within other portions of the landfill. Within the excavated area, a salt marsh wetland was established, and shoreline rock protection was constructed to minimize the effects of wave action in Jamaica Cove.

Tetra Tech EC was the Navy's environmental construction contractor for this project. Phase I of the project began on June 24, 2002, and the consolidation activities were completed in September 2002. The wetlands planting (salt marsh plants) was completed in spring 2003. Phase II of the remedial action started in spring 2003 and was completed in September 2004. The Phase II remedial action included the hazardous waste landfill cover, shoreline protection for Clark Cove, parking lots, surface drainage and erosion controls, recreational facilities (softball field and running track), and various ancillary items (e.g., lights, fencing, etc.).

The landfill cover includes both vegetated and paved cover systems. The vegetated cover system consists of the following components (from top to bottom):

- 6-Inch-thick layer of topsoil.
- 18-Inch-thick (minimum) layer of select fill, with varied thickness to accommodate drainage layer slope, (maximum thickness was 42 inches).
- Geosynthetic drainage layer.
- Geomembrane.
- Geosynthetic clay liner (GCL).
- Low-permeability soil layer.
- Gas collection layer.

The top two layers (topsoil and select fill) were incorporated into the cover system to protect the underlying low-permeability layers from physical damage, freeze/thaw cycles, and ultraviolet light. The topsoil was included so that a good stand of grass was established to limit erosion of the cover. The select fill also provides an additional depth of soil to allow for grass growth.

The geosynthetic drainage layer was included to remove any water that infiltrates through the overlying layers. The removal of water reduces the head on the underlying low-permeability layers, increasing the stability of the cap system. Also, in the event of a small defect in the low-permeability layers, a reduced head also reduces any leakage through the cover system.

The geomembrane is the primary layer that limits infiltration through the cap system. The GCL was included to limit infiltration of any water that might get through the geomembrane because of a defect. The low-permeability soil also retards the downward migration of any water that might get through the geomembrane and GCL. The gas collection layer collects any gases produced under the low-permeability layers and conveys the gas to collection strips and then finally to vents to the atmosphere.

The paved cover system consists of the following components (from top to bottom):

- Pavement (asphalt or Portland cement concrete)
- Aggregate base
- Geosynthetic drainage layer
- Geomembrane
- GCL
- Low-permeability soil layer
- Gas collection layer

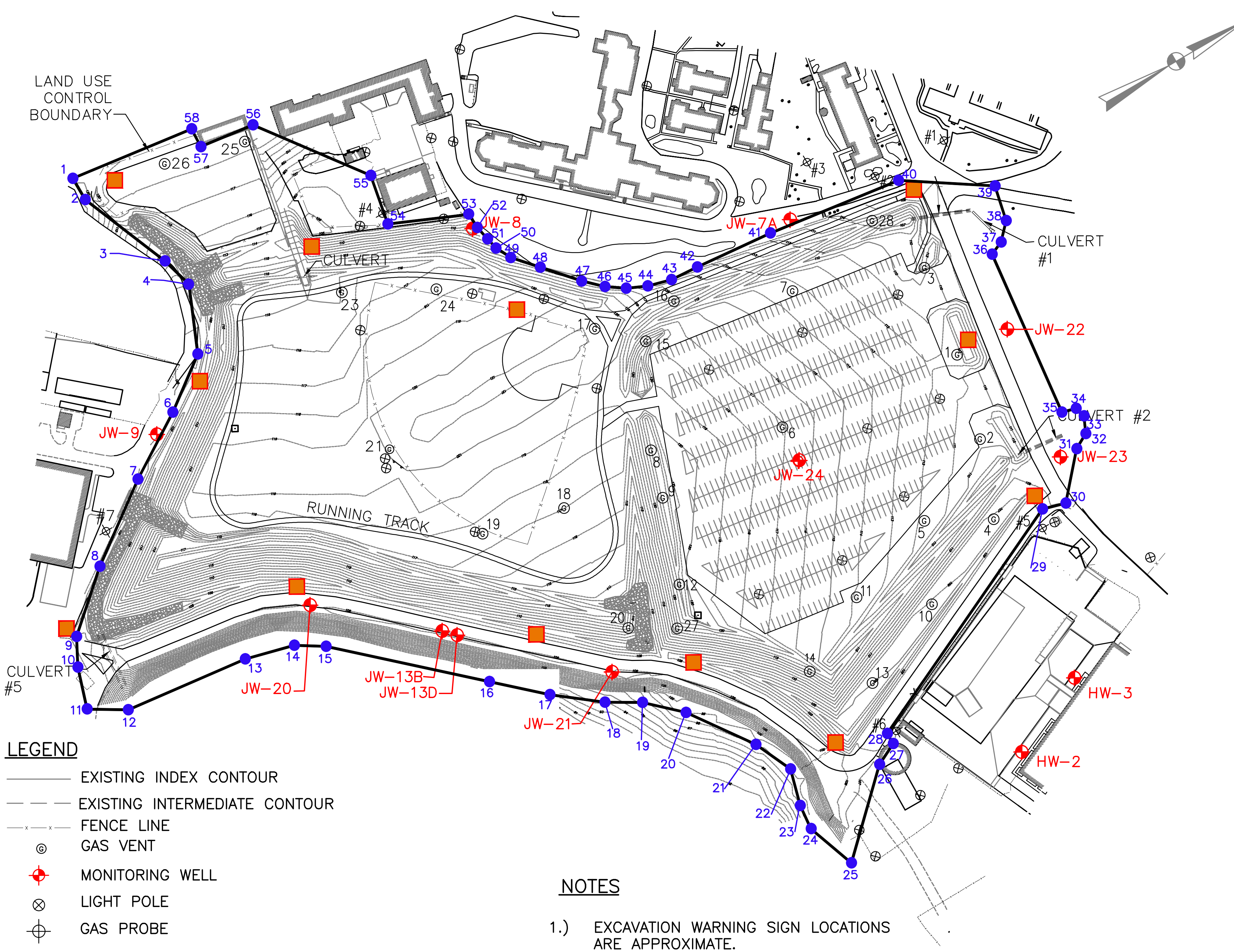
As in the vegetated cover system, the top two layers provide protection for the underlying low-permeability layers by physically separating those layers from physical hazards. The paved cover system also provides the added utility of allowing vehicular traffic. Based on final uses and anticipated vehicle traffic, three different pavement sections were used as part of the OU3 remedy.

Shoreline protection consisting of rip-rap underlain by sand and geotextile was installed along the Clark Cove and Jamaica Cove wetland shorelines adjacent to OU3. The shoreline protection protects the landfill from erosion due to flooding and wave action.

The surface water controls constructed as part of the remedy consist of a network of ditches, chutes, pipes, and culverts. These features are included in the remedy to remove surface water from the landfill cover system and to minimize erosion of or ponding water on the vegetated and paved cover systems.

Routine inspections and maintenance of the cover, erosion controls, and LUCs are being conducted to ensure that the remedy remains effective over the long term. The inspection and maintenance activities also include verification activities to determine whether the buildings and structures with the JILF boundary are still in place.

The LUC RD was finalized in August 2011. Verification activities were conducted as part of the Rounds 9 and 10 inspections using the LUC inspection checklist from the draft LUC RD. The LUC inspection is discussed in Section 4.5.4. The LUC RD was included in the Navy's LUC Tracker on August 22, 2011. The final LUC RD and LUC inspection checklist is included in the 2011 OM&M Plan (Tetra Tech, December 2011). A map defining the OU3 LUC area boundary was included in the LUC RD and is included here as Figure 4-3. Subsequent to finalization of the LUC RD, a copy of the LUC RD, which



POINT TABLE			POINT TABLE		
POINT #	NORTHING	EASTING	POINT #	NORTHING	EASTING
1	89734.0259	349034.1380	30	90836.3412	350273.0374
2	89734.0259	349073.3667	31	90894.7186	350207.0261
3	89794.4245	349221.2291	32	90919.2002	350193.6088
4	89808.0044	349271.6882	33	90930.9936	350167.9705
5	89765.1184	349374.9025	34	90926.2762	350151.4677
6	89684.2138	349434.8694	35	90903.5739	350145.2791
7	89582.7955	349498.8147	36	90934.2590	349872.8773
8	89460.9870	349587.9243	37	90956.0768	349863.4471
9	89373.0541	349665.3149	38	90980.2533	349838.1034
10	89350.2547	349708.2862	39	90992.6364	349781.5223
11	89329.5118	349773.1704	40	90864.8138	349696.8275
12	89385.2170	349807.2030	41	90646.9306	349666.7687
13	89586.4248	349831.0840	42	90519.5787	349654.8335
14	89664.5523	349851.4168	43	90474.1867	349651.5409
15	89707.3013	349878.2326	44	90436.4734	349641.3355
16	89903.1420	350057.1038	45	90405.0456	349627.2050
17	89975.6203	350123.4909	46	90377.0226	349607.8410
18	90045.0786	350177.8077	47	90349.7852	349581.6734
19	90096.4174	350207.9837	48	90303.8936	349529.7561
20	90148.1882	350256.6397	49	90271.1564	349492.8598
21	90218.3555	350356.2412	50	90258.5584	349467.8926
22	90246.3700	350417.7727	51	90254.4261	349448.5236
23	90230.2666	350475.5468	52	90249.3919	349424.9778
24	90226.7691	350516.0213	53	90248.2023	349399.4450
25	90254.7545	350595.2660	54	90129.5409	349348.6264
26	90371.9679	350482.5313	55	90144.8723	349268.1751
27	90407.3121	350464.9230	56	90023.8982	349104.8649
28	90407.3121	350446.2784	57	89934.8229	349092.9973
29	90799.7273	350262.5641	58	89936.3612	349061.2963

LEGEND

- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- FENCE LINE
- GAS VENT
- MONITORING WELL
- LIGHT POLE
- GAS PROBE
- EXCAVATION WARNING SIGN
- NORTHING/EASTING LOCATION (SEE TABLE ABOVE)

NOTES

1.) EXCAVATION WARNING SIGN LOCATIONS ARE APPROXIMATE.

2.) NORTHING AND EASTING COORDINATES BASED ON MAINE STATE PLANE COORDINATE, WEST ZONE.

0 200 400
GRAPHIC SCALE IN FEET

SOURCES:
OEST ASSOCIATES, INC., "FINAL GRADE AS-BUILT", JAMAICA ISLAND LANDFILL, DEPT. OF THE NAVY, NAVAL SHIPYARD, PORTSMOUTH, N.H., DWG.: C2, SHEET 2 OF 3, REV.: 1/24/05.

USACOE, OMAHA DISTRICT, NEW ENGLAND DISTRICT, OU-3 REMEDIAL DESIGN, PHASE 2, "DRAIN.DWG", CAD FILE DATED: 5/21/2003.

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MF	12/29/09
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TE	8/15/11
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ND	8/15/11
SCALE	
AS NOTED	

TETRA TECH

OU3 LAND USE CONTROL AREA
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

CONTRACT NO. 2103
OWNER NO. WE14
APPROVED BY DATE
DRAWING NO. FIGURE 4-3
REV. 0

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FORM CADD NO. SDIV-BH.DWG – REV 1 – 9/10/98 includes a LUC boundary map and a list of LUCs that have been implemented was submitted to the land record offices of the City of Portsmouth, New Hampshire, and the Town of Kittery, Maine, on October 4, 2011. In addition, Tetra Tech confirmed that the final OU3 LUC RD, which includes NAVSHIPYDPTSMH Instruction 5090.6D, was available at PNS on October 4, 2011. The Instruction is also included in Appendix A.3.

4.3.3 System Operations/Operation and Maintenance

4.3.3.1 Monitoring Program

The field SAP for groundwater and landfill gas is included in the OU3 Post-Remedial OM&M Plan (Tetra Tech, June 2006b) and the 2011 updated Post-Remedial OM&M Plan (Tetra Tech, December 2011). The sampling locations and groundwater discharge zones are shown on Figure 4-1. The groundwater sampling rationale is as follows:

- Based on groundwater discharge zones, downgradient monitoring wells are sampled at three locations along Clark Cove and two locations along the new boundary between OU3 and Jamaica Cove. Upgradient monitoring wells are sampled for each groundwater discharge zone.

- Based on the saturated fill thickness at low tide, one well within the saturated zone is sampled at each location. A one-time tidal study was conducted to determine appropriate sampling times based on tidal lags (Tetra Tech, July 2009).

- Based on regulatory concerns related to groundwater flow and concentrations of organics detected at the JW-13 well cluster (JW-13B and JW-13D), the Navy included the bedrock well (JW-13B) to monitor organics in the first four rounds of groundwater monitoring. There were no exceedances of action levels in JW-13D or JW-13B; therefore, in accordance with the OM&M Plan, JW-13B was removed from the OM&M program. However, based on continued MEDEP concerns regarding VOC concentrations in JW-13B, the Navy agreed to analyze JW-13B and JW-13D and OU3 OM&M wells for VOCs during the five-year sampling events in support of the five-year review.

The OM&M program for OU3 was initiated in July 2006, and to date, OU3 has been monitored for 6 years (nine rounds of semi-annual monitoring and one round of annual monitoring). A summary of the groundwater sampling and analysis program are as follows:

- During the first nine rounds, groundwater samples were collected twice per year, in July and December 2006, April and October 2007 and 2008, May and October 2009, and April 2010. The Round 10 (five-year) sampling event conducted in April 2011 including all sampling and analysis required to support the five-year review. The Navy has been and will continue to evaluate sampling frequency in accordance with the decision flow diagrams in the OM&M Plan (Tetra Tech, December 2011, Figures 2-1 through 2-3,). Initially, five upgradient wells (JW-7, JW-8, JW-9, HW-2, and HW3) and six downgradient wells (JW-13B, JW-13D, JW-20, JW-21, JW-22, and JW-23) were monitored. Well JW-7 was damaged and never able to be sampled, and was abandoned in October 2009. JW-7A was installed as a replacement well in August 2009 and was sampled during Rounds 8, 9, and 10.

- Groundwater samples from the first five rounds were analyzed for organics [Target Compound List (TCL) VOCs, SVOCs, pesticides and PCBs], Target Analyte List (TAL) metals (total and dissolved), and total suspended solids (TSS). Groundwater samples collected during Rounds 6 through 9 and Round 10 were analyzed for PAHs and TAL metals (total and dissolved). In addition, to support the five-year review, samples from OU3 OM&M wells and JW-13B were analyzed for VOCs in Round 10.

- Well stabilization parameters (dissolved oxygen, specific conductance, pH, turbidity, temperature, and oxidation-reduction potential) during sampling activities and salinity measurements are measured for all wells in the monitoring program during all rounds.

- Water level measurements are taken at all OU3 OM&M wells.

- Additional wells have been used to refine the groundwater contours and hydraulic gradient. Initially, JW-19 and JW-24 were included as additional wells for water level measurements, but JW-19 was obstructed and abandoned in October 2009. Groundwater level measurements were collected at SG-1, HW-1, HW-4, JW-4, WOT-4, and WOT-5 during Rounds 4 through 10. As provided in the OM&M Plan (Tetra Tech, December 2011), water level measurement will be discontinued at WOT-4, and continued at the other additional wells.

Initially (as part of the Rounds 1 through 4 Report), groundwater data were compared to screening levels to determine whether chemicals concentrations in groundwater could adversely impact offshore media. Screening levels were used to identify any potential COCs in addition to PAHs and metals. Action levels were subsequently identified for the COCs retained in the monitoring program. COCs can be removed from the monitoring program when they are less than action levels for three consecutive five-year sampling data evaluations. In the Rounds 1 through 9 Data Evaluation Report, concentrations of PAHs and metals were compared to action levels to determine whether COC concentrations in groundwater could adversely impact offshore media.

As part of Round 1, a one-time tidal study was conducted before initiation of sampling as part of the OU3 post-remedial program. Groundwater sampling is targeted around low tidal levels for tidally influenced groundwater monitoring well locations, whereas landfill gas measurements are targeted during rising tidal levels for gas probes. The tidal study was conducted in the monitoring wells and a stilling well (installed in the river) to determine the magnitude of tidal effects, response times, and appropriate sampling times for the tidally influenced monitoring wells. The results of this study were used to determine the appropriate time for landfill gas measurements and to assist in determining the appropriate timing of well development.

Landfill gas has been analyzed (real-time) from seven gas probes (G1 through G7, Figure 4-1) for methane during each round of groundwater sampling. Landfill gas field measurements were taken from gas sampling ports using a direct-reading instrument. The results of landfill gas monitoring are used to determine whether landfill gas could adversely impact groundwater sampling activities or people in nearby buildings, and the results were evaluated in the Rounds 1 through 4 and Rounds 1 through 9 Data Evaluation Reports. A reduction in the frequency of landfill gas monitoring was made from semi-annually to annually in accordance with the decision flow process in the OM&M Plan and was implemented in Round 10. Data from Rounds 10 and 11 will be evaluated to determine whether any additional reduction in monitoring frequency is warranted.

The Rounds 1 through 9 Data Evaluation Report (Tetra Tech, April 2011b) provided recommendations for modifications to the OM&M program after Round 9, and the updated OM&M Plan (Tetra Tech, December 2011) documents the modifications to the OM&M program.

4.3.3.2 Inspection

Routine inspections and maintenance of the cover, erosion controls, and LUCs are being conducted to ensure that the remedy remains effective over the long term. The inspection and maintenance activities also include verification activities to determine whether the buildings and structures within the JILF boundary are still in place. Inspection items are discussed in the O&M Manual, which is included in the OU3 Post-Remedial OM&M Plan as Appendix D (Tetra Tech, June 2006b and December 2011). Inspection items include grass-covered areas, erosion-control features, fencing, drainage, monitoring wells and gas vents, settlement and slope stability, and verification of LUCs. Findings of the inspections have been documented on the inspection checklist provided in the manual, and completed checklists are included in the data packages for each round.

The RD and remedial action for OU3 include many features that allow for reuse of the site. The O&M Manual only covers the O&M of components of the remedy included as part of the ROD and 2003 ESD; therefore, the running track, softball field and fences, paving areas, and lighting are not included. For instance, maintenance of the softball scoreboard is not covered by the O&M Manual; however, because the scoreboard footer penetrates the geomembrane layer of the cap, the scoreboard is inspected to determine whether the footer has moved, which in turn could affect the integrity of the geomembrane (i.e., a noticeable settling or lean of the scoreboard would trigger performance of an evaluation).

Inspection of the remedy at OU3 was performed semi-annually for the first nine rounds and annually beginning in Round 10. Inspection of wetland vegetation was performed annually for the first 5 years in accordance with the OM&M Plan. The preferred season for one of the semi-annual inspection events was spring because the winter thaw and spring precipitation may have the most effect on the remedy. The other semi-annual round was in the late summer/early fall. The wetlands inspections at Jamaica Cove and Clark Cove showed that the vegetation was healthy, that unwanted vegetation was not present, and that the Clark Cove shoreline was providing the shellfish and wildlife habitat necessary for nutrient export. No wetlands maintenance activities were required during any round of inspection, and routine wetlands inspection was discontinued after Year 5 (Round 9). Based on the results presented in the Rounds 1 through 9 Data Evaluation Report, the Round 10 annual inspection of landfill components was conducted concurrently with annual groundwater monitoring in early spring (April). Episodic inspections of both wetlands and landfill components will continue to be conducted as needed, per the updated OM&M Plan (Tetra Tech, December 2011).

4.3.3.3 Maintenance

Regular maintenance items are discussed in the O&M Manual, which is included as Appendix D of the OU3 Post-Remedial OM&M Plan (Tetra Tech, June 2006b, and December 2011). Maintenance items are identified on inspection reports, and follow-up maintenance activities were conducted at various times between October 2006 and June 2011.

4.4 PROGRESS SINCE LAST FIVE-YEAR REVIEW

Based on the results of the site inspection and review, the following table presents the recommendations made during the First Five-Year Review for OU3, along with the actions taken to address the recommendations:

TABLE 4-3: STATUS OF RECOMMENDATIONS FOR OU3

Recommendation from First Five-Year Review	Status
Continued implementation of LUCs and OM&M will maintain the effectiveness of the remedy into the future.	LUCs continue to be implemented and documented as part of the OM&M program (see checklist in the Round 9 and 10 Data Packages).
Continued OM&M of the site and address the O&M items noted in the first five-year review.	These activities were completed between Rounds 6 and 10.

Recommendation from First Five-Year Review	Status
Finalize the Land Use Control Plan	The LUC RD was finalized in August 2011 and the LUC RD was placed in the appropriate town departments in Kittery, Maine, Portsmouth, New Hampshire, and at PNS.
OU3 cap internal pipe outlets could not be located as shown on construction drawings. Changes to the design of these outlets should be checked to ensure proper functioning of the landfill cover.	No changes to the design were found in the Design Change Notifications or the Change Request Forms of the Final Remedial Action Report (Tetra Tech EC, May 2006). To further investigate the pipe outlets, video scoping of cap internal drainage pipes was completed in March 2011. Although the lateral pipe extensions/outlets were not found and a partially buckled portion of pipe was observed, calculations determined that the observed sections of pipe can convey the maximum flows that they are calculated to receive. It is not known whether portions of pipe beyond view of the video camera are damaged; however, because the surface of the cap is relatively flat, the cap surface is unlikely to become unstable. Therefore, the evaluation recommended continued observation of the area (Figure 4-4) during regularly schedule inspections. Topographic survey data collected in April 2011 have been reviewed and do not indicate cap settlement.

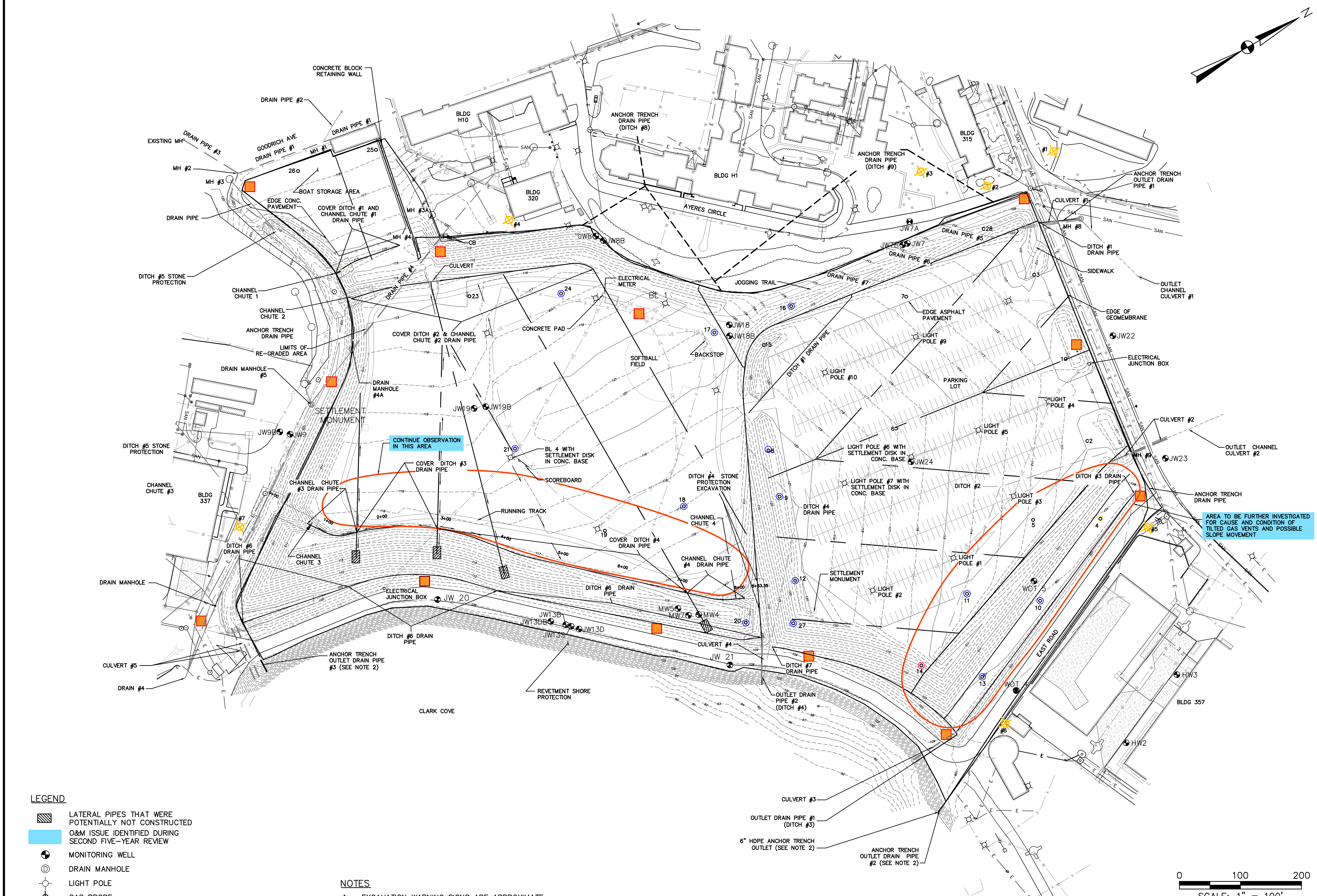
4.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

4.5.1 Document Review

The documents for OU3 reviewed for the Second Five-Year Review are listed below, and key information obtained from the documents is summarized in the following sections.

- Rounds 1 through 4 Data Evaluation Report (Tetra Tech, July 2009)
- Rounds 1 through 9 Data Evaluation Report (Tetra Tech, April 2011b)
- Round 10 Data Package for Post-Remedial OM&M (Tetra Tech, July 2011b)
- LUC RD (Navy, August 2011)
- Post-Remedial OM&M Plan (Revision 1) (Tetra Tech, December 2011)
- Evaluation of Drainage Pipe Configuration Beneath Cover Ditches #3 and #4 OU3 – Jamaica Island Landfill (Tetra Tech, July 2011c)



LEGEND

- LATERAL PIPES THAT WERE POTENTIALLY NOT CONSTRUCTED
- O&M ISSUE IDENTIFIED DURING SECOND FIVE-YEAR REVIEW
- MONITORING WELL
- DRAIN MANHOLE
- LIGHT POLE
- GAS PROBE
- GAS VENT
- GAS VENT WITH MINOR TILTING DURING ROUND 10
- GAS VENT WITH LARGER TILTING DURING ROUND 10
- GAS VENT WITH POTENTIAL HEAVING DURING ROUND 10
- EXCAVATION WARNING SIGN

NOTES

1. EXCAVATION WARNING SIGNS ARE APPROXIMATE.
2. DRAIN PIPE/OUTLET TERMINATES IN BEDDING STONE BENEATH ARMOR STONE.

SOURCES

OEST ASSOCIATES INC., "FINAL GRADE AS BUILT" JAMAICA ISLAND LANDFILL, DEPT. OF THE NAVY, NAVAL SHIPYARD PORTSMOUTH, N.H., DRAWING C-2 SHEET 2 OF 3, REV. 1/24/05.

USACOE, OMAHA DISTRICT, NEW ENGLAND DISTRICT OU-3 REMEDIAL DESIGN, PHASE 2, "DRAIN DRAWING", CAD FILE DATED 5/21/2003.

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PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

OU3 OM&M FEATURES

SCALE: 1'=100"

DATE:	04/16/12
PROJECT NO.:	112G02103
DESIGNED BY:	
DRAWN BY:	MF
CHECKED BY:	
SHEET: 1 OF 1	
SIZE: C	FIGURE 4-4

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4.5.2 Data Review

The table below presents a summary of the monitoring and OM&M activities conducted at OU3 to date.

TABLE 4-4: OM&M ACTIVITIES BY ROUND

Round	Groundwater Monitoring	Landfill Gas Monitoring	Landfill Components Inspection	Wetlands Inspection	Settlement Monument Survey	Maintenance Activities	Data Package Reference
1	July 2006	July 2006	July 2006	October 2006	April 2006	October 2006	Tetra Tech EC, June 2008b
2	December 2006	December 2006	December 2006	Not required	Not required	Not required	Tetra Tech EC, August 2008
3	April 2007	April 2007	April 2007	May 2007	May 2007	Not required	Tetra Tech EC, July 2008
4	October 2007	October 2007	October 2007	Not required	October 2007	October 2007-April 2008	Tetra Tech, May 2008
5	April 2008	April 2008	May 2008	June 2008	March 2008	April 2008	Tetra Tech, September 2008a
6	October 2008	October 2008	October 2008	Not required	October 2008	October 2008	Tetra Tech, January 2009
7	May 2009	May 2009	May 2009	May 2009	May 2009	May 2009	Tetra Tech, August 2009
8	October 2009	October 2009	October 2009	Not required	October 2009	October 2009	Tetra Tech, January 2010
9	April 2010	April 2010	April 2010	June 2010	April 2010	April 2010-May 2010	Tetra Tech, July 2010
10	April 2011	April 2011	April 2011	Not required	April 2011	June 2011	Tetra Tech, July 2011b

4.5.2.1 Monitoring Data Review

Based on the decision flow diagram included in the OM&M Plan (Tetra Tech, December 2011), all data collected during the monitoring program were evaluated for this five-year review, rather than only the data collected during the most recent 5 years.

The results of the first nine rounds of monitoring were provided in the Rounds 1 through 9 Data Evaluation Report (Tetra Tech, April 2011b). Results of the Round 10 sampling event were included in the Round 10 Data Package for Post-Remedial OM&M Program (Tetra Tech, July 2011b). Groundwater sampled during the most recent event, Round 10, was analyzed for VOCs, PAHs, TAL metals (total and dissolved) and TSS. Landfill gas (methane) was monitored at the gas probes.

Landfill gas was not detected at levels greater than the threshold value of 0.45 percent volume per volume of air during any of Rounds 1 through 10 sampling of the gas probes.

For groundwater, updated human health and ecological action levels for PAHs and metals are presented in Table 4-5, and a comparison of results from Rounds 1 through 9 and Round 10 is presented in Table 4-6. An evaluation of the data is provided in Appendix D.1. No PAHs or metals were detected in groundwater at concentrations greater than action levels. As determined during the evaluation of Rounds 1 through 9 data, the only constituent that requires annual monitoring is arsenic (total and dissolved) because the concentration at JW-13D was predicted to exceed the action level within the next 5-year period. Figures D.1.1 through D.1.10 in Appendix D.1 show total arsenic concentration trends and prediction bands by well including the Round 10 data. Although the arsenic concentration detected at JW-13D in Round 10 is consistent with most of the previous results, the maximum detection (in Round 6) continues to affect the prediction band such that an exceedance of the action level within the next 5-year period is predicted. The additional annual data to be collected before the next five-year sampling round will provide additional support for whether the Round 6 detection is an anomaly or whether an increasing trend may exist.

As discussed in Appendix D.1, updates in the action levels based on risk criteria updates were evaluated. Tables comparing the previous action levels and screening levels to the updated levels are included in Appendix C.5. The updates did not change the general conclusions regarding groundwater concentrations in comparison to action levels because groundwater concentrations are generally much lower than action levels. Thallium was evaluated further because the action level was updated to "Not Applicable (NA)". The update to thallium, further discussed in Appendix C.5, was made because of the uncertainty in the new toxicity criteria. Figures D.1.11 through D.1.20 present plots for total thallium data for all sampling rounds to date. The concentrations of thallium in Round 10 were similar to or less than previous results and do not indicate increasing levels. Criteria updates should continue to be evaluated as part of subsequent data evaluation as part of the OM&M program and five-year reviews.

VOCs were not identified as COCs for the OM&M program and therefore action levels were not developed for VOCs. For the evaluation of VOC data from the five-year sampling round, the screening levels were updated and are presented in Table 4-7. A comparison of results from Rounds 1 through 5 and Round 10 is presented in Table 4-8, and the evaluation for OU3 VOC data is discussed in Appendix D.1. Although VOC concentrations are much lower than screening levels, concentrations

TABLE 4-5

**UPDATED AQUEOUS PROJECT ACTION LEVEL SUMMARY
OU3 POST-REMEDIAL OM&M PROGRAM
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE**

Parameter	Ecological Action Levels			Human Health Action Levels	
	Acute Value (µg/L)(1)	Chronic Value (µg/L)(2)	Source	Action Level (µg/L)(3)	Carcinogen (C) or Noncarcinogen (N)
Polycyclic Aromatic Hydrocarbons					
2-METHYLNAPHTHALENE	30 (4)	1125 (5)	Buchman, 2008	590	N
ACENAPHTHENE	NA	15000	USEPA, Jan. 1996	8800	N
ACENAPHTHYLENE	30 (4)	1125 (5)	Buchman, 2008	7200 (6)	N
ANTHRACENE	30 (4)	1125 (5)	Buchman, 2008	24000	N
BENZO(A)ANTHRACENE	30 (4)	1125 (5)	Buchman, 2008	50	C
BENZO(A)PYRENE	30 (4)	1125 (5)	Buchman, 2008	5	C
BENZO(B)FLUORANTHENE	30 (4)	1125 (5)	Buchman, 2008	50	C
BENZO(G,H,I)PERYLENE	30 (4)	1125 (5)	Buchman, 2008	42000* (7)	N
BENZO(K)FLUORANTHENE	30 (4)	1125 (5)	Buchman, 2008	500	C
CHRYSENE	30 (4)	1125 (5)	Buchman, 2008	5000	C
DIBENZO(A,H)ANTHRACENE	30 (4)	1125 (5)	Buchman, 2008	5	C
FLUORANTHENE	NA	4125	USEPA, Jan. 1996	1800	N
FLUORENE	30 (4)	1125 (5)	Buchman, 2008	4300	N
INDENO(1,2,3-CD)PYRENE	30 (4)	1125 (5)	Buchman, 2008	50	C
NAPHTHALENE	235 (4)	525*	Buchman, 2008	5300	N
PHENANTHRENE	NA	3113	USEPA, Jan. 1996	2400 (7)	N
PYRENE	30 (4)	1125 (5)	Buchman, 2008	1600	N
Inorganics					
ALUMINUM	750 (8)	32625 (8)	USEPA, 2009	1300000	N
ANTIMONY	1500	187500	Buchman, 2008	366	N
ARSENIC	69 (9)	13500 (9)	USEPA, 2009	49	C
BARIUM	1000*	75000*	Buchman, 2008	131000	N
BERYLLIUM	1500*	37500*	Buchman, 2008	226	N
CADMIUM	40 (9)	3300 (9)	USEPA, 2009	270	N
CALCIUM	NA	NA	NA	NA	NA
CHROMIUM	1,100 (9) (10)	18750 (9) (10)	USEPA, 2009	569 (10)	N
COBALT	1,500 (8)	8625 (8)	Suter and Tsao, 1996	390	N
COPPER	4.8 (9)	1163 (9)	USEPA, 2009	52000	N
IRON	NA	375000 (8)	USEPA, 2009	910000	N
LEAD	210 (9)	3038 (9)	USEPA, 2009	455* (11)	NA
MAGNESIUM	NA	NA	NA	NA	NA
MANGANESE	2,300 (8)	45000 (8)	Suter and Tsao, 1996	11200	N
MERCURY	1.8 (9)	353 (9)	USEPA, 2009	200 (12)	N
NICKEL	74 (9)	3075 (9)	USEPA, 2009	20100	N
POTASSIUM	NA	NA	NA	NA	NA
SELENIUM	290 (9)	26625 (9)	USEPA, 2009	6500	N
SILVER	1.9 (9)	71.3 (5)	USEPA, 2009	3190	N
SODIUM	NA	NA	NA	NA	NA
THALLIUM	213 (4)	6375*	Buchman, 2008	NA* (13)	N
VANADIUM	280 (8)	7500 (8)	Suter and Tsao, 1996	6500	N
ZINC	90 (9)	30375 (9)	USEPA, 2009	402000	N

NA = Not Applicable.

* The action level changed since the 2009 update to support the OU3 Rounds 1 through 9 Data Evaluation Report (Tetra Tech, April 2011b). Acute and chronic ecological action level changes were based on updated marine values or updated source of criteria. Updates to human health action levels were based on changes in toxicity criteria or risk calculation methodology. Appendix C.5 provides a discussion of the updated human health risk methodology.

1 - Ecological acute values apply only to seeps that emerge above the mean mid-tide line and cause furrows in the sediment above mid-tide.
2 - Chronic ecological value presented is the chronic screening level multiplied by a diulition factor of 375 (minimum calculated dilution factor for OU3).

3 - The human health action levels presented in this table correspond to an incremental lifetime cancer risk of 1 x 10^{-5} or a hazard index of 1. These action levels are based on recreational exposure to surface water in the intertidal area. The action levels were calculated in accordance with the methodology presented in Appendix C.5.

4 - Acute value was calculated by multiplying the acute lowest observable effect level (LOEL) by 0.1 (to estimate an acute no observable effect level [NOEL]). Chronic value was calculated by multiplying acute value by 0.1.
5 - Chronic vaule was calculated by multiplying the acute LOEL by 0.01 to estimate a chronic NOEL.
6 - The reference dose for acenaphthene was used as a surrogate reference dose for calculation of the acenaphthylene human health action level.
7 - The reference dose for pyrene was used as a surrogate reference dose for calculation of the benzo(g,h,i)perylene and phenanthrene human health action levels.
8 - Value is based on freshwater criterion.
9 - Value is based on dissolved concentration.
10 - Action level for hexavalent chromium is presented.
11 - The action level for lead was calculated in accordance with the methodology presented in Appendix C.5.
12 -The reference dose for mercuric chloride was used for calculating the mercury humaan health action level.
13 -Based on uncertainty in the thallium reference does value, an action level was not calculated for thallium. See Appendix C.5 for additional information.

Sources:

Buchman, M. F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, 34 pages. http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html

Suter, G.W. II. and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Constituents of Concern for Effects on Aquatic Biota:1996 Revision. Environmental Sciences Division, Oak Ridge National Laboratory. ES/ER/TM-96/R2.

USEPA (United States Environmental Protection Agency), 1996. ECO Update, Ecotox Threshold, Office of Solid Waste and Emergency Response. Intermittent Bulletin, Volume 3, Number 2. EPA540/F-95/038. January.

USEPA, 2009. National Recommended Water Quality Criteria: 2009. Office of Water.

TABLE 4-6

**COMPARISON OF ROUNDS 1 THROUGH 9 AND ROUND 10 PAHs AND METALS GROUNDWATER MONITORING DATA
OU3 POST-REMEDIAL OM&M PROGRAM
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE**

	Rounds 1 through 9				Round 10					
Parameter	**Range of Detections**	**Location of Maximum Concentration**	**Sample with Maximum Concentration**	**Range of Non-detects**	**Range of Detections**	**Location of Maximum Concentration**	**Sample with Maximum Concentration**	**Range of Non-detects**	**Human Health Action Level (1)**	**Ecological Action Level (1)**
PAHs (µg/L)										
2-METHYLNAPHTHALENE	0.13 J	JW-9	OU3GWJW091008	0.07 - 10	---	---	---	0.094 - 0.1	590	1125
ACENAPHTHENE	---	---	---	0.06 - 11	---	---	---	0.094 - 0.1	8800	15000
ACENAPHTHYLENE	---	---	---	0.05 - 10	---	---	---	0.094 - 0.1	7200	1125
ANTHRACENE	---	---	---	0.04 - 11	---	---	---	0.094 - 0.1	24000	1125
BENZO(A)ANTHRACENE	---	---	---	0.04 - 10	---	---	---	0.094 - 0.1	50	1125
BENZO(A)PYRENE	---	---	---	0.06 - 10	---	---	---	0.094 - 0.1	5	1125
BENZO(B)FLUORANTHENE	---	---	---	0.08 - 10	---	---	---	0.094 - 0.1	50	1125
BENZO(G,H,I)PERYLENE	---	---	---	0.06 - 10	---	---	---	0.094 - 0.1	42000	1125
BENZO(K)FLUORANTHENE	---	---	---	0.05 - 10	---	---	---	0.094 - 0.1	500	1125
CHRYSENE	---	---	---	0.03 - 10	---	---	---	0.094 - 0.1	5000	1125
DIBENZO(A,H)ANTHRACENE	---	---	---	0.07 - 10	---	---	---	0.094 - 0.1	5	1125
FLUORANTHENE	---	---	---	0.07 - 11	---	---	---	0.094 - 0.1	1800	4125
FLUORENE	3 J	HW-2	OU3GWHW020706	0.06 - 10	---	---	---	0.094 - 0.1	4300	1125
INDENO(1,2,3-CD)PYRENE	---	---	---	0.05 - 10	---	---	---	0.094 - 0.1	50	1125
NAPHTHALENE	0.2 - 4 J	HW-2	OU3GWHW020706	0.06 - 11	0.79	JW-7A	OU3GWJW07A0411	0.094 - 0.1	5300	525
PHENANTHRENE	---	---	---	0.05 - 10	---	---	---	0.094 - 0.1	2400	3113
PYRENE	---	---	---	0.06 - 10	---	---	---	0.094 - 0.1	1600	1125
Inorganics, Total (µg/L)										
ALUMINUM	13.2 B - 505	JW-20	OU3GWJW200509-D	7.2 - 289	64.8 J - 65 J	JW-20	OU3GWJW200411-D	40 - 80	1300000	32625
ANTIMONY	0.38 - 17.4	JW-22	OU3GWJW221009	0.15 - 11	15.1 J - 15.4 J	JW-21	OU3GWJW210411	5 - 50	366	187500
ARSENIC	2 - 37.8	JW-13D	OU3GWJW13D1008	1.2 - 19	1.4 J - 13.3	JW-13D	OU3GWJW13D0411	4 - 8	49	13500
BARIUM	2.6 B - 223	JW-22	OU3GWJW221008	4.9 - 44.4	4 J - 68.6	JW-20	OU3GWJW200411-D	---	131000	75000
BERYLLIUM	0.25 B - 0.68 B	JW-13D	OU3GWJW13D1206	0.026 - 0.75	---	---	---	0.5 - 0.5	226	37500
CADMIUM	0.2 B - 1.4	JW-22	OU3GWJW221007	0.04 - 1	0.08 J - 0.37 J	JW-9	OU3GWJW090411	3 - 3	270	3300
CALCIUM	19700 - 422000	JW-13D	OU3GWJW13D1007	35300 - 273000	20400 - 287000	JW-13D	OU3GWJW13D0411	---	NA	NA
CHROMIUM	0.56 B - 42.9 J	JW-21	OU3GWJW21007	0.11 - 5.4	---	---	---	4 - 40	569	18750
COBALT	0.12 - 8.3	HW-2	OU3GWHW021007	0.1 - 4	0.42 J - 3 J	JW-9	OU3GWJW090411	4 - 4	390	8625
COPPER	0.37 - 60 J	JW-20	OU3GWJW201007-D	0.85 - 35.6	0.95 J - 17.4 J	JW-20	OU3GWJW200411-D	---	52000	1163
IRON	12.4 - 10200	HW-2	OU3GWHW021008	8.5 - 1630	7.6 J - 1800	HW-2	OU3GWHW020411	80 - 80	910000	375000
LEAD	0.08 J - 15.6 J	JW-20	OU3GWJW200509-D	0.05 - 25.4	0.06 J - 2.9	JW-20	OU3GWJW200411-D	1 - 4	455	3038
MAGNESIUM	2530 - 1340000	JW-13D	OU3GWJW13D1007	4370 - 20600	2220 - 787000	JW-23	OU3GWJW230411	---	NA	NA
MANGANESE	0.29 B - 1930 J	HW-2	OU3GWHW021007	0.84 - 889	1.5 J - 702	HW-2	OU3GWHW020411	4 - 4	11200	45000
MERCURY	0.01 B - 0.01 B	JW-9	OU3GWJW90407	0.01 - 0.2	0.01 J - 0.01 J	JW-20	OU3GWJW200411-D	0.1 - 0.1	200	353
NICKEL	0.74 J - 68	JW-21	OU3GWJW21007	0.41 - 30.3	0.36 J - 23.4 J	JW-21	OU3GWJW210411	---	20100	3075
POTASSIUM	2760 - 718000	JW-13D	OU3GWJW13D1007	4240 - 9760	3070 J - 276000 J	JW-13D	OU3GWJW13D0411	---	NA	NA
SELENIUM	4.2 B - 24.1 J	JW-8	OU3GWJW081007	0.8 - 16	3.5 J - 38.4 J	JW-23	OU3GWJW230411	7 - 70	6500	26625
SILVER	0.07 J - 2.1 J	JW-13D	OU3GWJW13D1008	0.05 - 7	---	---	---	0.4 - 0.8	3190	71.3
SODIUM	12400 - 12100000 J	JW-13D	OU3GWJW13D1007	83400 - 216000	12900 - 8710000	JW-13D	OU3GWJW13D0411	---	NA	NA
THALLIUM	1.2 J - 12.1 B	JW-13D	OU3GWJW13D1206	0.1 - 170	1.3 J - 19.4 J	JW-21	OU3GWJW210411	0.8 - 5	NA	6375
VANADIUM	0.33 - 11.6 J	JW-21	OU3GWJW21007	0.39 - 25.6	0.69 J - 5.5 J	JW-13D	OU3GWJW13D0411	4 - 8	6500	7500
ZINC	2.1 J - 231	JW-20	OU3GWJW200407	1.2 - 172	0.86 J - 146 J	JW-20	OU3GWJW200411/OU3GWJW200411-D	16 - 16	402000	30375

TABLE 4-6

**COMPARISON OF ROUNDS 1 THROUGH 9 AND ROUND 10 PAHs AND METALS GROUNDWATER MONITORING DATA
OU3 POST-REMEDIAL OM&M PROGRAM
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE**

Parameter	Rounds 1 through 9				Round 10				Human Health Action Level (1)	Ecological Action Level (1)
	Range of Detections	Location of Maximum Concentration	Sample with Maximum Concentration	Range of Non-detects	Range of Detections	Location of Maximum Concentration	Sample with Maximum Concentration	Range of Non-detects		
Inorganics, Filtered (µg/L)										
ALUMINUM	20.2 J - 348 J	JW-20	OU3GWJW200410	7.2 - 302	---	---	---	40 - 80	1300000	32625
ANTIMONY	0.16 - 19.9	JW-20	OU3GWJW201009	0.15 - 11	14.6 J - 15.6 J	JW-23	OU3GWJW230411	5 - 50	366	187500
ARSENIC	2.1 - 21.5	HW-2	OU3GWHW021008	1.2 - 19	5.2 - 11.4	JW-13D	OU3GWJW13D0411	5 - 5	49	13500
BARIUM	2.6 - 226	JW-22	OU3GWJW221009	10.9 - 54.6	4 J - 69.8	JW-22	OU3GWJW220411	---	131000	75000
BERYLLIUM	0.17 B - 0.74 B	JW-13D	OU3GWJW13D1206	0.026 - 0.83	---	---	---	0.5 - 0.5	226	37500
CADMIUM	0.21 B - 1.4	HW-2	OU3GWHW021007	0.04 - 1	0.14 J - 0.34 J	JW-9	OU3GWJW090411	0.4 - 3	270	3300
CALCIUM	19900 - 385000	JW-13D	OU3GWJW13D1007	34400 - 270000	21100 - 284000	JW-13D	OU3GWJW13D0411	---	NA	NA
CHROMIUM	0.58 B - 35.8 J	JW-23	OU3GWJW231007	0.11 - 4.9	0.77 J - 1.4 J	JW-7A	OU3GWJW07A0411	4 - 40	569	18750
COBALT	0.11 - 6.6	HW-2	OU3GWHW021007	0.1 - 4	0.39 J - 1.7 J	HW-2	OU3GWHW020411	4 - 4	390	8625
COPPER	0.53 - 27.7 J	JW-21	OU3GWJW210706	0.3 - 17.7	0.68 J - 14.2 J	JW-20	OU3GWJW200411-D	---	52000	1163
IRON	26.3 - 10800	HW-2	OU3GWHW021008	5.17 - 1660	6.5 J - 1740	HW-2	OU3GWHW020411	80 - 80	910000	375000
LEAD	0.08 - 1.3 B	HW-3	OU3GWHW30407	0.05 - 16.1	0.1 J - 0.52 J	JW-9	OU3GWJW090411	1 - 4	455	3038
MAGNESIUM	2480 - 1230000	JW-13D	OU3GWJW13D1007	4260 - 20200	2410 - 779000	JW-13D	OU3GWJW13D0411	---	NA	NA
MANGANESE	0.23 B - 1950 J	HW-2	OU3GWHW021007	0.37 - 868	2.7 J - 694	HW-2	OU3GWHW020411	4 - 4	11200	45000
MERCURY	0.02 B - 0.02 B	JW-21	OU3GWJW211206	0.01 - 0.2	0.01 J - 0.01 J	JW-23	OU3GWJW230411	0.1 - 0.1	200	353
NICKEL	0.47 J - 42.9	JW-21	OU3GWJW210706	0.41 - 23.4	0.44 J - 21.4 J	JW-21	OU3GWJW210411	4 - 4	20100	3075
POTASSIUM	2730 - 651000	JW-13D	OU3GWJW13D1007	4330 - 105000	2960 J - 280000 J	JW-13D	OU3GWJW13D0411	---	NA	NA
SELENIUM	3.3 J - 21.6 J	HW-2	OU3GWHW021007	0.8 - 16	2.6 J - 51.3 J	JW-22	OU3GWJW220411	7 - 70	6500	26625
SILVER	0.06 J - 1.4 B	JW-8	OU3GWJW81206	0.05 - 3	---	---	---	0.4 - 0.8	3190	71.3
SODIUM	11100 - 10800000 J	JW-13D	OU3GWJW13D1007	83300 - 210000	15000 - 7010000	JW-13D	OU3GWJW13D0411	---	NA	NA
THALLIUM	0.83 J - 10.9 B	JW-13D	OU3GWJW13D1206	0.1 - 17	1.2 J - 14.2 J	JW-9	OU3GWJW090411	0.4 - 5	NA	6375
VANADIUM	0.26 - 3.3 J	JW-20	OU3GWJW201007-D	0.39 - 25.6	0.37 J - 4.5 J	JW-13D	OU3GWJW13D0411	4 - 8	6500	7500
ZINC	4.1 - 213	JW-20	OU3GWJW200407	0.87 - 148	1.2 J - 166 J	JW-20	OU3GWJW200411-D	16 - 16	402000	30375

1 - Action levels were updated in September 2011 based on criteria changes as presented in Table 4-2.
J - estimated concetration
B - analyte found in blank, along with sample
PAHs - Polycyclic aromatic hydrocarbons
--- - Does not apply

TABLE 4-7

**UPDATED AQUEOUS SCREENING LEVEL SUMMARY
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	Ecological Screening Levels			Human Health Screening Levels	
Parameter	**Acute Value (μg/L) [1]**	**Chronic Value with Dilution (μg/L) [2]**	**Source**	**Screening Level (μg/L) [3]**	**Carcinogen (C) or Noncarcinogen (N)**
Volatile Organic Compounds					
1,1,1-TRICHLOROETHANE	3,120 [4]	117000 [5]	Buchman, 2008	120000*	N
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	NA	NA	NA	1300000	N
1,1,2,2-TETRACHLOROETHANE	902	33825 [5]	Buchman, 2008	21	C
1,1,2-TRICHLOROETHANE	NA*	712500*	Buchman, 2008	82	C
1,1-DICHLOROETHANE	830* [6]	17625* [6]	Suter and Tsao, 1996	830*	C
1,1-DICHLOROETHENE	450 [6]	9375 [6]	Suter and Tsao, 1996	3400	N
1,2,3-TRICHLOROBENZENE	NA**	3000** [6]	Buchman, 2008	14**	N
1,2,4-TRICHLOROBENZENE	16 [4]	2025*	Buchman, 2008	29*	C
1,2-DIBROMO-3-CHLOROPROPANE	NA	NA	NA	4.5*	C
1,2-DIBROMOETHANE	NA	NA	NA	2.9	C
1,2-DICHLOROETHANE	11,300 [4]	423750 [5]	Buchman, 2008	62	C
1,2-DICHLOROBENZENE	197 [4]	15750*	Buchman, 2008	2400	N
1,2-DICHLOROPROPANE	1,030 [4]	114000 [7]	Buchman, 2008	120*	C
1,3-DICHLOROBENZENE	197* [4]	7388* [5]	Buchman, 2008	NA*	NA
1,4-DICHLOROBENZENE	197 [4]	4838 [7]	Buchman, 2008	270*	C
2-BUTANONE	240,000 [6]	5250000 [6]	Suter and Tsao, 1996	77000	N
2-HEXANONE	1,800 [6]	37125 [6]	Suter and Tsao, 1996	560*	N
4-METHYL-2-PENTANONE	2,200 [6]	63750 [6]	Suter and Tsao, 1996	9000*	N
ACETONE	28,000 [6]	562500 [6]	Suter and Tsao, 1996	120000	N
BENZENE	510 [4]	41250*	Buchman, 2008	60	C
BROMOCHLOROMETHANE	NA**	NA**	NA	NA**	N
BROMODICHLOROMETHANE	1,200 [4]	240000 [7]	Buchman, 2008	82	C
BROMOFORM	2300* [6]	120000* [6]	Suter and Tsao, 1996	700	C
BROMOMETHANE	NA	6000* [6]	Buchman, 2008	160	N
CARBON DISULFIDE	17 [6]	345 [6]	Suter and Tsao, 1996	5600	N
CARBON TETRACHLORIDE	5,000 [4]	187500 [5]	Buchman, 2008	40*	C
CHLOROBENZENE	NA*	48750* [6]	Buchman, 2008	780	N
CHLOROETHANE	NA	NA	NA	NA*	N
CHLOROFORM	490* [6]	675* [6]	Buchman, 2008	150*	C
CHLOROMETHANE	NA	NA	NA	NA	C
CIS-1,2-DICHLOROETHENE	22,400 [4]	840000 [5]	Buchman, 2008	140*	N
CIS-1,3-DICHLOROPROPENE	79 [4]	2962.5 [5]	Buchman, 2008	44	C
CYCLOHEXANE	NA	NA	NA	NA	N
DIBROMOCHLOROMETHANE	1,200 [4]	240000 [7]	Buchman, 2008	64	C
DICHLORODIFLUOROMETHANE	NA*	NA*	NA	15000	N
ETHYLBENZENE	43 [4]	9375*	Buchman, 2008	130*	C
ISOPROPYLBENZENE	NA	NA	NA	1700	N
METHYL ACETATE	NA	NA	NA	130000	N
METHYLCYCLOHEXANE	NA	NA	NA	NA	NA
METHYLENE CHLORIDE	1,200 [4]	240000 [7]	Buchman, 2008	790	C
METHYL TERT-BUTYL ETHER	NA	1875000*	Buchman, 2008	3500*	C
STYRENE	NA	12000* [6]	Buchman, 2008	6500	N
TETRACHLOROETHENE	1,020 [4]	16875 [7]	Buchman, 2008	3	C
TOLUENE	630 [4]	80625*	Buchman, 2008	3000	N
TOTAL 1,2-DICHLOROETHENE	22400* [4]	840000* [5]	Buchman, 2008	140* [9]	N
TRANS-1,2-DICHLOROETHENE	22,400 [4]	840000 [5]	Buchman, 2008	1600	N
TRANS-1,3-DICHLOROPROPENE	79 [4]	2963 [5]	Buchman, 2008	55 [8]	C
TRICHLOROETHENE	200 [4]	7500 [5]	Buchman, 2008	14*	N
TRICHLOROFLUOROMETHANE	1,200 [4]	240000 [7]	Buchman, 2008	18000	N
VINYL CHLORIDE	NA	348750* [6]	Buchman, 2008	4	C
O-XYLENES	NA*	131250* [6]	Buchman, 2008	5700*	N
TOTAL XYLENES	230 [6]	4875 [6]	Suter and Tsao, 1996	5600	N

NA = Not Available

* The screening level changed since the 2008 update to support the OU3 Rounds 1 through 4 Data Evaluation Report (Tetra Tech, July 2009). Acute and chronic ecological changes were based on updated marine values or updated source of criteria. Updates to human health levels were based on changes in toxicity criteria or risk calculation methodology. Appendix C.5 provides a discussion of updated human health risk calculation methodology.

** Additional analyte included in Target Compound List Volatile Organic Compound analysis in Round 10.

Footnotes:

1 - Ecological acute values apply only to seeps that emerge above the mean mid-tide line and cause furrows in the sediment above mid-tide.

2 - Chronic ecological value presented is the chronic screening level multiplied by a diulition factor of 375 (minimum calculated dilution factor for OU3).

3 - The human health screening levels presented on this table for correspond to an incremental lifetime cancer risk of 1×10^{-6} or a hazard index of 0.1. These screening levels are based on recreational exposure to surface water in the intertidal area. The screening levels were calculated in accordance with the methodology presented in Appendix C.5.

TABLE 4-7

UPDATED AQUEOUS SCREENING LEVEL SUMMARY
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4 - Acute value was calculated by multiplying the acute lowest observable effect level (LOEL) by 0.1 (to estimate an acute no observable effect level [NOEL]). Chronic value was calculated by multiplying acute value by 0.1.

5 - Chronic vaule was calculated by multiplying the acute LOEL by 0.01 to estimate a chronic NOEL.

6 - Value is based on freshwater criterion.

7 - Value was calculated by multiplying the chronic LOEL by 0.1 to estimate a chronic NOEL.

8 - 1,3-Dichloropropene used as a surrogate.

9 - Cis-1,2-dichloroethene value used as a surrogate.

Sources:

Buchman, M. F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, 34 pages. http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html

Suter, G.W. II. and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Constituents of Concern for Effects on Aquatic Biota:1996 Revision. Environmental Sciences Division, Oak Ridge National Laboratory. ES/ER/TM-96/R2.

Response. Intermittent Bulletin, Volume 3, Number 2. EPA540/F-95/038. January.

USEPA, 2009. National Recommended Water Quality Criteria: 2009. Office of Water.

TABLE 4-8

**COMPARISON OF ROUNDS 1 THROUGH 5 AND ROUND 10 VOC GROUNDWATER MONITORING DATA(1)
OU3 POST-REMEDIAL OM&M PROGRAM
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE**

Parameter	Rounds 1-5					Round 10					Human Health Screening Criteria (2)	Ecological Screening Criteria (2)
	FOD	Range of Detections	Location of Maximum Concentration	Sample with Maximum Concentration	Range of Non-detects	FOD	Range of Detections	Location of Maximum Concentration	Sample with Maximum Concentration	Range of Non-detects		
VOLATILES (µg/L)												
1,1,1-TRICHLOROETHANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	120000	117000
1,1,2,2-TETRACHLOROETHANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	21	33825
1,1,2-TRICHLOROETHANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	82	712500
1,1,2-TRICHLOROTRIFLUOROETHANE	10/51	18 J - 170	JW-9	OU3GWJW91206	1 - 5	2/11	16 - 32	JW-9	OU3GWJW090411	0.5 - 0.5	1300000	NA
1,1-DICHLOROETHANE	7/51	0.5 J - 17	JW-13B	OU3GWJW13B0407	1 - 5	2/11	0.62 J - 10	JW-13B	OU3GWJW13B0411	0.5 - 0.5	830	17625
1,1-DICHLOROETHENE	5/51	1.6 - 3 J	JW-13B	OU3GWJW13B0706	1 - 5	1/11	1.6	JW-13B	OU3GWJW13B0411	0.5 - 0.5	3400	9375
1,2,3-TRICHLOROBENZENE	---	---	---	---	---	0/11	---	---	---	0.5 - 0.5	14	3000
1,2,4-TRICHLOROBENZENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	29	2025
1,2-DIBROMO-3-CHLOROPROPANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.75 - 0.75	4.5	NA
1,2-DIBROMOETHANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	2.9	NA
1,2-DICHLOROBENZENE	6/51	2 J - 3 J	JW-13B	OU3GWJW13B0706	1 - 5	1/11	2.8	JW-13B	OU3GWJW13B0411	0.5 - 0.5	2400	15750
1,2-DICHLOROETHANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	62	423750
1,2-DICHLOROPROPANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	120	114000
1,3-DICHLOROBENZENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	NA	7388
1,4-DICHLOROBENZENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	270	4838
2-BUTANONE	0/51	---	---	---	5 - 10	0/11	---	---	---	2.5 - 2.5	77000	5250000
2-HEXANONE	0/51	---	---	---	1 - 5	0/11	---	---	---	2.5 - 2.5	560	37125
4-METHYL-2-PENTANONE	0/51	---	---	---	1 - 5	0/11	---	---	---	2.5 - 2.5	9000	63750
ACETONE	1/42	9.1 J	JW-13B	OU3GWJW13B1007	5 - 10	0/11	---	---	---	2.5 - 2.5	120000	562500
BENZENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	60	41250
BROMOCHLOROMETHANE	---	---	---	---	---	0/11	---	---	---	0.5 - 0.5	NA	NA
BROMODICHLOROMETHANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	82	240000
BROMOFORM	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	700	120000
BROMOMETHANE	0/51	---	---	---	1 - 5	0/11	---	---	---	1 - 1	160	6000
CARBON DISULFIDE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	5600	345
CARBON TETRACHLORIDE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	40	187500
CHLOROBENZENE	3/51	0.5 J - 0.6 J	JW-13B	OU3GWJW13B0706	1 - 5	0/11	---	---	---	0.5 - 0.5	780	48750
CHLORODIBROMOMETHANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	64	240000
CHLOROETHANE	0/51	---	---	---	1 - 5	0/11	---	---	---	1 - 1	NA	NA
CHLOROFORM	4/51	0.4 J - 0.94 J	JW-8	OU3GWJW081007	1 - 5	0/11	---	---	---	0.5 - 0.5	150	675
CHLOROMETHANE	2/51	0.8 J - 0.9 J	HW-3	OU3GWHW30407	1 - 5	0/11	---	---	---	1 - 1	NA	NA
CIS-1,2-DICHLOROETHENE	8/51	0.5 J - 20	JW-13B	OU3GWJW13B0407	1 - 5	3/11	0.25 J - 11	JW-13B	OU3GWJW13B0411	0.5 - 0.5	140	840000
CIS-1,3-DICHLOROPROPENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	44	2963
CYCLOHEXANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	NA	NA
DICHLORODIFLUOROMETHANE	5/51	0.37 J - 16	JW-9	OU3GWJW090408	1 - 5	1/11	1.3 J	JW-13B	OU3GWJW13B0411	1 - 1	15000	NA
ETHYLBENZENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	130	9375
ISOPROPYLBENZENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	1700	NA
M+P-XYLENES	0/31	---	---	---	10 - 10	---	---	---	---	---	5600 (3)	4875 (3)
METHYL ACETATE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.75 - 0.75	130000	NA
METHYL CYCLOHEXANE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	NA	NA
METHYL TERT-BUTYL ETHER	4/51	0.9 J - 2 J	JW-9	OU3GWJW90407/ OU3GWJW91206	1 - 5	0/11	---	---	---	0.5 - 0.5	3500	1875000
METHYLENE CHLORIDE	2/51	2.9 - 6.7	JW-9	OU3GWJW091007	1 - 5	0/11	---	---	---	2.5 - 2.5	790	240000
O-XYLENE	0/31	---	---	---	5 - 5	---	---	---	---	---	5700	131250
STYRENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	6500	12000
TETRACHLOROETHENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	3	16875
TOLUENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	3000	80625
TOTAL 1,2-DICHLOROETHENE	5/31	1 J - 20	JW-13B	OU3GWJW13B0407	10 - 10	---	---	---	---	---	140 (4)	840000 (4)
TOTAL XYLENES	0/51	---	---	---	1 - 15	0/11	---	---	---	1.5 - 1.5	5600	4875
TRANS-1,2-DICHLOROETHENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	1600	840000
TRANS-1,3-DICHLOROPROPENE	0/51	---	---	---	1 - 5	0/11	---	---	---	0.5 - 0.5	55	2963
TRICHLOROETHENE	6/51	0.7 J - 2 J	JW-13B	OU3GWJW13B0706	1 - 5	0/11	---	---	---	0.5 - 0.5	14	7500
TRICHLOROFLUOROMETHANE	0/51	---	---	---	1 - 5	0/11	---	---	---	1 - 1	18000	240000
VINYL CHLORIDE	4/51	0.7 J - 2 J	JW-13B	OU3GWJW13B1206-D	1 - 5	1/11	1.1 J	JW-13B	OU3GWJW13B0411	1 - 1	4	348750

1- Values were updated in November 2011 based on updated criteria as presented in Table 4-5.
2 - Total xylenes used as a surrogate.
3 - cis-1,2-Dichloroethene used as a surrogate.

continue to be greatest at JW-13B (downgradient shallow bedrock well). The main VOCs detected at this well are vinyl chloride, cis-1,2-dichloroethene, total 1,2-dichloroethene, and trichloroethene. The Navy recommended that the analytical program for VOCs for the next 5-year sampling round be reduced to these four VOCs. Based on MEDEP comments on the Second Five-Year Review Report (provided in Appendix E), the cis-isomer of 1,2-dichloroethene was found to be the primary constituent of the total value, and therefore, analysis for total 1,2-dichloroethene is not necessary for the next 5-year sampling round. However, 1,1-dichloroethane will be analyzed for the next 5-year sampling round. The removal of VOCs from the analytical program should be considered after the next 5-year sampling round.

4.5.2.2 O&M Data Review

Minor landfill maintenance items identified during the routine inspections are listed in the inspection reports. Maintenance activities have been conducted and are ongoing. Maintenance items recommended in the Round 10 Data Package (Tetra Tech, July 2011b), items that have been addressed, and remaining maintenance items are provided in Table A-1. Tilted gas vents (as shown on Figure 4-4) with settlement/heave at their bases and possible minor slope movement upslope of the access road east of the JILF parking area and west of Building 357 (based on a comparison of 2006 and 2011 topographic mapping) are indicators of potential slope instability and should be further investigated.

4.5.3 ARAR and Site-Specific Action Level Changes

The remedial action implemented for soil/fill material at the JILF includes a hazardous waste landfill cover, LUCs, landfill and shoreline erosion controls, and monitoring. ARARs and TBCs were reviewed to determine whether there have been changes since the ROD, ESDs, and OM&M Plan were issued. ARARs tables from the OU3 ROD and ESDs are provided in Appendix C.3. Because the cover and erosion controls have been constructed, the only changes in ARARs and TBCs that could affect the remedy at this time are related to the OM&M components of the remedy. The post-remedial OM&M Plan for OU3, finalized in June 2006 and revised in 2011, outlines the activities to be conducted as part of the OM&M program. The ARARs and TBCs used to develop the criteria for the monitoring program are the following chemical-specific ARARs and TBCs for OU3:

- Clean Water Act, Section 304(a), National Recommended Water Quality Criteria.
- Maine Surface Water Toxics Control Program, Chapter 530.5, Statewide Water Quality Criteria.
- USEPA health advisories for drinking water, risk RfDs, and CSFs.
- State of Maine Guidance Manual for Human Health Risk Assessments at Hazardous Substance Sites (June 1994 updated in July 2009).

Other ARARs and TBCs used to develop the OM&M program for OU3 are as follows:

- 40 CFR, Subpart F, Releases from Solid Waste Management Units (264.95 and 264.97)
- 40 CFR, Subpart N, Closure and Post-Closure Care (264.310)
- Maine Hazardous Waste Management Rules, Chapter 854
- RCRA Subtitle C, Subpart F, 264.101 Corrective Action for Solid Waste Management Units
- Maine Solid Waste Management Regulations, Chapter 405
- Maine Solid Waste Management Regulations, Chapter 401

The ARARs and TBCs were used to develop the OM&M program as discussed in Section 1.6.2 of the Post-Remedial OM&M Plan for OU3. Several ecological and human health action levels were developed in the OM&M Plan using guidance and sources not listed in the ARARs tables. The water quality criteria are updated periodically, and any updates that affect the monitoring program are taken into account as part of evaluation of groundwater monitoring data. For chemicals that do not have water quality criteria, ecological action levels were developed as part of the OM&M program using other sources, as shown in Table 4-5. There was an update to one of the sources and the ecological action levels were updated for the identified chemicals. The human health action levels for the OU3 OM&M groundwater monitoring program were calculated using RfDs and CSFs in accordance with current risk guidance. The risk guidance, RfDs, and CSFs are updated periodically, and any updates that affect the monitoring program are taken into account as part of the evaluation of groundwater monitoring data. Changes to action levels and screening levels based on changes in standards for ARARs or TBCs (including risk guidance, RfDs, and CSFs) are provided in Tables 4-5 and 4-7. The updated action and screening levels were used for comparison to data in this five-year review evaluation. A comparison of the updated action and screening levels to the previous levels is included in Appendix C.5.

4.5.4 Site Inspection

The Round 10 inspection, which included a LUC inspection, was conducted in April 2011 and was used to support the five-year review. The site inspection checklist completed based on the Round 10 inspection is provided in Appendix A. Tetra Tech personnel took photographs of site features in August 2011 and the photographs are included in Appendix B. In addition, Tetra Tech confirmed in October 2011 that a copy of the LUC RD, which includes the LUC boundary map and a list of LUCs that have been implemented, was submitted to the appropriate record offices of the City of Portsmouth, New Hampshire, and Town of Kittery, Maine.

4.5.5 Site Interviews

No interviews were conducted as part of the Second Five-Year Review.

4.6 TECHNICAL ASSESSMENT

The following conclusions support the determination that the remedy for OU3 is currently protective of human health and the environment.

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

- ***Remedial Action Performance and Monitoring Results:*** A hazardous waste landfill cover was installed at the JILF and is currently effective in limiting direct exposure to contaminated soil and waste materials. The cover also reduces infiltration of precipitation/runoff through contaminated soil and waste materials. Shoreline erosion controls are minimizing the potential for washing away of soil and waste materials from the edge of the JILF (Clark Cove area). Contaminated soil and waste materials were excavated from the area adjacent to Jamaica Cove, and wetlands were created in the excavated area; therefore, erosion from the JILF in this area is no longer a concern. A groundwater and landfill gas monitoring program is being conducted to evaluate the performance of the remedy regarding minimizing contaminant migration and to ensure that groundwater contaminants are not at concentrations that could adversely impact the offshore environment. Data from the first 10 rounds of sampling have shown that no COC concentrations exceeded action levels. Concentrations are generally steady, and for the majority of the COCs, concentrations are not projected to exceed action levels based on trend analyses. Landfill gas concentrations were not greater than acceptable levels.

- ***System Operations/O&M/Costs:*** Installation of the hazardous waste landfill cover was completed in 2004. An O&M Manual was developed in 2006, and an O&M program was initiated in July 2006. The O&M Manual was updated to include sampling plan modifications to the program (included in Revision 1 of the OM&M Plan, Tetra Tech, December 2011). The cap system is functioning as intended, and maintenance is performed as needed to maintain proper long-term performance of the landfill cover and shoreline erosion protection.

  Monitoring of groundwater and landfill gas began in July 2006 and has continued through the most recent event in April 2011, with 10 rounds of sampling and analysis to date. The projected annual monitoring costs in the ROD, listed below, were projected prior to the development of the monitoring plan and assumed the following: annual sampling and analysis of 16 wells for VOCs, SVOCs, and metals and eight wells for pesticides; 10 filtered and unfiltered surface water samples for SVOCs, metals, pesticides, and PCBs; and 30 sediment samples for metals, PAHs, pesticides, PCBs, and limited dioxins; and validation and reporting.

TABLE 4-9: PROJECTED ANNUAL MONITORING COSTS FROM THE ROD

Source	Year	Projected Cost of Monitoring
ROD	1 to 5 6 to 30 Every 5 Years	$88,900 $86,900 $12,000

O&M of the cap system began in July 2006 and has continued for 10 events through April 2011. The projected annual maintenance costs in the ROD, listed below, were projected prior to the development of the O&M plan and assumed inspection and replacement of 25 percent of wetland plants, soil cap maintenance, and asphalt cap patching during Year 1; soil cap maintenance and asphalt cap patching during Years 2 through 4 and Years 6 through 9; soil cap maintenance and asphalt cap patching, crack repair, and clean and seal pavement during Years 5, 15, and 25; and soil cap maintenance and repaving the asphalt cap (1½ inches thick) during Years 10, 20, and 30.

TABLE 4-10: PROJECTED ANNUAL MAINTENANCE COSTS FROM THE ROD

Source	Year	Projected Cost of O&M
ROD	1 2 to 4 and 6 to 9 5, 15, and 25 10, 20, and 30	$62,800 $7,800 $64,700 $169,800

Actual costs for each OM&M round and documents prepared since the First Five-Year Review Report were estimated. Except as noted, actual costs include project planning (including mobilization and demobilization activities), field sampling, laboratory analysis, survey, maintenance, project meetings, and reporting (including data validation and data management), as appropriate. The following provides a comparison of actual and projected combined total monitoring and O&M costs by year. Large maintenance items are noted.

TABLE 4-11: COMPARISON OF ACTUAL COST AND PROJECTED COST FOR OU3

Year of Monitoring	Fiscal Year	Round/ Document	Actual Cost	Notes	Actual Total Annual Cost	Projected Total Annual Cost
1	FY06	1	$8,800+	Round 1 and 2 actual labor costs for project planning, mobilization, field work, and reporting are not available	$14,900+	$151,700
	FY07	2	$6,100+			

Year of Monitoring	Fiscal Year	Round/ Document	Actual Cost	Notes	Actual Total Annual Cost	Projected Total Annual Cost
2	FY07	3	$9,200+	Round 3 actual labor costs for project planning, mobilization, field work, and reporting are not available	80,900+	96,700
	FY08	4	$71,700			
3	FY08	5	$41,400		$145,000	$96,700
	FY09	Rounds 1 through 4 Report	$65,400			
	FY09	6	$38,200			
4	FY09	7	$50,200		$128,000	96,700
	FY10	8	$77,800	Culvert repair conducted		
5	FY10	9	$46,000	Large area reseeding conducted	$86,300	165,600
	FY10	Rounds 1 through 9 Report	$40,300			
6	FY11	10	$55,400	Topographic survey conducted	$101,300	$96,700
	FY12	OM&M Plan Update	$45,900	Plan update conducted over multiple years (4 to 6); costs included in Year 6 only		

Actual costs were generally in the range of +50 and -30 percent of the projected costs in the ROD, although actual Year 5 costs were approximately 50 percent less than projected costs. The analytical program included fewer samples than the ROD cost estimate, but the costs for monitoring and inspection were greater than anticipated because semi-annual monitoring, instead of annual monitoring as assumed in the ROD cost estimate, was conducted. Actual maintenance costs were less than projected because major maintenance (such as wetland planting, large area soil cap maintenance and asphalt patching, and sealing of pavement) has not been required for most rounds. Well abandonment (completed in December 2011) and repair of storm water drainage from the parking area (planned for January 2012) are considered part of Round 11 costs and are not included in the costs presented above. The annual costs for Round 11 and subsequent rounds are expected to be less than projected because of the reduction of monitoring frequency to annual and reductions in analytical program.

- ***Opportunities for Optimization:*** The OM&M Plan descriptions of opportunities for optimization and the evaluations of those opportunities are presented below:

  The OM&M Plan indicated that after the first four rounds, if concentrations of organic chemicals in JW-13B exceed action levels and are greater than concentrations in JW-13D, the well will be retained in the monitoring program. Concentrations of organics did not exceed action levels, and JW-13B was not retained in the OM&M program. However, VOC concentrations in JW-13B were greater than in JW-13D, and to address MEDEP concerns regarding VOC concentrations in JW-13B, JW-13B will be analyzed for VOCs during the 5-year sampling events to support the five-year reviews. Evaluation of VOC data, as provided in Appendix D.1, recommends reduction of the VOC analyte list to four VOCs. Based on the responses to the MEDEP comments on the draft document (provided in Appendix E), continued total 1,2-dichloroethene analysis is not required. Instead 1,1-dichloroethane will be included and four representative VOCs will be analyzed for during the next five-year sampling round (vinyl chloride, cis-1,2-dichloroethene, trichloroethene, and 1,1-dichloroethane).

  The OM&M Plan called for evaluating the first four rounds of data and, if warranted, reducing the sampling frequency and/or selecting a sampling season. In addition, the plan called for evaluation of whether modifications to the monitoring program (e.g., frequency, analytes, etc.) are necessary at a minimum of every 5 years from the start of the monitoring program and to make the appropriate recommendations to the regulators. Modifications to the monitoring program will be made in consultation with the regulators. The modifications after the first four rounds and first 5 years of monitoring were made based on the conclusions in the Rounds 1 through 4 Data Evaluation Report and the Rounds 1 through 9 Data Evaluation Report, respectively. The changes included a reduction of the analytical list beginning with Round 6 and decreasing the sampling frequency to annually after the Round 9. In addition, the analytical program was reduced to arsenic for annual rounds and PAHs and metals every 5 years, as recommended in the Rounds 1 through 9 Data Evaluation Report.

  Initially groundwater samples were analyzed for organics (VOCs, SVOCs, pesticides, and PCBs) and metals (total and filtered). After evaluation of the first four rounds, beginning with Round 6, the analytical list was reduced to PAHs and metals, and other organic compounds detected in groundwater at concentrations exceeding screening levels. No organic compound concentrations exceeded screening levels; therefore, PAHs and metals were identified as the COCs for continued monitoring after evaluation of the Rounds 1 through 4 data.

  Initially, methane gas readings were taken at the beginning, middle, and end of rising water levels (for wells in the vicinity of the probes). If the differences in the readings were not significant, the Navy would reduce the number of readings to be taken from one or more probes. Based on the Rounds 1 through 9 data, it was recommended and accepted that methane gas be monitored only at high tide because there was little to no variation in readings between water levels. It was also recommended and agreed upon in the Rounds 1 through 9 Data Evaluation Report that landfill gas monitoring be conducted on an annual, rather than a semi-annual basis for Rounds 10 and 11, and then results would be re-evaluated to determine whether continued annual monitoring or monitoring at a reduced frequency is required.

For monitored groundwater COCs (PAHs and metals), results must be projected to be less than action levels, based on statistical trend plots, during three consecutive five-year reviews before they can be eliminated; therefore, no additional parameters can be eliminated now.

- ***Early Indicators of Potential Remedy Problems:*** Tilted gas vents with settlement/heave at their bases and possible minor slope movement upslope of the access road east of the JILF parking area and west of Building 357 are indicators of potential slope instability, and should be further investigated. Evaluation of cap internal drainage pipes did not indicate problems; however, due to limitations of the evaluation, the cap surface in the area shown on Figure 4-4 should be observed for ponding or unstable soil during regularly scheduled inspections. The pipes of interest are greater than 800 feet from the tilted gas vents near the East Road; therefore, the pipe and gas vent issues are not related.

- ***Implementation of Institutional Controls and Other Measures:*** The LUC RD was finalized, provided to PNS, and implemented in August 2011. A copy of the LUC RD was submitted to the appropriate land record offices of the City of Portsmouth, New Hampshire, and Town of Kittery, Maine. It was verified on October 4, 2011, that the LUC RD was present at these locations. Verification of LUCs is a component of the O&M inspections, and the LUC inspection checklist will be completed as part of O&M inspections. As part of this five-year review site inspection, LUC verification activities were conducted. As discussed in Section 1.0, Tetra Tech inspection personnel verified with Shipyard environmental personnel that there were no significant changes to the Shipyard excavation policy. As part of the OU3 inspection, Shipyard environmental personnel indicated that there has been no unauthorized disturbance of the cap, and the inspection of OU3 verified this. The only authorized disturbance was the placement of signs around the landfill indicating that no disturbance of the cap is allowed. Groundwater is not used at OU3; the only wells are groundwater monitoring wells.

Question B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

- ***Changes in Exposure Pathways:*** There have been no changes at the site that would have resulted in new exposure pathways to human or ecological receptors. Based on the completion of remedial construction activities, there are no longer seeps in the intertidal area, and most of the mid- to high tide intertidal area sediments are covered by the shoreline erosion controls. Therefore, no exposure to seeps or sediments in the intertidal area are expected.

- ***Changes in Land Use:*** There have been no changes in land use at the site that would have resulted in new exposure pathways to human or ecological receptors.

- ***New Contaminants and/or Contaminant Sources:*** There have been no new contaminants or contaminant sources at the site.

- ***Remedy Byproducts:*** There are no byproducts from the remedy.

- ***Changes in Standards, Newly Promulgated Standards, and TBCs***: ARARs and TBCs considered during preparation of the ROD and ESDs were reviewed to determine changes to standards since the remedial design and OM&M Plan were issued. For OU3, human health action levels are calculated using toxicity criteria (RfDs and CSFs), that are identified as TBC for OU3. There were updates to the toxicity criteria, as noted in Table 4-5, which directly affected certain action levels due to the updated RfDs/CSFs being used in calculation. For chemicals that do not have water quality criteria (ARARs), ecological action levels were developed as part of the OM&M program using other sources, as shown in Table 4-5. There was an updated to one of these sources that affected the ecological action levels. None of the criteria changes affect protectiveness as long as the landfill cap remains in place and uncompromised, eliminating the chance of exposure. Side-by-side comparisons of the updated and previous action levels and screening levels are included in Appendix C.5, Tables C5-1 and C5-2, respectively.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in human health toxicity criteria that would impact the monitoring criteria.

- ***Expected Progress Towards Meeting RAOs:*** The RAOs for OU3 are being met by the hazardous waste landfill cover and shoreline erosion controls, by conducting groundwater and landfill gas monitoring and O&M activities, and by implementing and maintaining LUCs. Table 4-2 summarizes the achievement of RAOs by remedy components.

- ***Changes in Risk Assessment Methods:*** Except for groundwater monitoring, the remedy components are not chemical specific, and changes in risk assessment methodology would not impact the protectiveness of the remedy. Groundwater monitoring action levels for human health are risk based, and this five-year review evaluation was based on risk assessment methods and criteria. Groundwater monitoring action levels for ecological receptors are based on screening benchmarks such as water quality criteria and are not developed using risk assessment methodologies. This five-year review evaluation of groundwater monitoring data for ecological receptors was based on current criteria.

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

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

4.7 ISSUES

No issues related to current site operating conditions or activities currently prevent the remedy from being protective; however, tilting gas vents and possible minor slope movement may be indicators potential landfill slope instability or potential veneer failure of the cap at that location. During a video inspection of pipe in the cap's internal drainage layer, a portion of pipe was found to be partially buckled. The partially buckled portion was determined to allow adequate flow; however, the buckled pipe prevented video camera access to the remaining portion of the pipe for inspection. Confirmation of adequate pipe capacity can be determined by observation of the ground surface. Topographic survey data collected in April 2011 have been reviewed and do not indicate cap settlement.

4.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Based on the results of the site inspection and review, the following recommendation is made for OU3:

TABLE 4-12: OU3 ISSUES AND RECOMMENDATIONS

Issue	Recommendations/ Required Actions	Responsible Party	Oversight Agency	Mile-stone Date	Affects Protectiveness	
					Current	Future
Tilted gas vents and possible minor slope movement upslope of the access road east of the JILF parking area.	Investigate cause and condition of tilted gas vents and possible slope movement.	Navy	USEPA and MEDEP	2013	No	Possibly
Internal drainage pipe is damaged in at least one place within the cap.	Conduct inspection of the area as part of the O&M program, with no further revaluation unless there is ponding in that area for an extended period of time, or unstable soil	Navy	USEPA and MEDEP	2013	No	Possibly

4.9 PROTECTIVENESS STATEMENT

The remedy at OU3 is currently protective of human health and the environment. The source of contamination is contained. The hazardous waste landfill cover minimizes infiltration and subsequent contaminant migration and prevents direct contact with soil. A landfill gas monitoring and O&M program is being implemented to verify that the cap is performing as designed, and the results of the program indicate that the cap is performing as planned. Groundwater monitoring is being implemented to verify that unacceptable groundwater migration is not occurring. Continued implementation of LUCs and OM&M and investigation and any necessary action to address the identified issues (Section 4.7) will maintain the effectiveness of the remedy into the future.

5.0 OPERABLE UNIT 4

OU4 consists of the areas offshore of PNS that were potentially affected by PNS onshore IRP sites and Site 5 – Former Industrial Waste Outfalls, a site that had offshore impacts but no onshore impacts. An interim remedy (monitoring) is being conducted for OU4 until a final remedy is implemented. A five-year review for OU4 is being conducted because hazardous substances, pollutants, or contaminants remain in offshore areas in excess of levels that allow for unlimited use and unrestricted exposure.

5.1 SITE CHRONOLOGY

The following table provides the site chronology for investigation and interim remedy activities and includes a brief summary of these activities for OU4.

TABLE 5-1: OU4 SITE CHRONOLOGY AND DOCUMENTATION

INVESTIGATION/ INTERIM REMEDY ACTIVITY	DATE	ACTIVITIES	AR NUMBER
IAS (Weston) and FCS (LEA)	1983	Industrial waste outfalls were first identified as a site in the IAS. The outfalls were used to discharge industrial wastes into the Piscataqua River from approximately 1945 until 1975. Sediment sampling in the offshore began in the FCS.	N00102.AR. 000002 and N00102.AR. 000012 and 000013
Phase I and Phase II Sampling	1991 to 1993	Offshore sampling was conducted to provide data to support human health and ecological risk assessments for the PNS offshore area. As part of the sampling, six AOCs were identified as nearshore habitats adjacent to PNS that may have been affected by onshore IRP sites.	NA
Human Health Risk Assessment (HHRA) for Offshore Media (McLaren/Hart) and Phase I/Phase II Offshore Data Comparison (Tetra Tech)	1994 and 1998	The 1994 HHRA was based on the Phase I data and the results were updated in 1998 based on the Phase II data. Based on the assessment, human health risks for exposure to sediment and surface water were acceptable; risks from consumption of seafood exceeded regulatory guidelines. However, the HHRA could not differentiate whether the chemicals that could cause the risk were from PNS sources or from other sources within the lower Piscataqua River.	N00102.AR. 000229 and N00102.AR. 000606
Interim ROD (Navy) and Interim Offshore Monitoring Plan (Tetra Tech)	1999	Based on the results of the revised draft final EERA (finalized in 2000), an interim remedy for offshore monitoring was selected in May 1999. A monitoring plan was prepared and the first round of monitoring was conducted in October 1999. The monitoring program is discussed in Section 5.3.2.	N00102.AR. 000676 and N000102.AR .000750

TABLE 5-1: OU4 SITE CHRONOLOGY AND DOCUMENTATION

INVESTIGATION/ INTERIM REMEDY ACTIVITY	DATE	ACTIVITIES	AR NUMBER
EERA (NCCOSC)	2000	An ecological risk assessment for the PNS offshore area was conducted using the 1991 to 1993 data. Although the document was finalized after the Interim ROD, the risk results supported selection of the interim remedy. Phase I and Phase II data were used to assess potential risks to the estuarine environment in the vicinity of PNS. The risk determinations associated with surface water and sediment exposure for each AOC and the chemicals of potential concern (COPCs) for each AOC were identified. The ecological risks associated with exposure to surface water were determined to be acceptable, and the ecological risks associated with exposure to sediment were determined to be potentially unacceptable. Sediment COPCs included metals, PAHs, and PCBs.	N00102.AR. 000838
Preliminary Remediation Goals (PRGs) for Offshore Media (Tetra Tech)	2001	PRGs for OU4 were developed using Interim Offshore Monitoring Round 2 data. The PRGs supported identification of Interim Remediation Goals (IRGs) for COCs for the monitoring program. IRGs were developed for selected metals and PAHs (see Section 5.3.2).	N00102.AR. 001062
Baseline Interim Offshore Monitoring Report (Tetra Tech)	2002	The first four rounds of Interim Offshore Monitoring data were evaluated to determine whether modifications to the program were necessary (see Section 5.3.2).	N00102.AR. 001150
Rounds 1 to 7 Interim Offshore Monitoring Report (Tetra Tech)	2004	Data evaluated to determine whether additional investigation (scrutiny) or monitoring (Rounds 8 and/or 9) was required for the monitoring stations (see Section 5.3.2).	N00102.AR. 001416 and N00102.AR. 001417
Additional Scrutiny investigations and Rounds 8 and 9 Interim Monitoring conducted	2004 to 2008	Two phases of Additional Scrutiny and Rounds 8 and 9 monitoring were conducted (see Section 5.3.2).	NA
Rounds 1 to 10 Interim Offshore Monitoring Report (Tetra Tech)	2010	Evaluation of the first 10 rounds of sampling and two phases of Additional Scrutiny was conducted to determine whether modifications to the monitoring program were necessary (see Section 5.3.2).	N00102.AR. 001716
Interim Offshore Monitoring Plan update (Tetra Tech)	2010	The Interim Offshore Monitoring program was updated based on the conclusions and recommendations in the Rounds 1 to 10 Report (see Section 5.3.2).	N00102.AR. 002514

5.2 BACKGROUND

OU4 is the offshore area of the Piscataqua River and Back Channel around PNS potentially impacted by onshore IRP sites. OU4 includes Site 5 and six AOCs, as shown on Figure 1-2. As part of the Interim Offshore Monitoring Program, 14 interim offshore monitoring stations (MSs) are located around PNS in the AOC areas, and four reference stations are located in the Great Bay Estuary, as shown on Figures 5-1 and 5-2, respectively. Figure 5-3 shows the conceptual site model, including the location of the onshore IRP sites in relation to the MS locations.

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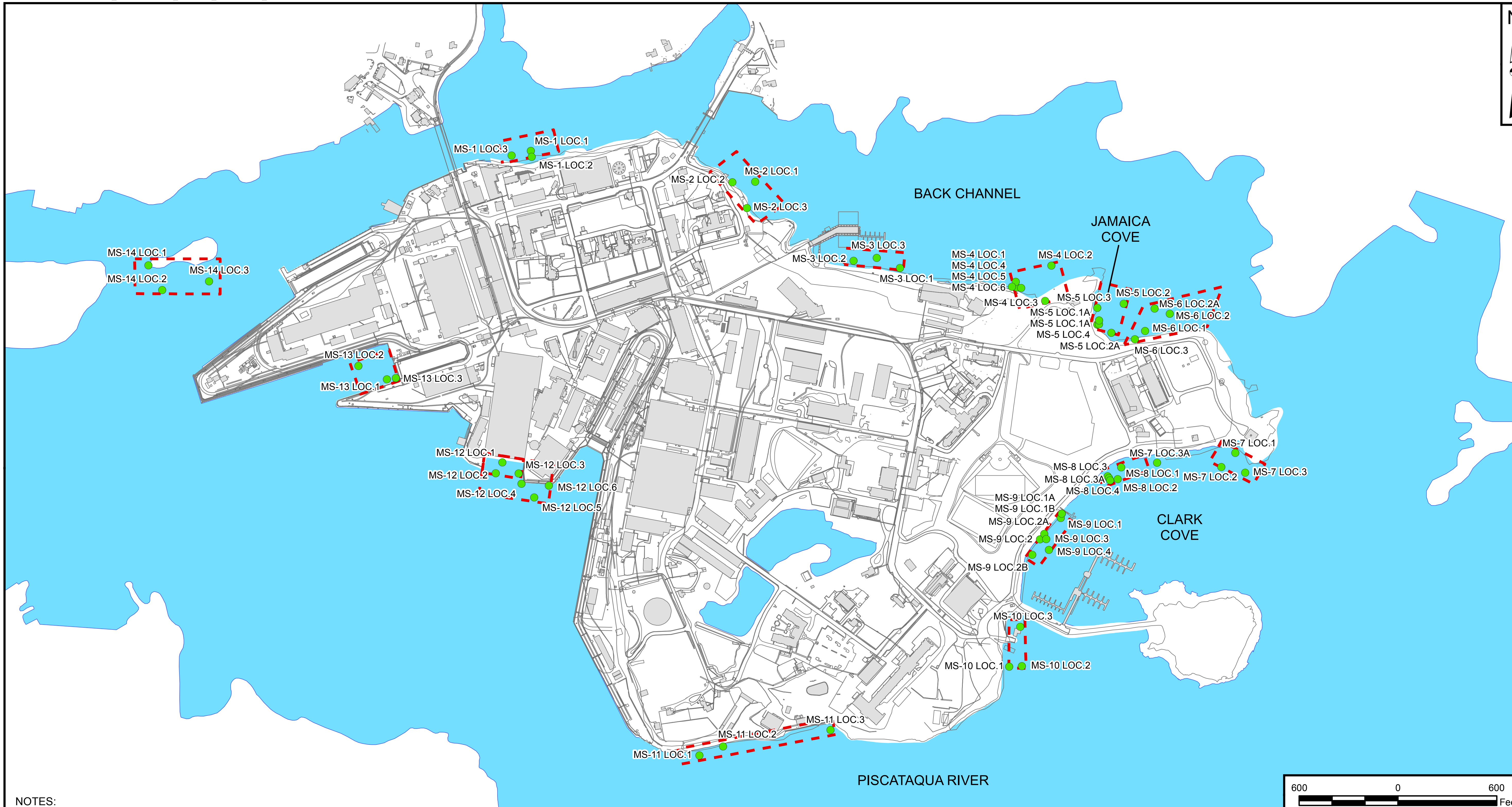


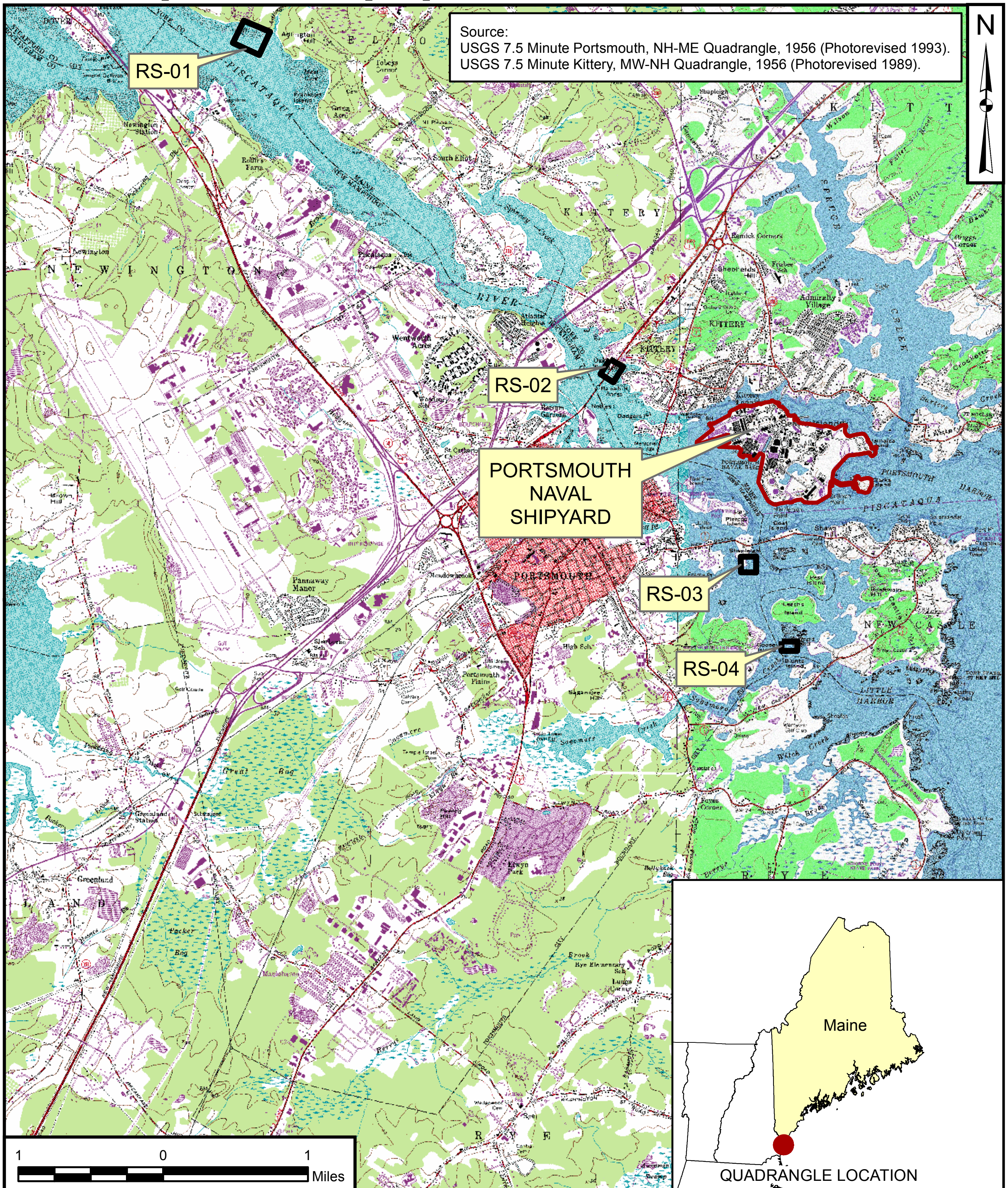
NOTES:
1) Source: 2010 basemap data, received from PSY.
2) This figure shows all sample locations within each monitoring station collected as part of the interim offshore monitoring program.

Legend

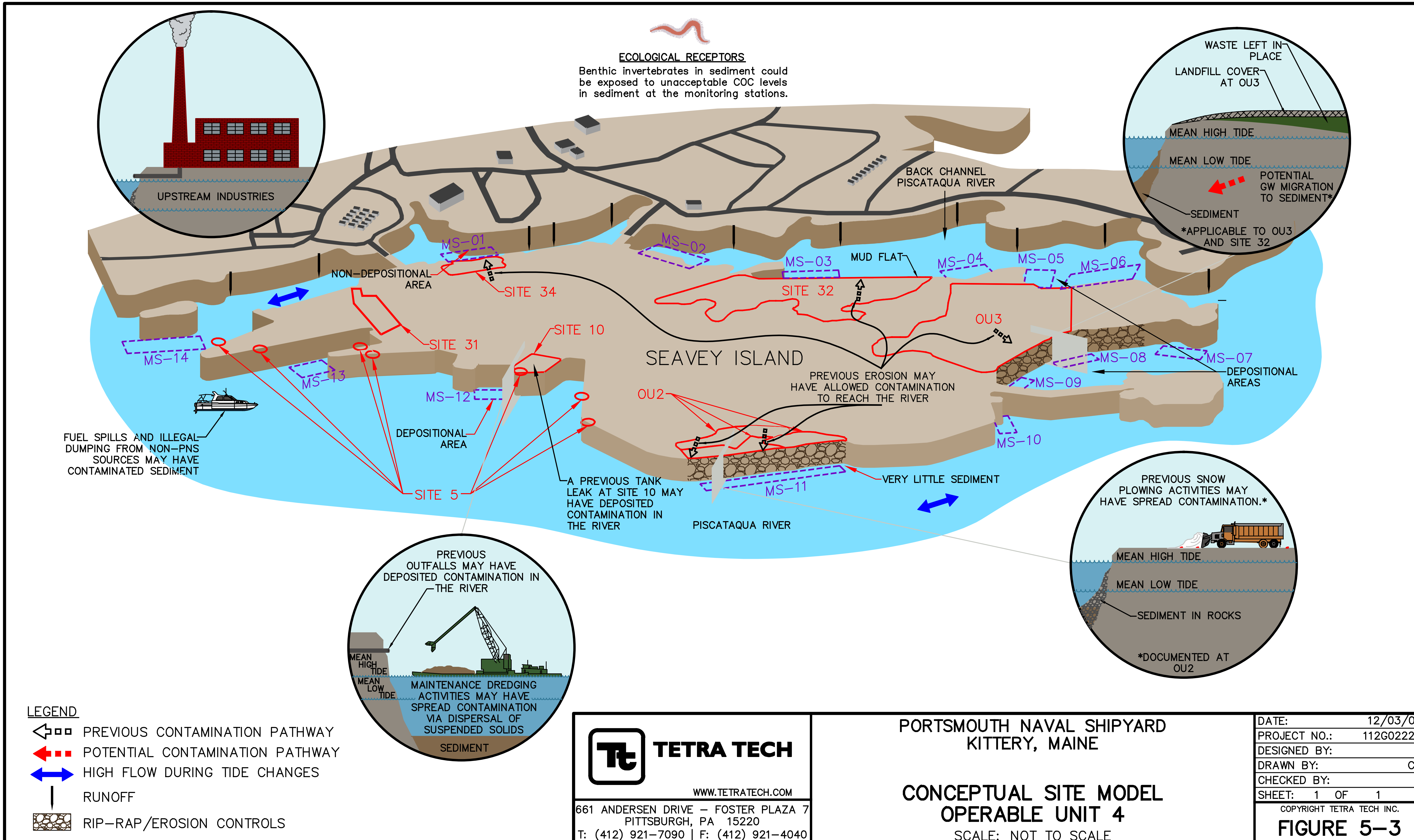
- Sampling Location within Monitoring Station (MS)
- Monitoring Station Location

DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
K. MOORE	09/30/11		2103	WE14
CHECKED BY	DATE	OVERVIEW OF OU4 MONITORING STATION LOCATIONS	APPROVED BY	DATE
N. BALSAMO	12/29/11	SECOND FIVE-YEAR REVIEW REPORT	—	—
REVISED BY	DATE	PORTSMOUTH NAVAL SHIPYARD	APPROVED BY	DATE
—	—		—	—
SCALE		KITTERY, MAINE	FIGURE NO.	REV
AS NOTED			FIGURE 5-1	0

PGH P:\GIS\PORTSMOUTH_NSY\MAPDOCS\MXD\REFERENCE_STATION_OVERVIEW.MXD 12/29/11 JEE



DRAWN BY K. MOORE	DATE 12/29/11	TETRA TECH	CONTRACT NUMBER 2103	CTO NUMBER WE14
CHECKED BY N. BALSAMO	DATE 12/29/11	OVERVIEW OF OU4 REFERENCE STATION LOCATIONS SECOND FIVE-YEAR REVIEW REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY ___	DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___	DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 5-2	REV 0



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Physical Characteristics

Site 5 – Former Industrial Waste Outfalls is a site that had offshore impacts but no onshore impacts. This site is located within the Dry Docks AOC, and any impacts that Site 5 may have had on the offshore are being addressed as part of the Dry Dock AOC. The six AOCs identified in the EERA as nearshore habitats adjacent to PNS that may have been affected by onshore IRP sites, are Clark Cove, Sullivan Point, DRMO Storage Yard, Dry Docks, Back Channel, and Jamaica Cove.

Land and Resource Use

The offshore area of PNS includes various habitats including wetlands, mudflats, rocky bottoms, eelgrass, salt marsh, and boat docks and piers. The different habitats support a diverse group of floral and faunal species such as phytoplankton, algae, and eelgrass along with invertebrates such as mussels and lobsters, birds such as gulls and herons, and mammals such as raccoons and mink, to just name a few.

There are several potential non-Navy sources of contamination in the Piscataqua River offshore of PNS, especially sources of metals and petroleum products. Petroleum products (i.e., fuel oil, diesel fuel, tar, etc.) and the incomplete combustion products of fuels from deposition on impervious surfaces outside the Shipyard facility can be sources of metals and PAHs and may migrate offshore via sheet flow or storm sewers. Also, boat traffic in the river is a potential source of PAHs to the offshore area. Finally, there are several industries along the Piscataqua River that may release contaminants into the river.

History of Contamination

Site 5 consisted of numerous discharge points along the Piscataqua River in the berth area by the dry docks at the western end of PNS (Figure 1-2). The outfalls were used from approximately 1945 to 1975 to discharge liquid industrial wastes (primarily from acidic, alkaline, and metal-plating rinse baths) to the offshore before the sanitary and storm sewer systems were separated and offshore discharge of industrial wastes was discontinued. The wastewaters may have contained heavy metals (mercury, lead, cadmium, chromium, copper, and zinc), oils and grease, and PCBs. Lead sediment from decommissioned batteries (as part of operations at Site 10) was also reportedly included in the discharges to the river before 1975 (Weston, June 1983). Maintenance dredging is conducted periodically in the berth areas. Dredging activities occurred between January 2002 and April 2002, between Interim Offshore Monitoring Program Rounds 5 and 6 (Tetra Tech, November 2004), and in 2009.

As part of the Phase I and Phase II sampling, additional areas of potential offshore contamination from onshore IRP sites were identified. These potential sources and associated offshore areas are discussed further in Section 5.3.2.

Initial Response

Discharges from Site 5 were discontinued in 1975. Other actions (see Section 5.3.2) were conducted at the onshore IRP sites to eliminate continued onshore IRP impacts to the offshore areas.

Basis for Taking Action

The HHRA for Offshore Media (McLaren/Hart, May 1994) and Phase I/Phase II Offshore Data Comparative Analysis (Tetra Tech, October 1998) provide human health risk assessment details for OU4. Based on the assessment, human health risks for exposure to sediment and surface water were acceptable; risks from consumption of seafood exceeded regulatory guidelines. However, the HHRA could not differentiate whether the chemicals that could cause the risk were from PNS sources or from other sources within the lower Piscataqua River. The Public Health Assessment for PNS prepared by the Agency for Toxic Substances and Disease Registry (ATSDR) in 2007 concluded that adults and children consuming fish or shellfish or wading in the surface water and sediment offshore of PNS are not likely to experience adverse health effects from the levels of chemicals in those media (ASTDR, November 2007).

The EERA evaluated potential risks associated with surface water and sediment exposure for each AOC. The ecological risks associated with exposure to surface water were determined to be acceptable, and the ecological risks associated with exposure to sediment were determined to be potentially unacceptable.

5.3 REMEDIAL ACTIONS

A final remedy has not been selected or implemented for OU4; however, an interim remedy was selected as documented in the Interim ROD for OU4 (Navy, May 1999). The Interim ROD requires the Navy to conduct monitoring in the offshore area of PNS in the interim period before a final remedy is selected and implemented for OU4. The Navy determined that interim monitoring was warranted for OU4 to provide current data on the offshore areas to determine whether onshore remedial actions, natural processes, and/or other sources have affected chemical concentrations in OU4. Monitoring began in 1999, and 11 rounds of sampling have been conducted to date. After the majority of remedial actions for the onshore sites were initiated, a draft FS for OU4 was prepared in 2010.

Selection of the interim remedy is discussed further in Section 5.3.1 and the interim remedy and the current status and schedule for OU4 are discussed in Section 5.3.2.

5.3.1 Remedy Selection

During implementation of the interim remedy, environmental conditions in the offshore AOCs are being determined by comparing concentrations of COCs in site media to IRGs for OU4. The IRGs are concentration-based levels that were developed to meet the following interim RAOs:

- Protect pelagic, epibenthic, eelgrass, and salt marsh communities by identification of exposure to COCs at unacceptable levels in the estuarine waters of the PNS offshore AOCs.

- Protect epibenthic, benthic, eelgrass, and salt marsh communities by identification of exposure to COCs at unacceptable levels in the sediment of the PNS offshore AOCs.

The COPCs identified for OU4 at the time of the Interim ROD included metals, PCBs, and PAHs. IRGs were identified for the COCs that accounted for the majority of risk (limiting COCs), which include several metals and PAHs. Lead was not originally identified as a limiting COC; however, an IRG was subsequently developed for lead because it is a COC at many of the onshore IRP sites. IRGs are discussed further under Remedy Implementation in Section 5.3.2.

The interim remedy consists of offshore monitoring of environmental media (e.g., sediment) in the areas offshore of PNS that were potentially affected by onshore IRP sites. Offshore environmental media are being monitored to determine whether, over the course of interim monitoring, current and future concentrations of COCs in the offshore AOCs are at acceptable levels (IRGs). In addition, the objectives of interim monitoring were identified as follows: (1) to provide information on the current condition of the offshore areas; (2) to provide information to support the identification and selection of any removal action, any additional interim action, or a final remedy; (3) to be consistent with any final remedial action; and (4) to provide a basis for any monitoring that may be incorporated as part of the final remedy. The Interim ROD provides for interim offshore monitoring in accordance with a monitoring plan that specifies the media, locations, analytes, procedures, frequency of sampling, and interim action decisions, including IRGs.

Table 5-2 presents a summary of the identified potential unacceptable risks at OU4, the interim RAOs established in the Interim ROD to address that risk, the interim remedy component to meet the RAOs, the metric/cleanup level considered, and the expected outcome of the implemented remedy component.

TABLE 5-2

**SUMMARY OF REMEDIAL ACTION OBJECTIVES FOR OU4
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE**

Risk	Interim RAO	Remedy Component	Metric/Cleanup Level	Expected Outcome
Potential unacceptable risks to ecological receptors from exposure to estuarine waters and sediment in the PNS offshore AOCs.	Protect pelagic, epibenthic, eelgrass, and salt marsh communities by identification of exposure to COCs at unacceptable levels in the estuarine waters of PNS offshore AOCs. Protect epibenthic, benthic, eelgrass, and salt marsh communities by identification of exposure to COCs at unacceptable levels in the sediment of PNS offshore AOCs.	Interim offshore monitoring in accordance with an interim offshore monitoring plan.	Metals, PAHs, and PCBs were identified as COCs in the interim ROD. The Interim Offshore Monitoring Plan (Revision 0, 1999) provides initial monitoring requirements and the development method for IRGs. Monitoring of offshore AOCs is conducted through sampling at 14 monitoring stations. The Interim Offshore Monitoring Plan was updated in 2010 (Revision 1) based on evaluation of the first 10 rounds of data. The 2010 plan provides the current interim offshore monitoring requirements and associated monitoring COCs for each monitoring station.	Interim offshore monitoring will be conducted at the identified monitoring station locations as provided in the 2010 Revision 1 Interim Offshore Monitoring Plan until a final remedy is implemented for OU4.

5.3.2 Remedy Implementation

In accordance with the Interim ROD, the Interim Offshore Monitoring Plan (Tetra Tech, October 1999) was prepared to present the interim monitoring program (Revision 0), and Revision 1 of the Interim Offshore Monitoring Plan (Tetra Tech, November 2010a) provides the updated interim offshore monitoring plan, which was implemented beginning with Round 11 sampling. Eleven rounds of sampling have been conducted to date. Also, two rounds of Additional Scrutiny sampling and analysis were conducted based on evaluation of Rounds 1 through 7 data. Data collected as a part of the monitoring program provide the information necessary to determine whether the RAOs for this interim period are being met. These interim RAOs were developed so that the protection of ecological offshore communities can be ensured by identification of exposure to COCs at concentrations greater than acceptable levels.

Revision 0 of the Interim Offshore Monitoring Plan provides the methodology for development of acceptable levels (IRGs) and for modifying the program based on data evaluation as part of the program. The IRGs, monitoring program, and modifications are discussed further herein. Table 5-3 presents a summary of the monitoring activities conducted through Round 11, Table 5-4 provides a current status of the monitoring program, and Table 5-5 summarizes the 2010 modifications to the interim offshore monitoring program. Figures 5-1 and 5-2 present the overall layout of the monitoring and reference stations, respectively.

The IRGs were developed for the chemicals potentially causing the most offshore impact. The data from Round 2 were used to develop PRGs for OU4 (Tetra Tech, November 2001) that were the basis for the IRGs for making decisions as part of the Interim Offshore Monitoring Program. A PRG was not originally developed for lead; however, because the copper and nickel PRGs were approximately twice the ER-M values (Long et al., 1995), twice the ER-M value was used as the IRG for lead.

TABLE 5-3

SUMMARY OF INVESTIGATIONS CONDUCTED AT MONITORING AND REFERENCE STATIONS
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
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Station	Samples Collected as Part of the Interim Offshore Monitoring Program						Additional Scrutiny Investigation	
	Rounds 1 through 5(1)	Rounds 6 and 7(2)	Round 8(3)	Round 9(3)	Round 10(3)	Round 11(3)	Phase I	Phase II
Date	Sep-99, May-00, Aug-00, May-01, Aug-01	Aug-02, Aug-03	Aug-05	Nov-07	Dec-08	Apr-11	2005	Nov-07 and May-08
Monitoring Stations								
MS-1	SD, MU, LJ	SD, MU	NS	NS	NS	PAHs	Yes	Yes
MS-2	SD, MU, LJ	SD, MU	NS	NS	NS	NS	NS	NS
MS-3	SD, MU, LJ	SD, MU	NS	NS	NS	PAHs, Cu	NS	NS
MS-4	SD, MU, LJ	SD, MU	NS	NS	NS	PAHs, Cu	NS	NS
MS-5	SD, MU, LJ	SD, MU	Full Suite	Full Suite	Full Suite	PAHs, Select Metals (4)	Yes	NS
MS-6	SD, MU, LJ	SD, MU	NS	NS	NS	NS	NS	NS
MS-7	SD, MU, LJ	SD, MU	NS	NS	NS	PAHs, Select Metals, pesticides, PCBs, dioxins/furans	NS	NS
MS-8	SD, MU, LJ	SD, MU	Full Suite + Dioxins/Furans	Full Suite + Dioxins/Furans	Full Suite + Dioxins/Furans	PAHs, Select Metals, pesticides, PCBs, dioxins/furans	NS	NS
MS-9	SD, MU, LJ	SD, MU	Full Suite + Dioxins/Furans	Full Suite + Dioxins/Furans	Full Suite + Dioxins/Furans	PAHs, Select Metals, pesticides, PCBs, dioxins/furans	Yes	NS
MS-10	SD, MU, LJ	SD, MU	PAHs	NS	NS	NS	NS	NS
MS-11	SD, MU, LJ	SD, MU	NS	NS	NS	Nickel, Copper, Lead	Yes	NS
MS-12	SD, MU, LJ	SD, MU	NS	NS	NS	PAHs, Lead	Yes	Yes
MS-13	SD, MU, LJ	SD, MU	PAHs	NS	NS	NS	NS	NS
MS-14	SD, MU, LJ	SD, MU	PAHs	NS	NS	NS	NS	NS
Reference Stations								
RS-01	SD, MU, LJ	SD, MU	PAHs, PCBs, Dioxins/Furans, TOC	NS	NS	NS	NS	NS
RS-02	SD, MU, LJ	SD, MU		PAHs, PCBs, Dioxins/Furans, TOC	NS	NS	NS	NS
RS-03	SD, MU, LJ	SD, MU		NS	NS	NS	NS	NS
RS-04	SD, MU, LJ	SD, MU		NS	NS	NS	NS	NS

SD - Sediment samples
MU - Mussel samples
LJ - Juvenile lobster samples
NS - Not sampled or investigated.

1 - All samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls (PCBs), and metals.
Samples from MS-7 through MS-12 and all four reference stations were also analyzed for dioxins/furans.
- Sediment samples were additionally analyzed for grain size, total organic carbon (TOC), and acid volatile sulfide/simulataneously extracted metals (AVS/SEM).
- Mussel samples were additionally analyzed for percent lipids.

TABLE 5-3

SUMMARY OF INVESTIGATIONS CONDUCTED AT MONITORING AND REFERENCE STATIONS
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2 - Samples were analyzed for the same parameters as in Rounds 1 through 5 with the following expections:
- Sediment samples were not analyzed for AVS/SEM.

3 - Only sediment samples were collected during this sampling round, and the samples were analyzed for the parameters listed in the table.
- Full suite includes: PAHs, pesticides, PCBs, metals, grain size, and TOC (sediment samples were not analyzed for alkylated PAHs).
- Samples were not analyzed for chloropyrifos, pentachloroanisole, pentachlorobenzene, 1,2,3,4-tetrachlorobenzene, or 1,2,4,5-tetrachlorobenzene as they were for the first seven rounds.

4 - Select metals includes: aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc.

TABLE 5-4

**STATUS OF INTERIM OFFSHORE MONITORING STATIONS
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPAYARD, KITTERY, MAINE
PAGE 1 OF 2**

Monitoring Station	AOC/Associated Offshore or Onshore IRP	Rounds 1 through 10 and Interim Offshore Monitoring Program Status (until a final remedy for OU4 is implemented)(1)	Remedy Status(2)
MS-01	Back Channel / Site 34 (OU9)	Monitoring to be conducted every 5 years for PAHs.	Remedial alternatives being evaluated in the OU4 FS.
MS-02	Back Channel / None	Monitoring discontinued.	No further action required.
MS-03 and MS-04	Back Channel / Site 32 (OU7)	Monitoring to be conducted every 5 years for PAHs and copper.	Remedial alternatives being evaluated in the FS.
MS-05	Jamaica Cove / OU3	Monitoring to be conducted every 5 years for PAHs and metals and every 2 years between five-year sampling rounds for copper, lead, and nickel.	No further action required.
MS-06	Jamaica Cove / OU3	Monitoring discontinued.	No further action required
MS-07	Clark Cove / OU3	Identified as a reference station for MS-08 and MS-09. Monitoring to be conducted every 5 years for PAHs, 4,4'-DDT, dioxins/furans, PCBs, and metals	No further action required.
MS-08 and MS-09	Clark Cove / OU3	Monitoring to be conducted every 5 years for PAHs, 4,4'-DDT, metals and every 2 years between five-year sampling rounds for PAHs, 4,4'-DDT, metals, PCBs, and dioxins/furans.	No further action required.
MS-10	Sullivan Point / None	Monitoring discontinued.	No further action required
MS-11	DRMO Storage Yard/ Sites 6 and 29 (OU2)	Monitoring to be conducted every 5 years for copper, lead, and nickel	Remedial alternatives being evaluated in the OU4 FS.
MS-12	Dry Docks / Site 5 (OU4) and Site 10 (OU1)	Monitoring to be conducted every 5 years for PAHs and lead. Analyze additional sediment samples near AS12-SD12 to be analyzed every 5 years and every 2 years between five-year sampling rounds.	Remedial alternatives being evaluated in the OU4 FS.

TABLE 5-4

**STATUS OF INTERIM OFFSHORE MONITORING STATIONS
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPAYARD, KITTERY, MAINE
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Monitoring Station	AOC/Associated Offshore or Onshore IRP	Rounds 1 through 10 and Interim Offshore Monitoring Program Status (until a final remedy for OU4 is implemented)[1]	Remedy Status[2]
MS-13 and MS-14	Dry Docks / Site 5 (OU4) and Site 31 (OU8)	Monitoring discontinued.	No further action required.
Reference Stations	None	Monitoring discontinued.	None.

1 – Round 11 was a five-year sampling round. The next biennial round between five-year sampling rounds will be Round 12, which is anticipated to be conducted in spring 2013 if the final remedy for OU4 has not yet been implemented.
2 – The OU4 FS is being prepared and a Proposed Remedial Action Plan and Record of Decision will be prepared for OU4 to document selection of further action or no further action for each monitoring station.

TABLE 5-5

MODIFICATIONS TO THE INTERIM OFFSHORE ROUNDS 1 THROUGH 10
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE
PAGE 1 OF 3

Report	Round	Modification	Rationale/Comments	Modification Implemented
Baseline Interim Offshore Monitoring Report For Operable Unit 4 (Tetra Tech, July 2002)	Round 1-4	Discontinue analysis of sediment samples for AVS/SEM.	AVS/SEM data were not needed for future evaluations.	Round 6
		Discontinue juvenile lobster sampling.	Chemical concentrations in juvenile lobsters were similar between monitoring and reference stations. Mussels are a better indicator of contaminant concentrations.	
		Conduct future sampling rounds in late summer.	No significant differences in data collected during spring or summer. Round 5 samples were collected in summer before report was approved.	
Rounds 1 through 7 Interim Offshore Monitoring Program Report (Tetra Tech, November 2004)	Round 1-7	Collect sediment samples only at MS-05, MS-08, MS-09, MS-10, MS-13, and MS-14 during Rounds 8 and 9.	These locations had increasing concentrations that exceed IRGs or are predicted to exceed the IRGs within the next 5 years.	Round 8
		Conduct additional scrutiny only at MS-01, MS-03, MS-04, MS-05, MS-08, MS-09, MS-11, and MS-12. PAHs and metals were identified as target analytes.	Locations exceed IRGs and are predicted to continue to exceed the IRGs within the next 5 years.	
		Discontinued mussels collection until the next 5-year sampling event.	BSAFs/BAFs are not expected to change. Area is closed to shellfishing, so human health risks do not need to be re-evaluated.	
		Discontinue analysis of sediment and mussel samples for alkylated PAHs.	Alkylated PAHs have not been identified as COCs and are not used to make recommendations for additional sampling.	
		Perform dioxin/furan analysis only at MS-08, MS-09, and the reference stations for Rounds 8 and 9, but perform dioxin/furan analysis for MS-07 through MS-12 and the reference stations during Round 10.	Risks from dioxins/furans to human and ecological receptors are low. Samples will be collected in future rounds due to increase in dioxin/furans concentrations during Round 7.	
		Conduct further evaluation of 4,4'-DDT as part of the additional scrutiny for MS-01 and MS-08. (Additional scrutiny for 4,4'-DDT was not conducted at MS-08 because the sediment with the elevated 4,4'-DDT detection was excavated as part of the OU3 remedial activities in 2004.)	Elevated 4,4'-DDT level at MS-01.	

TABLE 5-5

MODIFICATIONS TO THE INTERIM OFFSHORE ROUNDS 1 THROUGH 10
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Report	Round	Modification	Rationale/Comments	Modification Implemented
Additional Scrutiny Quality Assurance Project Plan for Operable Unit 4, Appendix B: Technical Memorandum Comparison of Analytical Methods (Tetra Tech, August 2005)	Round 1-7	Use USEPA analytical methods for organic chemical analysis of sediment as opposed to NOAA methods.	Similar results by both methods. Greater number of laboratories capable of analyzing using USEPA methods, which results in cost saving.	Round 8 / Additional Scrutiny
		Use USEPA analytical methods for organic chemical and metal analyses of mussel samples as opposed to NOAA methods.	Similar results expected by both methods. Greater number of laboratory capable of analyzing using USEPA methods results in cost saving.	
		Remove select pesticides (chloropyrifos, pentachloroanisole, pentachlorobenzene, 1,2,3,4-tetrachlorobenzene, and 1,2,4,5-tetrachlorobenzene) from analytical parameter list.	At least two different analytical methods needed using USEPA methods for all parameters. The eliminated pesticides were not identified as COCs, do not have IRGs, and are not used in decision-making.	
Phase II Additional Scrutiny Quality Assurance Project Plan, Appendix A (Tetra Tech, September 2007)	Round 8 / Additional Scrutiny	Move sample locations at MS-05 and MS-09.	Obtain better spatial coverage of chemical concentrations in sediment.	Round 9 / Phase II Additional Scrutiny
		Collect sediment at two additional locations at MS-05 for analysis of copper and lead for Round 9.	Ensure that size of area near MS-05, Loc. 1 with elevated concentrations of metals is not increasing.	
		Eliminate sampling at reference stations (Navy agreed to collect sediment samples at one reference station for Round 9 after receiving comments from the regulators).	No increasing or decreasing trends in concentrations noted.	
		Discontinue monitoring at MS-10, MS-13, and MS-14.	Data do not indicate any impacts from IRP sites, and concentrations of PAHs are generally low and do not appear to be increasing.	

TABLE 5-5

MODIFICATIONS TO THE INTERIM OFFSHORE ROUNDS 1 THROUGH 10
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE
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Report	Round	Modification	Rationale/Comments	Modification Implemented
Technical Memorandum for Round 10 (Tetra Tech, September 2008c)	Prior to Round 10	Eliminate sampling at reference stations.	Overall, chemical concentrations at reference stations were consistent across all rounds at a particular station, with no increasing or decreasing trends in concentrations.	Round 10[(1)]
			The reference data are not currently being used for decision making because chemical concentrations are less than IRGs.	
			The data set is adequate for making decisions after Round 10.	
		Only collect sediment samples from MS-05, MS-08, and MS-09 during Round 10.	Sediment samples not needed at other monitoring stations for various reasons as discussed in the Technical Memorandum.	
		Discontinue use of NOAA methods for analysis of metals in sediment. Use USEPA Method 6020B for analysis of metals in future offshore sampling events. During an October 8, 2008, conference call, it was suggested that the Navy collect additional sediment samples from MS-05, MS-08, and MS-09 during Round 10 for analysis of metals by NOAA and USEPA methods to strengthen the data set.	Greater number of laboratories capable of analyzing using USEPA methods, which results in cost saving.	
		Discontinue mussel sampling at all monitoring and reference stations.	Bioaccumulation factors do not need to be recalculated.	

1 - Some of these modifications were recommended for future rounds, but based on regulator comments, it was agreed that the modifications would be applied to Round 10 only.

AVS - Acid volatile sulfides
BAF - Biota accumulation factor
BSAF - Biota sediment accumulation factor
COC - Chemical of concern
IRG - Interim remediation goal
IRP - Installation Restoration Program
NOAA - National Oceanic and Atmospheric Administration
PAH - Polycyclic aromatic hydrocarbon
SEM - Simimultaneously extracted metals
USEPA - United States Environmental Protection Agency

The IRGs were developed for the following chemicals:

TABLE 5-6: OU4 IRGS

Parameter	IRG (dry weight)	Basis
Copper	486 mg/kg	2001 PRG development process
Lead	436 mg/kg	Twice the ER-M
Nickel	124 mg/kg	2001 PRG development process
Acenaphthylene	210 µg/kg	2001 PRG development process
Anthracene	1,236 µg/kg	2001 PRG development process
Fluorene	500 µg/kg	2001 PRG development process
High molecular weight (HMW) PAHs	13,057 µg/kg	2001 PRG development process

During Rounds 1 through 7, at each monitoring station, three sediment samples (with the exception of MS-11), one to three mussel samples, and one juvenile lobster sample (Rounds 1 through 5 only) were collected during each monitoring event. Except for Round 1, only one sediment sample (at MS-11 Location 3) was collected per sampling event at MS-11 because sediment was not present at two of the three MS-11 sampling locations. During Round 1, sediment present at one location (MS-11 Location 2) was covered by shoreline erosion controls placed along the OU2 shoreline in 1999. Four sediment samples, two mussel samples, and one juvenile lobster sample (Rounds 1 through 5 only) were collected at each reference station. As discussed in the 1999 Interim Offshore Monitoring Plan (Revision 0, Tetra Tech, October), the reference stations were located to represent potential contribution of contamination to the offshore from non-Navy sources in the estuary. Comparison of reference station concentrations in sediment and biota was conducted as part of the evaluation of data and confirmed that the IRGs were not less than reference concentrations.

As shown in Tables 5-3 through 5-4 and as discussed herein, modifications were made to the sampling media, frequency, and/or analytical program beginning with Round 6. The data from the first four rounds were evaluated and documented in the Baseline Interim Offshore Monitoring Program Report (Tetra Tech, July 2002). The main objective of the evaluation of the baseline data was to provide the Navy's recommendation for the appropriate sampling season for further monitoring rounds. In addition, the Baseline Report provided a comparison of results to IRGs, evaluation of the need for continued juvenile lobster sampling, risk evaluation of dioxin/furan data, and results of other evaluations conducted with the Rounds 1 through 4 data. The major changes to the interim offshore monitoring program based on the Rounds 1 through 4 data were to discontinue select analyses (acid volatile sulfides and simultaneously extract metals) for sediment, discontinue juvenile lobster sampling, and conduct subsequent sampling (starting with Round 6) during late summer (Tetra Tech, November 2004).

The data from the first seven rounds were evaluated and documented in the Rounds 1 through 7 Interim Offshore Monitoring Program Report (Tetra Tech, November 2004). The main objectives of the Rounds 1 through 7 Report were to determine the appropriate frequency of monitoring for each monitoring station for the next 5 years and to determine whether Additional Scrutiny was recommended at any monitoring station. The evaluation also included recommendations for other modifications to the monitoring program, including not collecting mussel samples during Rounds 8 or 9 and discontinuing alkylated PAH analysis.

A Quality Assurance Project Plan (QAPP) for the Additional Scrutiny Investigation was prepared in 2005 (Tetra Tech, August 2005), the investigation was conducted in 2005, and the data were presented in a data package (Tetra Tech, February 2006). The report of the results for the first phase of the Additional Scrutiny Investigation (Tetra Tech, August 2007) recommended additional investigation at two monitoring stations, and a QAPP for the second phase of additional scrutiny was prepared (Tetra Tech, September 2007). Phase II Additional Scrutiny sampling was conducted in November 2007 and May 2008, and the data were presented in the Round 9 and Phase II Additional Scrutiny Data Package for OU4 (Tetra Tech, September 2008b).

Round 8 sampling was conducted in 2005, and the data package was submitted in 2006 (Tetra Tech, January 2006b). Round 9 sampling was conducted in 2007, and Round 10 sampling was conducted in December 2008. After the Round 9 and the Additional Scrutiny Investigations were completed, the Technical Memorandum – Recommendation for Modifications to the Interim Offshore Monitoring Program for OU4 (Tetra Tech, September 2008c) was prepared to document further changes to the program. In summary, the sampling investigation consisted of collecting samples at 14 monitoring stations (MS-01 through MS-14) adjacent to PNS and four reference stations (RS-01 through RS-04) in the Piscataqua River. Based on the changes made to the monitoring program, Round 10 sampling, conducted in December 2008, included sampling and analysis of sediment collected at MS-05, MS-08, and MS-09 only, at the same sampling locations and analyzed for the same parameters as the Round 9 event. Mussel sampling was discontinued, and USEPA Method 6020B was used for sample analyses for metals along with the NOAA methods that were used exclusively during the first nine rounds. A subtidal sediment sample was also collected from MS-12. Results were evaluated in the Rounds 1 through 10 Interim Offshore Monitoring Program Report (Tetra Tech, February 2010), and further recommendations were made for the monitoring program.

The Interim Offshore Monitoring Plan, Revision 1 (Tetra Tech, November 2010a) was prepared to provide additional information and updates to the monitoring program. The updated monitoring plan changed the sampling frequency at select monitoring stations to biennial between five-year sampling rounds for certain COCs and every 5 years for others. Based on the recommendations and Revision 1 of the Interim

Offshore Monitoring Plan, monitoring is no longer required at several monitoring stations, as discussed below.

The location and monitoring status of each monitoring station based on the results of the Rounds 1 through 10 data evaluation and in accordance with the 2010 Interim Offshore Monitoring Plan are as follows:

- **MS-01**: This monitoring station is located in the western portion of the Back Channel AOC, offshore of Site 34 (OU9) where an RI was conducted (2009 and 2010). An Additional Scrutiny Investigation was conducted at MS-01 to determine the likely sources of PAH contamination in sediment at this station. Rounds 8, 9, and 10 sampling were not required for MS-01. In 2007, a non-time-critical removal action was conducted for source material at Site 34, and additional sediment sampling at MS-01 was conducted in August 2009 to determine the extent of PAH contamination. Monitoring of sediment for PAHs was conducted at this station during Round 11.

- **MS-02 and MS-10**: These monitoring stations are located in the Back Channel and Sullivan Point AOCs, respectively, and are not located immediately offshore of any IRP sites. Additional Scrutiny and Rounds 8, 9, and 10 sampling were not required for these monitoring stations. No additional offshore monitoring or actions are needed for these stations because chemical concentrations in sediment are less than IRGs and the data do not indicate any impacts from known IRP sites. Therefore, interim offshore monitoring was discontinued at these stations.

- **MS-03 and MS-04**: These monitoring stations are located in the eastern portion of the Back Channel AOC, offshore of Site 32 (OU7). Foundry slag associated with Site 32 has been identified in the intertidal areas of MS-03 and MS-04 and is likely the source of elevated metals concentrations at those stations. In June 2006, a time-critical removal action was conducted to provide shoreline erosion controls where significant erosion was occurring. As part of the removal action, surficial debris (including slag) was removed from the shoreline, and shoreline controls were placed along the entire Site 32 shoreline in the mid- to high-tide area. Additional sampling was conducted in 2008 as part of OU7 Phase II RI field work to determine the extent of copper and PAH contamination in sediment. Rounds 8, 9, and 10 sampling were not required for these monitoring stations. Monitoring of sediment for PAHs and copper was conducted at this station during Round 11.

- **MS-05, MS-06, MS-07, MS-08, and MS-09**: MS-05 and MS-06 are located in the Jamaica Cove AOC, and MS-07, MS-08, and MS-09 are located in the Clark Cove AOC. MS-05, MS-08, and MS-09 are immediately offshore of OU3, and MS-06 and MS-07 are in the offshore area adjacent to OU3. Remedial action conducted at OU3 included excavation of wastes from OU3 adjacent to Jamaica

Cove and subsequent wetlands construction in the excavated area, excavation of wastes from the offshore area within MS-08, and placement of shoreline controls along the entire OU3 shoreline. Because increases in chemical concentrations were identified within MS-05 and MS-09 after OU3 remedial action construction, Additional Scrutiny sampling and analysis was conducted to delineate the areas of elevated chemical concentrations in these two stations. Additional sampling during Rounds 8, 9, and 10 was conducted for MS-05, MS-08, and MS-09 to evaluate post-remedial concentration trends. Although an initial increase in concentrations was observed at some locations, the increase was temporary. Chemical concentrations in sediment at MS-05, MS-08, and MS-09 during the recent sampling events were less than IRGs. MS-06 and MS-07 have not had exceedances of IRGs, indicating that sediment in the offshore area adjacent to OU3 has not been impacted by OU3. Monitoring of sediment for PAHs and metals at MS-05 and PAHs, 4,4'-DDT, dioxins/furans, PCBs, and metals at MS-08 and MS-09 was conducted during Round 11. Sediment at MS-07 was also monitored during Round 11 as a reference station for MS-08 and MS-09. In accordance with the 2010 Interim Offshore Monitoring Plan, interim offshore monitoring was discontinued at MS-06 after Round 10.

- **MS-11**: This monitoring station is located in the DRMO Storage Yard AOC offshore of OU2. Erosion of metals-contaminated soil along a portion of the OU2 shoreline (by Site 6) was identified in 1999, and a time-critical removal action was conducted to prevent further erosion of contaminants by placing shoreline erosion controls along a portion of the OU2 shoreline. Additional erosion was noted in areas of the OU2 shoreline where erosion controls were not in place, and a time-critical removal action was conducted in 2005 and 2006 to provide shoreline erosion controls along the remaining portion of the OU2 shoreline (at Site 29). In 2008, repairs were made to the shoreline controls placed in 2005. The entire OU2 shoreline now has some type of shoreline erosion controls. Sediment is present at only one location at MS-11 (on the eastern side of the monitoring station); sediment concentrations (for comparison to IRGs) at the other two locations were estimated from mussel data from those locations using mussel-sediment biota-sediment accumulation factors (Tetra Tech, November 2004). Additional Scrutiny sampling and analysis was conducted to confirm that elevated concentrations of metals (copper, lead, and nickel) in MS-11 sediment on the eastern side of the monitoring station were likely from erosion from OU2. Rounds 8, 9, and 10 sampling were not required for MS-11. Monitoring of sediment for copper, lead, and nickel was conducted at this station during Round 11.

- **MS-12**: This station is located in the Dry Dock AOC, offshore of Site 10 (OU1). One industrial waste outfall (Site 5) discharged in the offshore area of Site 10, apparently from Site 10 and other nearby operations. Lead-contaminated soil is present at Site 10 from a CERCLA release at the site; however, groundwater data from Site 10 do not indicate that lead in soil is leaching to groundwater at concentrations that would adversely impact the offshore. PAHs are not chemicals associated with the Site 10 source. Metals (including lead) and PAHs were reportedly included in discharges from Site 5; however, these discharges were discontinued by 1975. Therefore, there are no current IRP sources to MS-12. The elevated levels of lead and/or PAHs at MS-12 may be caused by a combination of sources that may or may not be related to PNS, including potential migration or transport from IRP sites, discharges from barges/boats, discharges from storm water outfalls located in the vicinity of the Shipyard, and dock-side activities. Additional Scrutiny sampling and analysis was required for MS-12 to determine the extent and potential sources of contamination. Rounds 8, 9, and 10 sampling were not required for MS-12. Monitoring of sediment for PAHs and lead was conducted at this station during Round 11.

- **MS-13 and MS-14**: These stations are located in the Dry Dock AOC to monitor sediment potentially impacted by Site 31 (OU8). Industrial waste outfalls (Site 5) had discharge points in this area, but these discharges were discontinued by 1975. The area by MS-13 was dredged between January and April 2002 (between Rounds 5 and 6). Potential sources of PAHs detected in sediment at these stations that may or may not be related to PNS include potential migration or transport from IRP sites, discharges from barges/boats, discharges from storm water outfalls located in the vicinity of the Shipyard, and dock-side activities. Round 8 sampling was required for these monitoring stations; Additional Scrutiny sampling and analysis was not required. PAH concentrations in most samples were less than IRGs. No additional monitoring or action is needed at these stations because of infrequent exceedances of IRGs over the eight rounds of sampling and because the data do not indicate any impacts from IRP sites. Therefore, in accordance with the 2010 Interim Offshore Monitoring Plan, interim offshore monitoring was discontinued at these stations.

Round 11 sampling, conducted in April 2011, was conducted as a five-year sampling event and followed the sampling plan detailed in Table 5-4. Round 11 results were presented in the Interim Offshore Monitoring Program Round 11 Data Package for OU4 (Tetra Tech, September 2011). The next biennial round between five-year sampling rounds will be Round 12, which is anticipated to be conducted in the spring 2013, if the final remedy for OU4 has not been implemented. The monitoring data support evaluation of remedial alternatives as part of the FS for OU4. The FS is scheduled to be completed in 2012 and a ROD signed by 2013.

5.4 PROGRESS SINCE LAST FIVE-YEAR REVIEW

Based on the results of the site inspection and review, the following table presents the recommendations made during the first Five-Year Review for OU4, along with the actions taken to address the recommendations.

TABLE 5-7: STATUS OF RECOMMENDATIONS FOR OU4

Recommendation from First Five-Year Review	Status
Conduct Rounds 9 and 10 of Interim Offshore Monitoring and evaluate the Rounds 1 through 10 data	Completed. Round 9 was conducted in 2007 and Round 10 was conducted in 2008. The data evaluation report was finalized in February 2010.
Complete Additional Scrutiny Reports	Completed. Phase I report was finalized in August 2007 and the Phase II data package was finalized in September 2008. Data from the Additional Scrutiny investigations were evaluated in the Rounds 1 through 10 Report, which was finalized in February 2010.

5.5 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken to complete this review.

5.5.1 Document Review

The following documents were reviewed for the Second Five-Year Review, and key information obtained from the documents is summarized in the following sections:

- Rounds 1 through 10 Interim Offshore Monitoring Report for OU4 (Tetra Tech, February 2010)
- Interim Offshore Monitoring Plan, Revision 1 (Tetra Tech, November 2010a)
- Round 11 Interim Offshore Monitoring Data Package (Tetra Tech, September 2011)

5.5.2 Data Review

The Rounds 1 through 10 Interim Offshore Monitoring Report presents an evaluation of data from Rounds 1 through 10 and the two phases of Additional Scrutiny and provides recommendations for modifications to the Interim Offshore Monitoring Program. The Interim Offshore Monitoring Plan, Revision 1, provides the updated monitoring program based on these recommendations. Round 11 was conducted in April 2011 in accordance with the updated monitoring plan, as a five-year sampling round. Rounds 12 and 13 will be 2-year sampling rounds and will be conducted in 2013 and 2015, if a final remedy has not been implemented for OU4. The monitoring program is outlined in Table 5-4. As discussed in Section 5.3.2, IRGs were used to evaluate COC concentrations at OU4 monitoring stations.

The results of the Rounds 1 through 10 Report are being used as part of the development and evaluation of remedial alternatives in the OU4 FS Report. Based on the results of the evaluation, Interim Offshore

Monitoring at MS-02, MS-06, MS-10, MS-13, and MS-14 was discontinued after Round 10 because there are no exceedances of IRGs (MS-02 and MS-06) or few exceedances of IRGs (MS-10, MS-13, and MS-14); therefore, no remedial alternatives are being evaluated for these monitoring stations. Although interim offshore monitoring is being continued to confirm previous results for MS-05, MS-08, and MS-09, there were also no recent IRG exceedances based on the Rounds 1 through 10 data evaluation, and no remedial alternatives are being evaluated for these monitoring stations. Interim offshore monitoring is being continued at MS-07 as a reference station for MS-08 and MS-09. Remedial alternatives are being evaluated for MS-01, MS-03, MS-04, MS-11, and MS-12, where there have been consistent or recent IRG exceedances. Consistent with the evaluation method for the Rounds 1 through 10 data, Round 11 data were evaluated to determine whether these results support the remedy evaluation status for monitoring stations that remain in the interim offshore monitoring program. Appendix D.2 provides the evaluation of the data, including concentration trend plots. The COCs (PAHs, copper, lead, and/or nickel) analyzed for each station in Round 11 were compared to IRGs. In addition, 4,4'-DDT, dioxins/furans, and PCBs data for Round 11 for MS-07, MS-08, and MS-09 were compared to results from previous rounds to determine whether the results were consistent and whether these chemicals still do not present an unacceptable risk for the identified station. For dioxin/furans and PCBs, toxicity equivalent (TEQ) concentrations were calculated for the evaluation, consistent with the methodology used for the Rounds 1 through 10 data evaluation of these chemicals.

Select concentration trend plots for the monitoring stations are provided in Figures 5-4 to 5-14 to show representative trend plots for the monitoring stations sampled in Round 11. The HMW PAH plot is provided for monitoring stations where PAH concentrations exceeded IRGs (MS-01, MS-04, MS-09, and MS-12) and a copper or lead plot is provided for monitoring stations where metals concentrations exceeded IRG exceedances (copper for MS-03, MS-04, MS-05, MS-08, and MS-09 and lead for MS-11 and MS-12). All other plots can be found in Appendix D.2 along with an evaluation of the data.

Based on the evaluation of the Round 11 data in comparison with the results of the evaluation of the Rounds 1 through 10 data and sediment data from onshore RIs (at OU7 and OU9), the following conclusions and considerations for further evaluation are made:

- Consistent and recent exceedances of IRGs were identified at MS-01, MS-03, MS-04, and MS-12. However, Round 11 concentrations were lower at the interim offshore monitoring locations at MS-01, MS-03, and MS-04 than previously found and suggest that natural recovery is occurring. At MS-01, there were no exceedances of IRGs during Round 11; however, there were IRG exceedances for the 2009 sediment samples collected as part of the OU9 RI. The results of Round 11 should be considered in the selection of remedial alternatives for MS-01, MS-03, MS-04, and MS-12.

FIGURE 5-4
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS-01
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

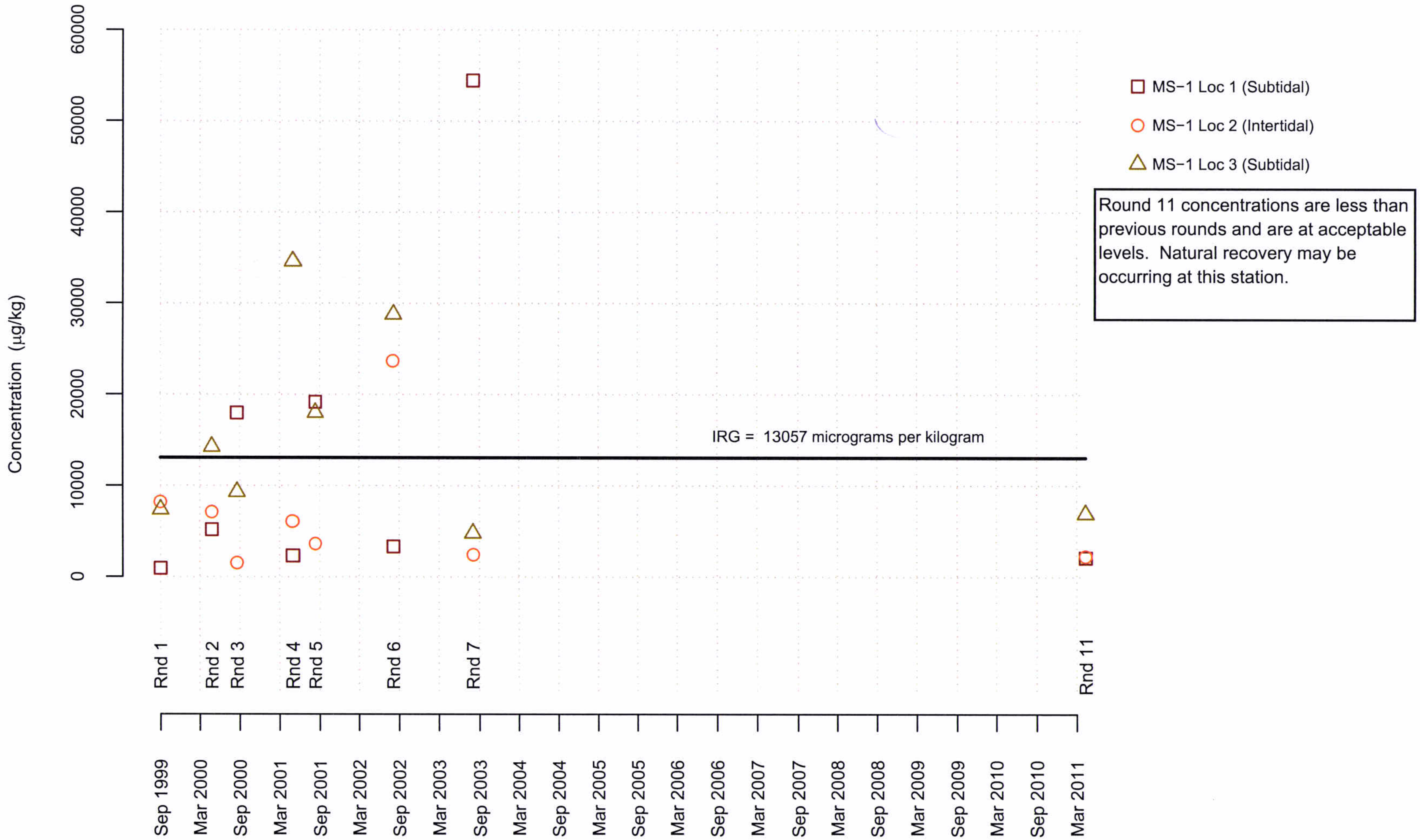


FIGURE 5-5
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS-03
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

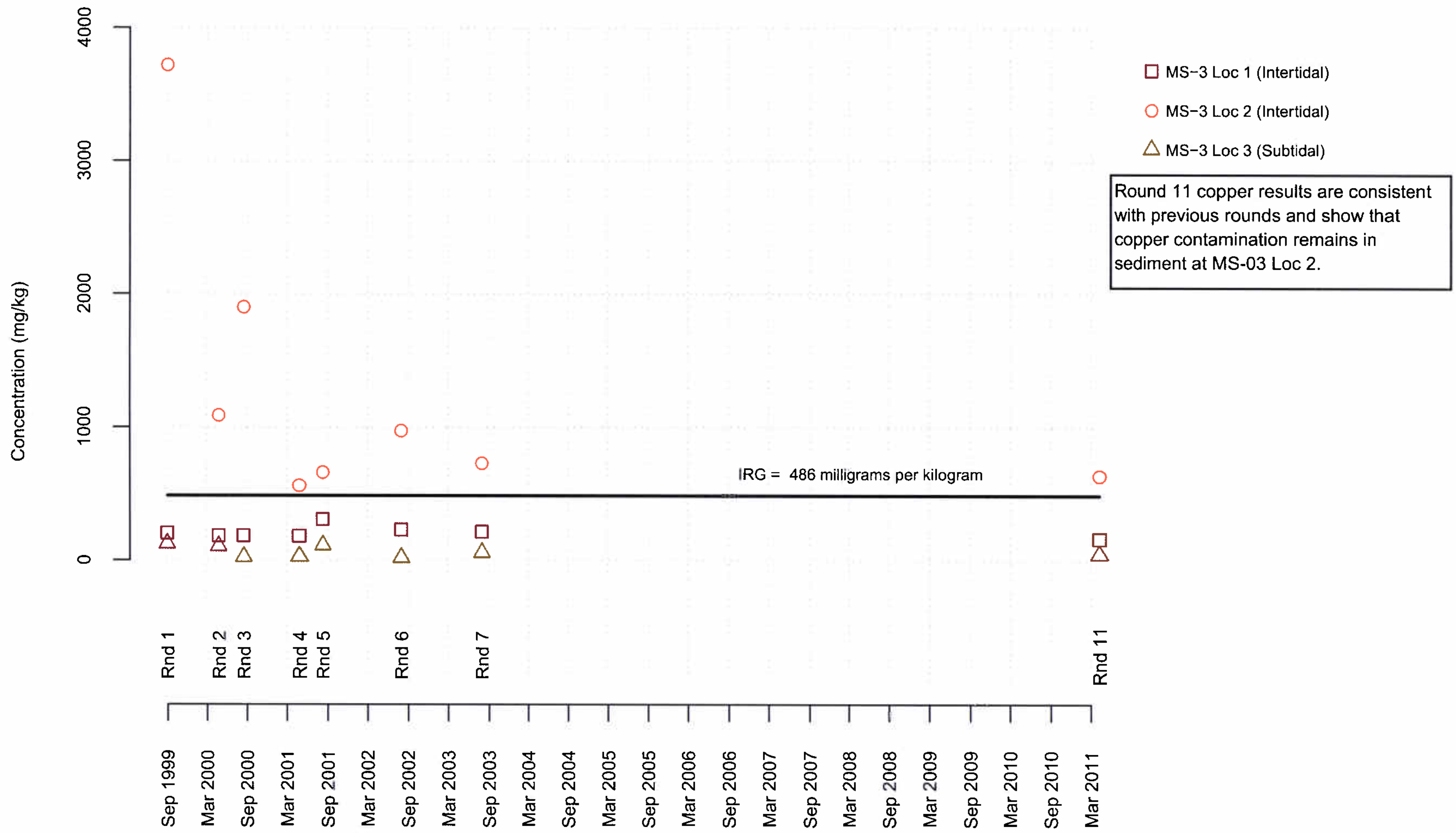


FIGURE 5-6
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS-04
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

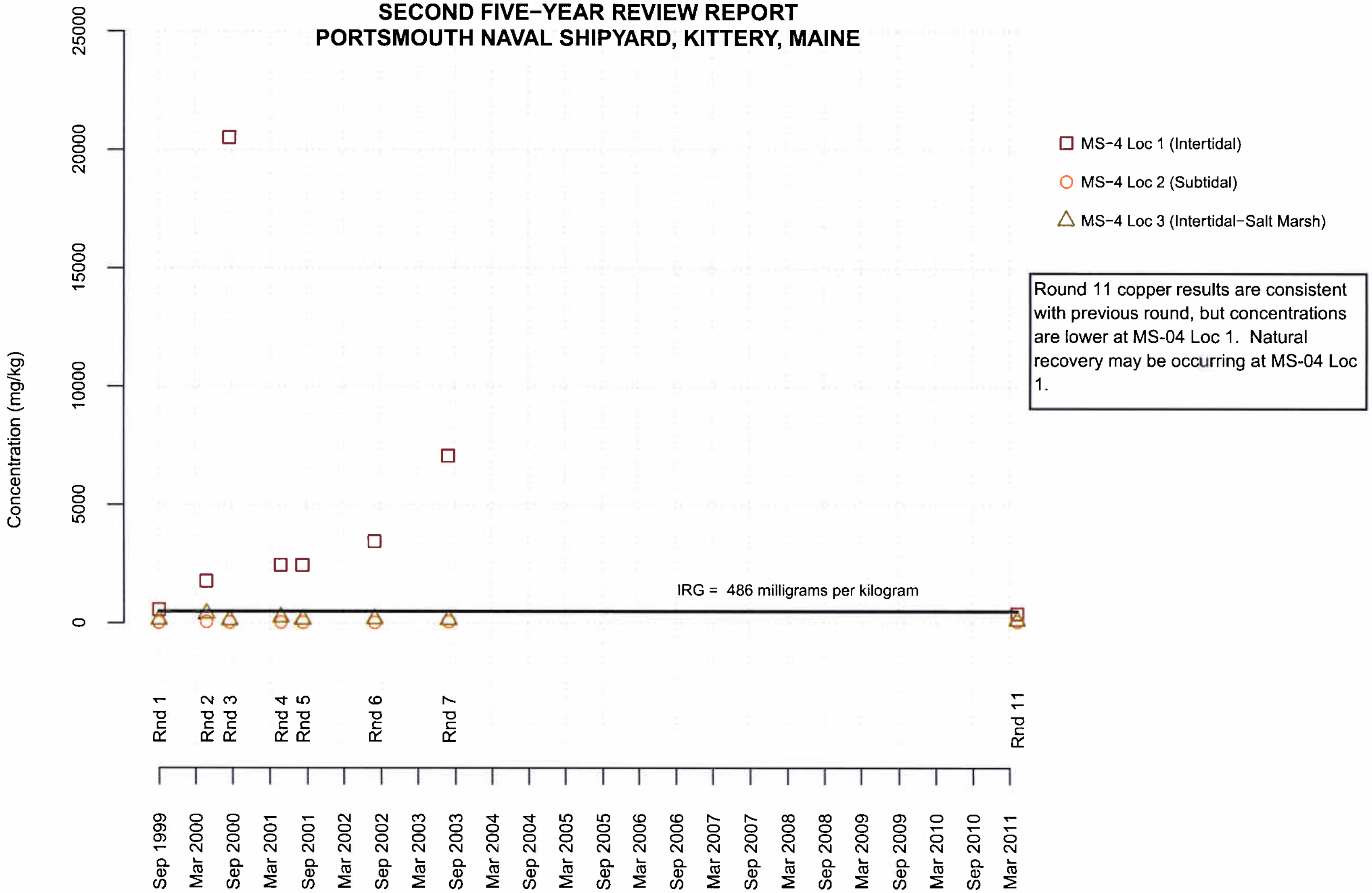


FIGURE 5-7
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS-04
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

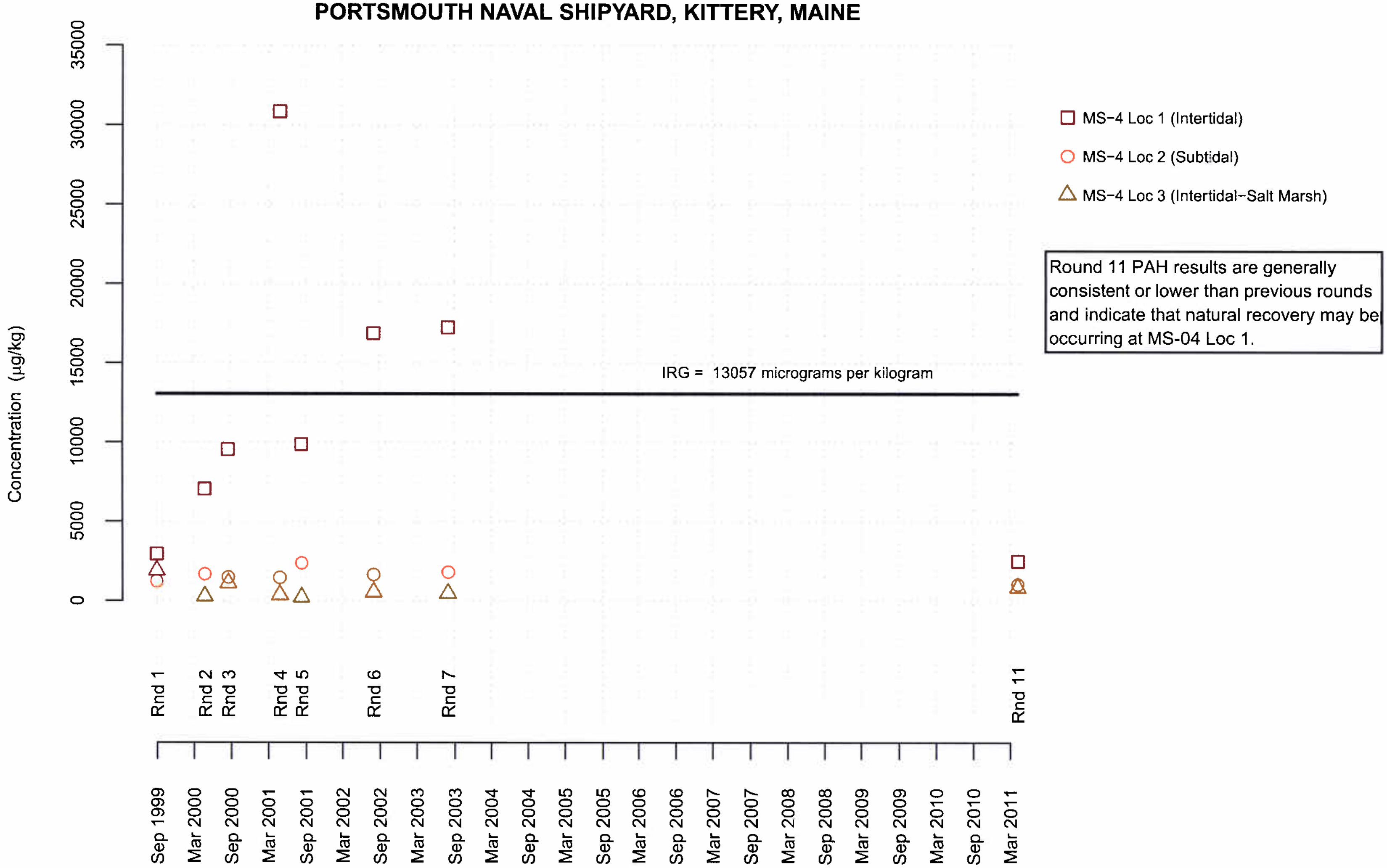


FIGURE 5-8
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS-05
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

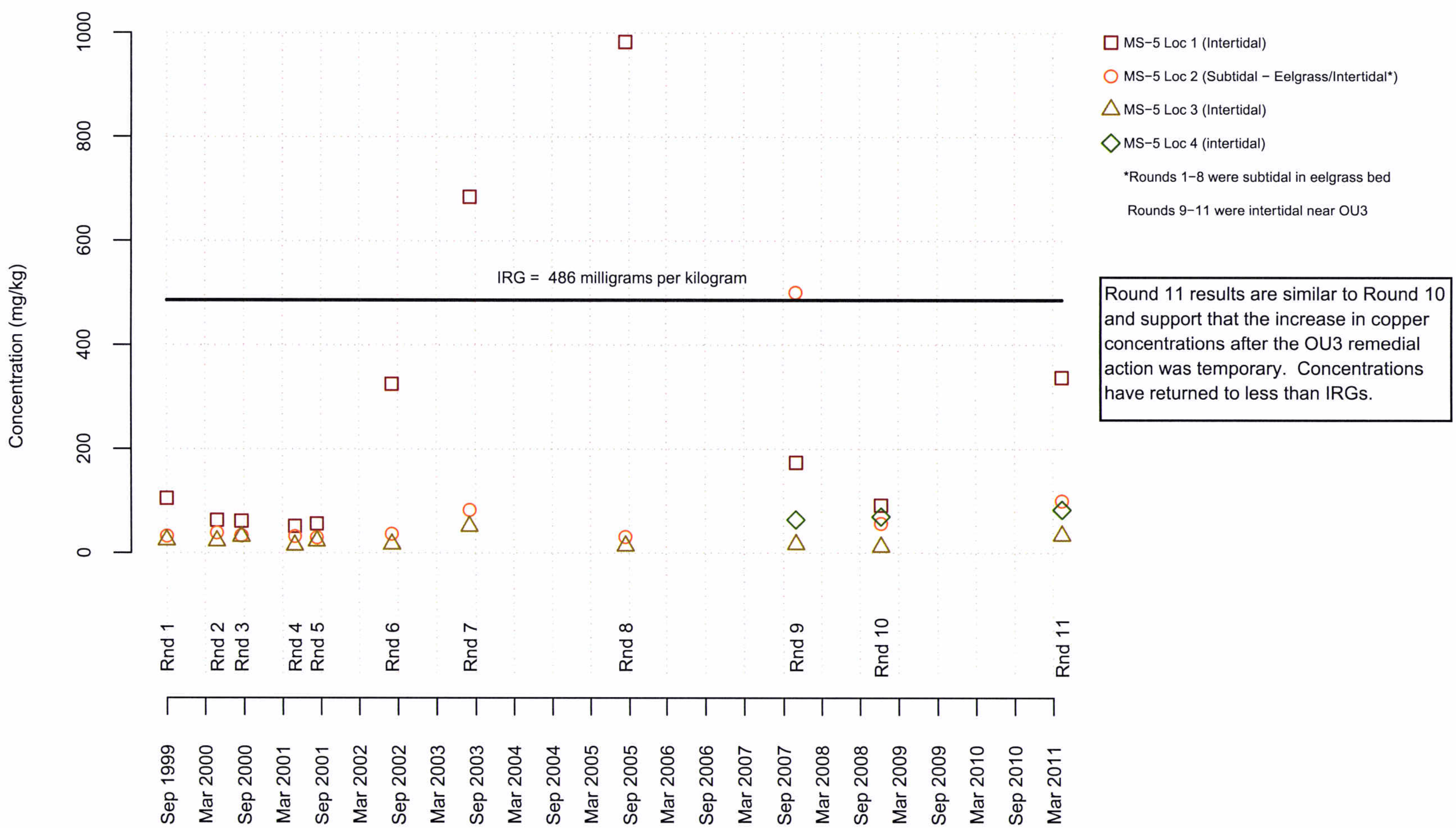


FIGURE 5-9
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS-08
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

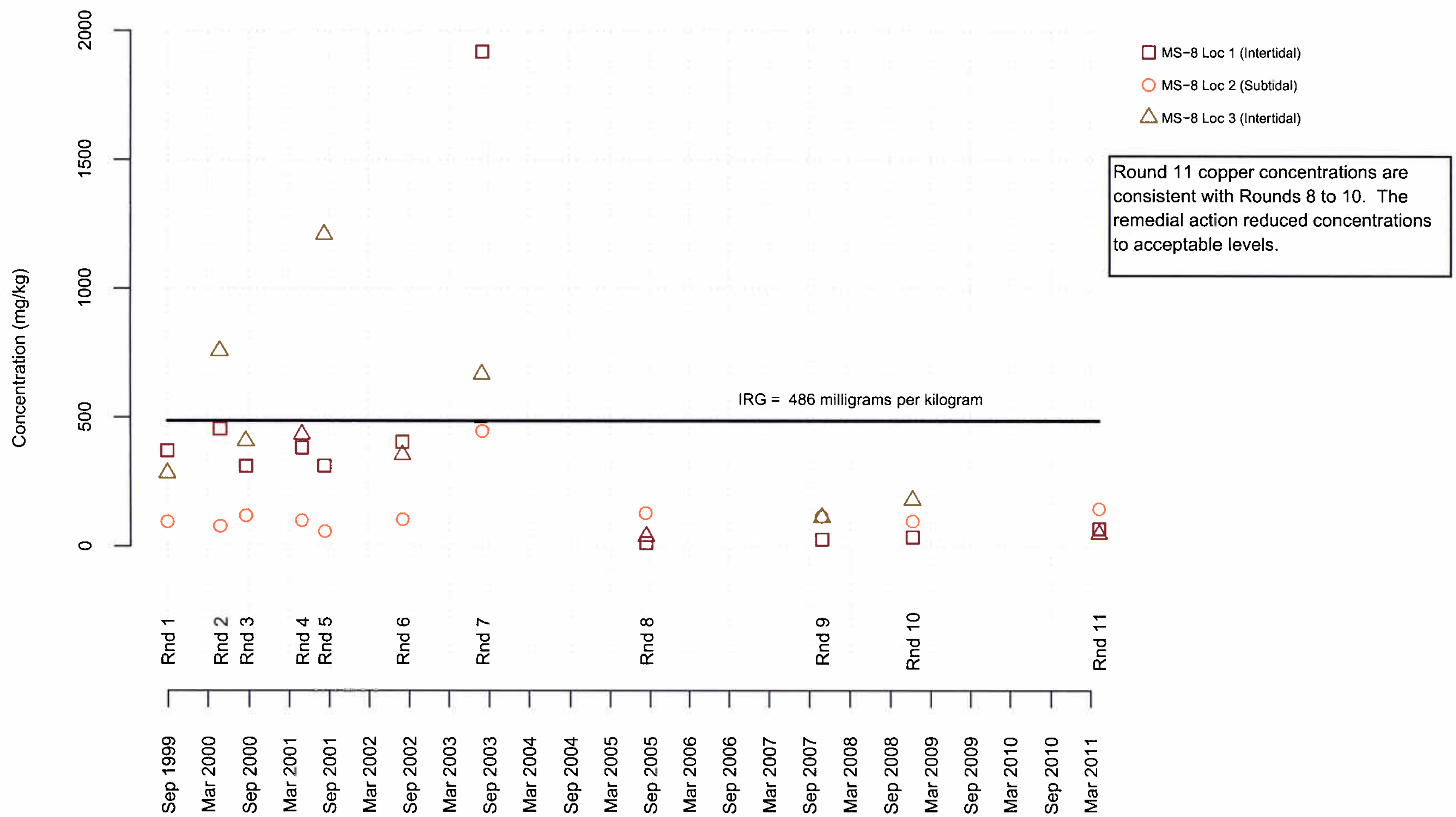


FIGURE 5-10
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

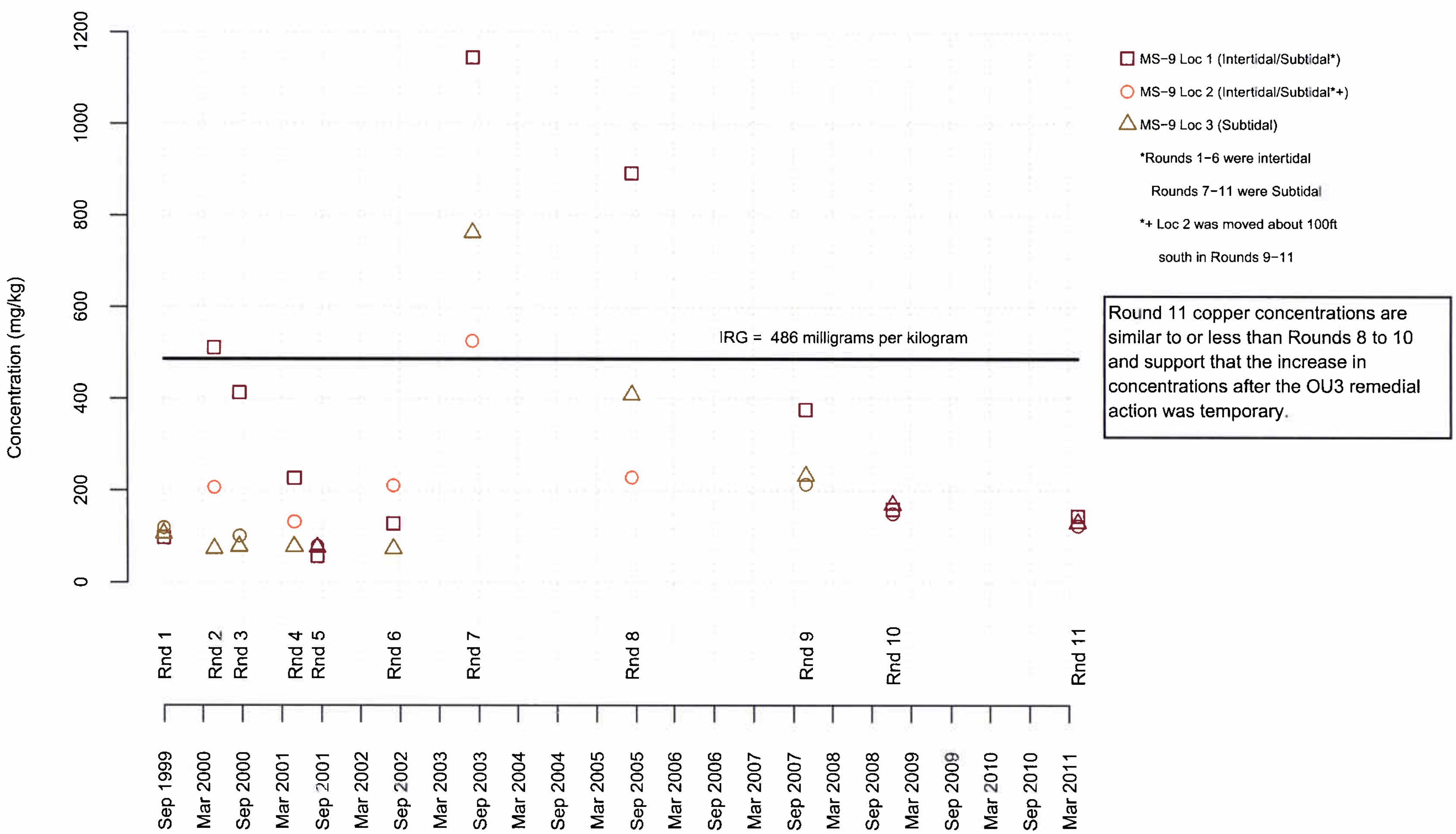


FIGURE 5-11
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

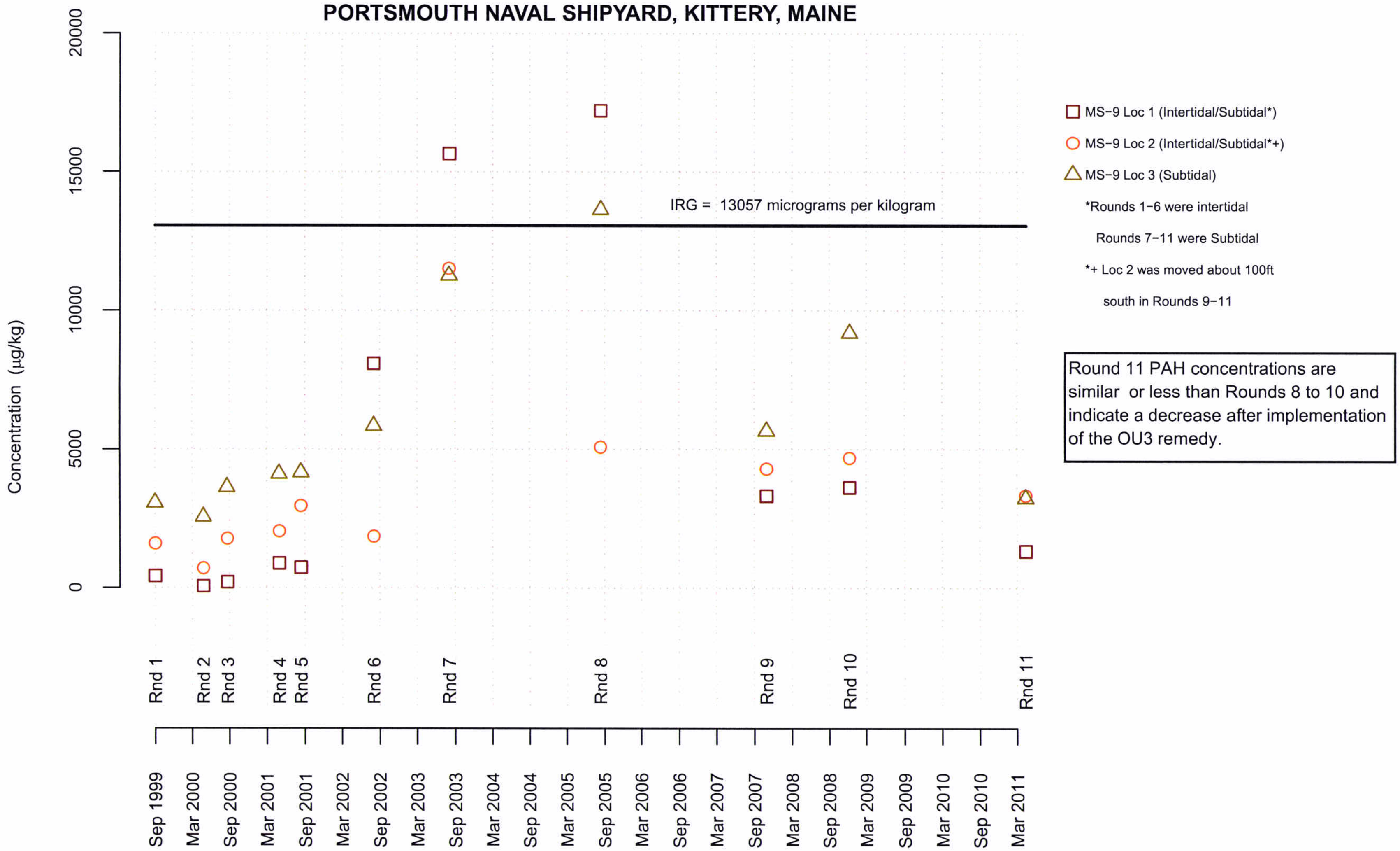


FIGURE 5-12
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR LEAD AT MS-11
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

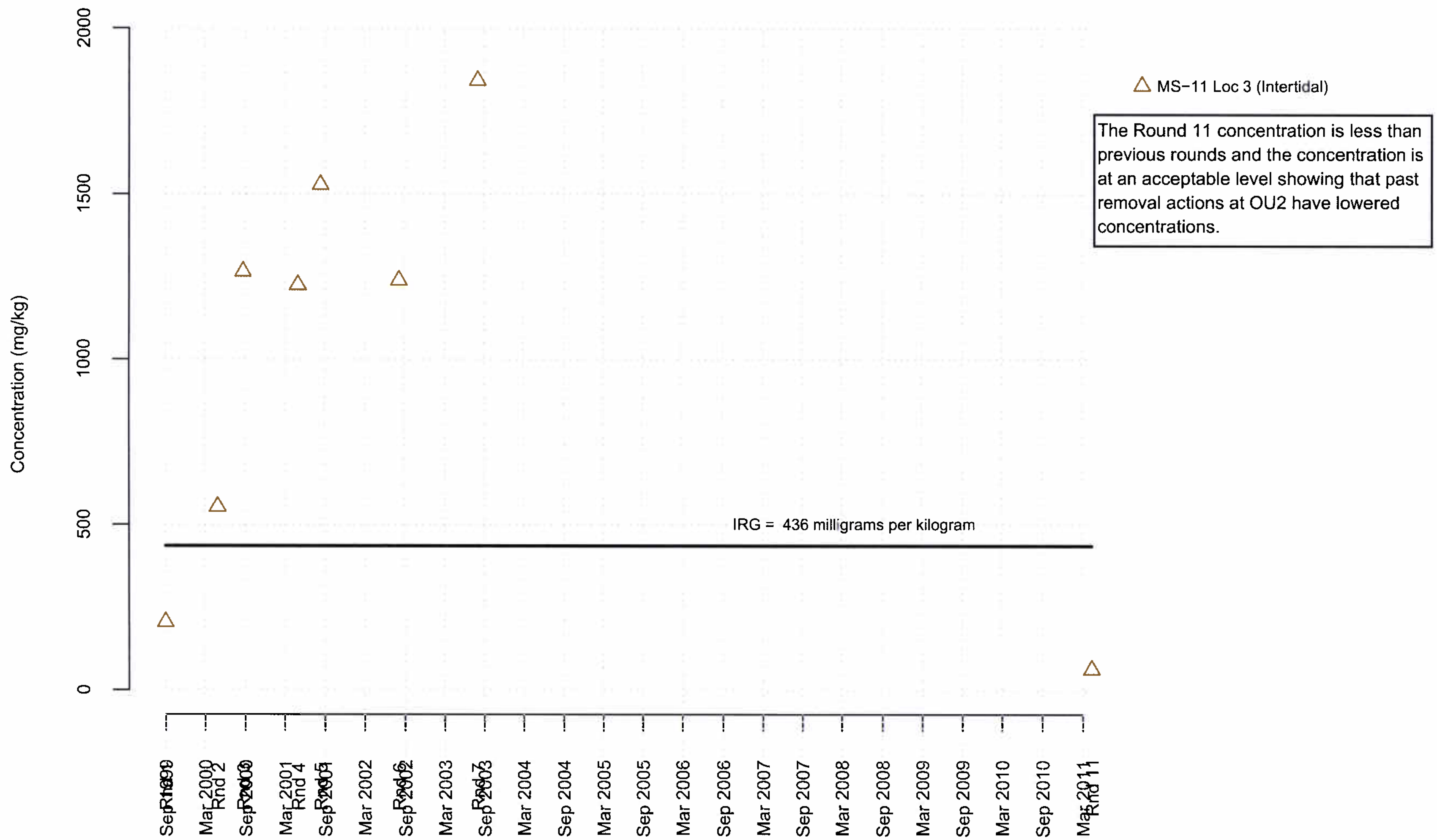


FIGURE 5-13
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR LEAD AT MS-12
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

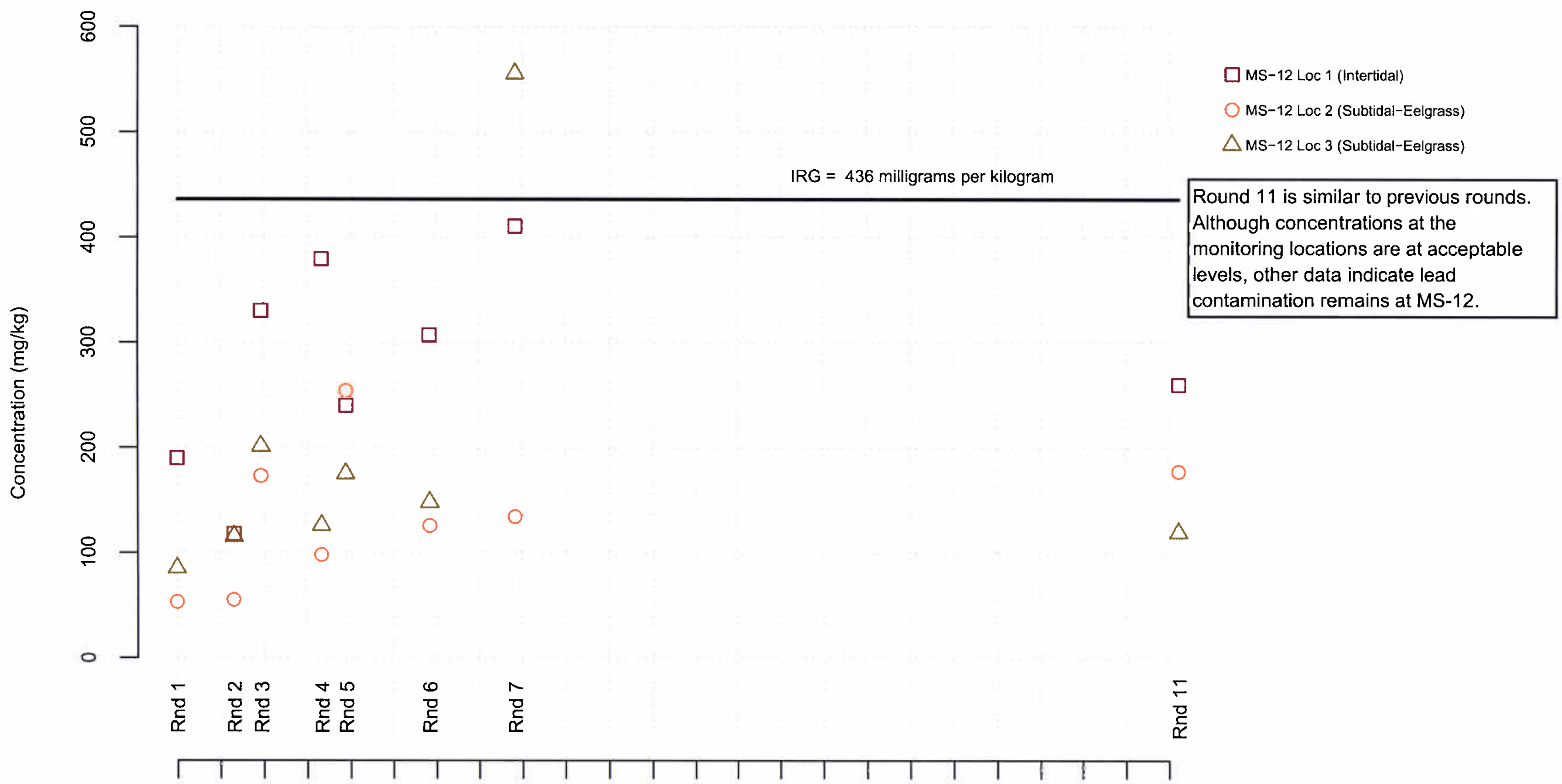
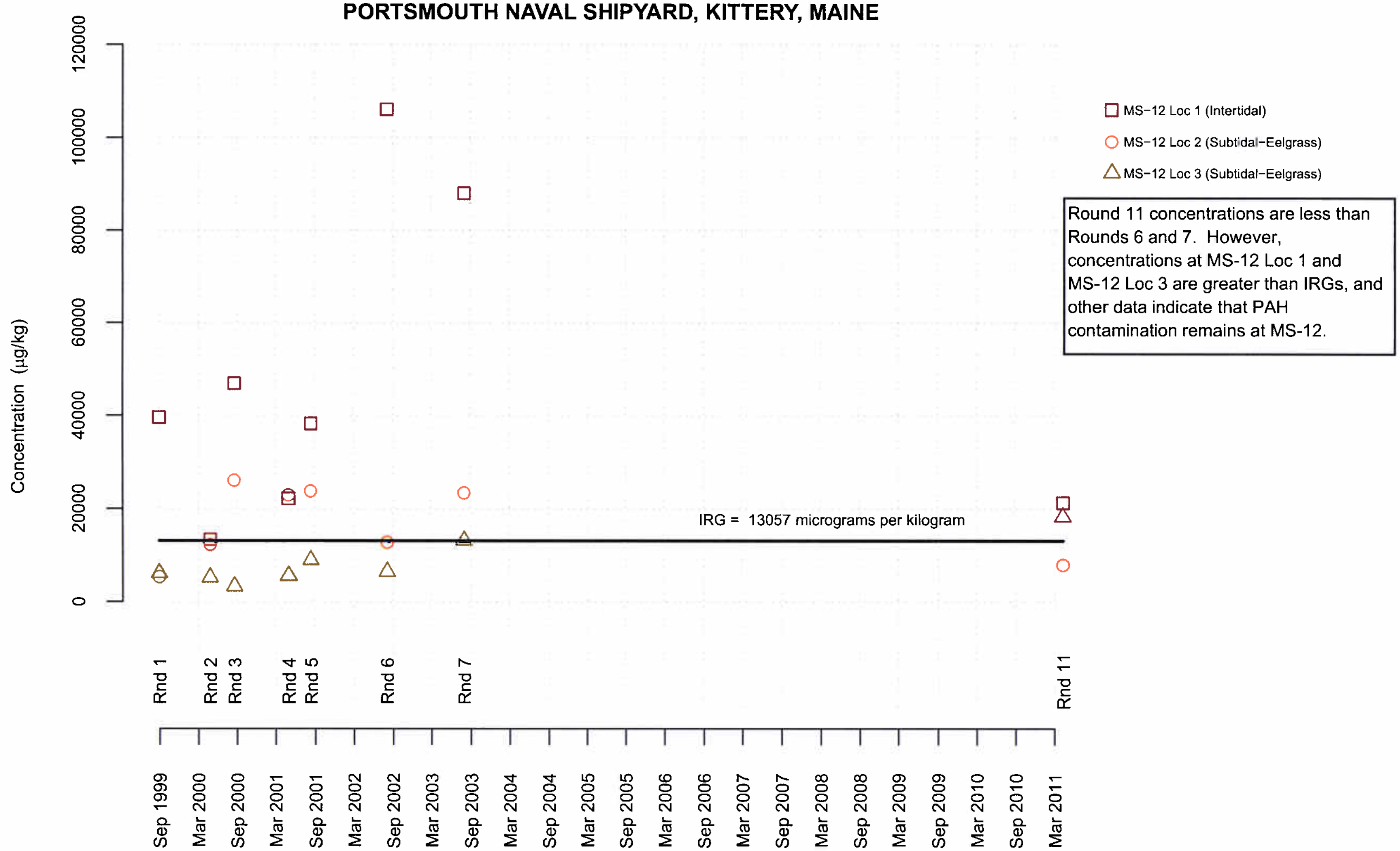


FIGURE 5-14
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS-12
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



- MS-11 concentrations have decreased to less than IRGs in Round 11. Because there is little sediment for ecological exposure and concentrations are low, it is recommended that NFA be considered for this monitoring station during the selection of remedial action.

  MS-05, MS-08, and MS-09, offshore of OU3, do not have exceedances of IRGs in recent rounds and therefore further action is not necessary at these monitoring stations. In addition, 4,4'-DDT, PCBs, and dioxins/furans concentrations are low and similar to previous concentrations, and these chemicals are not at levels of concern at these monitoring stations. These stations are still included in the interim offshore monitoring program; however, the Round 11 data support the conclusion that further monitoring of these stations is not warranted. Because 4,4'-DDT, PCB, and dioxin/furan concentrations remain low, action levels (e.g., IRGs or PRGs) are not required and therefore it is recommended that analyses of these chemicals be discontinued. MS-07 is only included in the interim offshore monitoring program as a reference location for MS-08 and MS-09; therefore, any changes in monitoring at MS-08 and MS-09 should also be made for MS-07 (e.g., reduction of analyte list or discontinuation of monitoring). Consistent with the results of Rounds 10 and 11, NFA should be considered for MS-05, MS-07, MS-08, and MS-09.

- No sampling at MS-02, MS-06, MS-10, MS-13, or MS-14 was conducted in Round 11 because COC concentrations are at acceptable levels indicating that these monitoring stations have not been adversely impacted by onshore IRP sites. These stations were removed from the interim offshore monitoring program, and NFA should be considered as the final remedy for these monitoring stations.

The OU4 FS is being prepared to establish RAOs, screen remedial technologies, and assemble, evaluate, and compare remedial alternatives that will be used in selecting final remedial action to address ecological risk at OU4. The FS will be finalized and remedies will be selected for the monitoring station areas. Table 5-4 summarizes the remedial status at each monitoring station and associated AOC/IRP area.

5.5.3 ARAR and Site-Specific Action Level Changes

A final remedy has not been selected and a final ROD has not been signed for OU4; however, the interim remedial action designated by the Interim ROD is monitoring in the offshore area of PNS in the interim until a final remedy is selected. Tables presenting the ARARs and TBCs from the OU4 Interim ROD are provided in Appendix A. ARARs and TBCs were reviewed to determine whether there have been changes since the Interim ROD and Interim Offshore Monitoring Plan were issued. The chemical-specific ARARs and TBCs for in the Interim ROD for OU4 are as follows:

- NRWQCs (Relevant and Appropriate) and Maine Surface Water Toxics Control Program, Statewide Water Quality Criteria (Relevant and Appropriate).

- FDA Action Levels and NOAA National Status and Trends Program Mussel Watch Data (TBCs).

- NOAA Incidence of Adverse Biological Effects within Ranges of Chemical Concentration in Marine and Estuarine Sediments (ER-L and ER-M concentrations) (Long et al., 1995) and USEPA Proposed Sediment Quality Criteria (TBCs).

Of the above-listed ARARs and TBCs, only the water quality criteria and ER-L and ER-M concentrations were used to develop IRGs. The NRWQCs were revised in 2009, but the criteria for the OU4 COCs did not change. The ER-L and ER-M concentrations for the COCs have not changed since the IRGs were developed.

5.5.4 Site Inspection

The offshore areas were observed on August 10, 2011 by Tetra Tech personnel. No changes in the offshore areas of MS-01, MS-05, MS-06, MS-07, MS-08, MS-09, MS-11, and MS-12 were observed since the Round 11 sampling (April 2011). Topeka Pier near the MS-03 and MS-04 offshore area was no longer in the area because it had been removed in May 2011. Construction of a new pier is planned; however, no construction had begun. Shipyard personnel indicated that construction for Building 178 (onshore of MS-12) is planned, but work has not yet begun.

5.5.5 Site Interviews

No interviews were conducted as part of the Second Five-Year Review.

5.6 TECHNICAL ASSESSMENT

The following conclusions support the determination that the interim remedy for OU4 will be protective of human health and the environment upon completion.

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

- ***Remedial Action Performance and Monitoring Results:*** The Interim Offshore Monitoring Program for OU4 provides data for OU4 until a final remedy is selected. The data are used to determine whether, over the course of interim monitoring, concentrations of COCs in the offshore areas are less than IRGs or whether additional remediation is required as part of a final remedy for OU4. In addition, interim monitoring provides information on the current condition of the offshore areas that has been used to support the identification and selection of several removal actions for the onshore area (e.g., shoreline stabilization at OU2 and OU7). Table 5-4 shows the stations where additional remediation is being evaluated as part of the final remedy or NFA is required because concentrations are less than IRGs.

- ***System Operations/O&M/Cost:*** Data have been collected under the Interim Monitoring Program from September 1999 to April 2011. The projected costs in the Interim ROD are $100,000 to $500,000 annually. Actual costs for Rounds 1 to 8 were presented in the First Five-Year Review Report, which showed that costs generally ranged from $100,000 to $500,000 per sampling event and reporting costs were between $30,000 to $90,000. Actual costs for Rounds 9, 10, and 11 monitoring were much lower than previous rounds because of the reduction in media, analytes, and number of monitoring stations. Phase II Additional Scrutiny Investigation was conducted concurrently with Round 9. The costs include those associated with sampling, analysis, validation, and reporting for monitoring and document preparation for the reports.

TABLE 5-8: COMPARISON OF ACTUAL COSTS AND PROJECTED COSTS FOR OU4

Year of Monitoring	Fiscal Year	Round/ Document	Actual Cost	Actual Total Annual Cost	Projected Total Annual Cost
9 (2007/2008)	FY08	9	$63,900	$146,200	$100,000 to $500,000
		AS Phase II (including QAPP)	$82,300		
10 (2008)	FY09	10	$37,000	$37,000	
12 (2010)	FY09	Rounds 1 to 10 Report	$47,300	$89,900	
	FY10	Interim Offshore Monitoring Plan update	$42,600		
13 (2011)	FY10	11	$61,600	$61,600	

- ***Opportunities for Optimization:*** The 1999 Interim Offshore Monitoring Plan provided an evaluation method for decisions to optimize the monitoring program. Modifications were made after Round 4, after Round 7, and after Round 10 (see Table 5-5). The major optimization recommendations since the first five-year review were based on the Rounds 1 through 10 data evaluation and these activities were implemented in Round 11. Monitoring was eliminated at five monitoring stations and all four reference stations, analytical requirements were reduced to make the list specific to each retained monitoring station, and the frequency of monitoring was reduced at some stations (see Table 5-4). As provided in Table 5-4, select stations for select analytes will be included in Rounds 12 and beyond, until a final remedy is selected and implemented.

Based on review of Round 11 data, it is recommended that elimination of analysis for 4,4'-DDT, dioxins/furans, and PCBs be considered for future interim offshore monitoring rounds for MS-07, MS-08, and MS-09.

- ***Early Indicators of Potential Remedy Problems:*** There are no indicators of potential issues with the interim remedy.

- ***Implementation of Institutional Controls and Other Measures:*** There are no institutional controls or other measures associated with the interim remedy.

Question B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

- ***Changes in Exposure Pathways:*** There have been no changes that would have resulted in new exposure pathways to human or ecological receptors.

- ***Changes in Land Use:*** There have been no changes in land use onshore that would result in an adverse impact to the offshore.

- ***New Contaminants and/or Contaminant Sources:*** There have been no new contaminants or contaminant sources identified.

- ***Remedy Byproducts:*** There are no remedy byproducts for the interim remedy.

- ***Changes in Standards, Newly Promulgated Standards, and TBCs:*** As discussed in Section 5.5.3, there have been no significant changes to the standards in the ARARs that affect the IRGs or interim remedy.

- ***Changes in Toxicity and Other Contaminant Characteristics:*** There have been no changes in the estuarine ecological criteria that impact the IRGs.

- ***Expected Progress Towards Meeting RAOs:*** The interim RAOs for OU4 are being met by conducting offshore monitoring until a final remedy is selected and implemented.

- ***Changes in Risk Assessment Methods:*** There have been no major changes in estuarine ecological risk assessment methodology since the signing of the Interim ROD that would impact the protectiveness of the remedy.

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

The final remedy has not yet been determined. The final remedy will be determined based on an evaluation of data collected during the interim remedy. There has been no new information that calls into question the protectiveness of the interim remedy.

5.7 ISSUES

No issues were identified for OU4.

5.8 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

No issues were identified; therefore, no recommendations or actions are needed to address issues.

5.9 PROTECTIVENESS STATEMENT

The selected interim remedy is protective of human health and the environment in the short term and will be conducted until a final remedy is implemented for OU4. The interim remedy is functioning as intended by the interim ROD, and the intent and goals of the interim ROD have been met. Because this is an interim action, review of site conditions and implementation of this interim remedy will be ongoing as the Navy continues to develop final remedial alternatives for OU4.

A final remedy at OU4 has not yet been selected. The results presented in the Rounds 1 through 10 Interim Offshore Monitoring Report and Round 11 data do not indicate any imminent threats to human health or the environment under current land use scenarios. The onshore remedy for OU3 has reduced the infiltration of precipitation through the unsaturated zone of the landfill and has reduced the potential for contaminant migration to the offshore. Landfill material was excavated from a 3-acre area of the landfill adjacent to Jamaica Cove, further reducing the potential for contaminant migration to the offshore. Onshore activities have been conducted to reduce erosion along the shoreline at OU2 (onshore of MS-11) and OU7 (onshore of MS-03 and MS-04). A removal action removed the source material (soil and ash) at OU9 (onshore of MS-01). These actions will reduce the current and potential future impact from the onshore sites.

6.0 BASE-WIDE CONCLUSIONS AND RECOMMENDATIONS

The base-wide conclusions and recommendations are presented below. These conclusions and recommendations are provided in the form of a base-wide protectiveness statement and a summary of the requirements for the next five-year review.

6.1 ISSUES, RECOMMENDATIONS, AND FOLLOW-UP ACTIONS

There were no issues, recommendations, or follow-up actions for OUs 1, 2, or 4. The issues, recommendations, and follow-up actions for OU3 are as follows in Table 6-1:

TABLE 6-1: ISSUES AND RECOMMENDATIONS SUMMARY

Issue	Recommendations / Required Actions	Responsible Party	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Tilted gas vents and possible minor slope movement upslope of the access road east of the JILF parking area.	Investigate cause and condition of tilted gas vents and possible slope movement.	Navy	USEPA and MEDEP	2013	No	Possibly
Internal drainage pipe is damaged in at least one place within the cap.	Conduct inspection of the area as part of the O&M program with no further evaluation unless there is ponding in that area for an extended period of time, or unstable soil.	Navy	USEPA and MEDEP	2013	No	Possibly

6.2 PROTECTIVENESS STATEMENT

The remedies selected at OU1 and OU2 are expected to be protective of human health and the environment upon completion of the remedies and implementation of LUCs. Steps are being taken to implement the remedies selected in the OU1 and OU2 RODs. There are no imminent threats to human health or the environment under the current land use scenarios, and none are expected prior to completion of the remedy implementation.

The Second Five-Year Review shows that the Navy is meeting the requirements of the ROD for OU3 and the Interim ROD for OU4. The review confirmed that the remedial action at OU3 at PNS remains protective of human health and the environment and that the interim action at OU4 is protective and is expected to remain protective of human health and the environment until a final remedy is selected.

This Second Five-Year Review shows that the Navy is meeting the requirements of the RODs for the sites at PNS.

6.3 NEXT REVIEW

This report represents the Second Five-Year Review conducted at PNS. The next five-year review will be required within 5 years of the signature date of this review, June 2017.

6.3.1 Continued Reviews

Five-year reviews are required by statute under CERCLA for Site 10 (OU1), Sites 6 and 29 (OU2), Sites 8, 9, and 11 (OU3), and the offshore areas (OU4), because remedial actions were conducted at OU3 and will be conducted at OU1, OU2, and OU4 that allow hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure. The next review will provide updated discussions of the remedial actions that are selected and the status of their implementation for all OUs that have RODs that allow hazardous substances, pollutants, or contaminants to remain on site in excess of levels that allow for unlimited use and unrestricted exposure at that time.

A summary of the anticipated requirements for the next five-year review is presented in Table 6-2.

TABLE 6-2: ANTICIPATED REQUIREMENTS

Anticipated Requirement	Milestone Date
An evaluation of the completed remedy and any monitoring results at OU1, and the costs associated with OM&M.	Third Five-Year Review (June 2017).
An evaluation of the completed remedy and any monitoring results at OU2, and the costs associated with OM&M.	Third Five-Year Review (June 2017).
Evaluation of LUC requirements and inspections for OU1, OU2, and OU3.	Third Five-Year Review (June 2017).
An evaluation of groundwater monitoring and O&M activities at OU3 and the costs for the activities.	Third Five-Year Review (June 2017).
An evaluation of actions taken to address the potential threats posed by the conditions at OU4 and a description of the permanent remedy selected for the offshore areas.	Remedy selection anticipated by 2013 and implementation by 2014. Third Five-Year Review (June 2017)
A review of the recommendations listed in the Second Five-Year Review.	Third Five-Year Review (June 2017).

Anticipated Requirement	Milestone Date
A review of sites within OUs where a remedy that does not allow unlimited use and unrestricted exposure is selected subsequent to the Third Five-Year Review.	Third Five-Year Review (June 2017).

6.3.2 Discontinue Reviews

The DRMO Impact Area within OU2 will no longer require five-year reviews. The OU2 ROD (Navy, September 2011) selected NFA as the appropriate remedy for the DRMO Impact Area because site conditions allow for unlimited use and unrestricted exposure.

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APPENDIX A

FIVE-YEAR REVIEW INSPECTION ITEMS

APPENDIX A.1

OU3 LANDFILL COMPONENTS INSPECTION AND MAINTENANCE RECOMMENDATIONS - ROUND 10

TABLE A-1

OU3 LANDFILL COMPONENTS INSPECTION AND MAINTENANCE RECOMMENDATIONS - ROUND 10
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

System/Physical Features	Recommendations	Maintenance Recommendation Status
Vegetated Cover System	Identified in Round 10: Continue to monitor for potential erosion of areas prone to ponding.	Monitored in landfill components inspection.
	Identified in Round 10: Continue the program to remove groundhogs from the landfill. Burrows should be filled in after removing the animals.	Program administered by the Shipyard contracting officer during the winter and spring months.
	Identified in Round 10: Repair areas damaged by snow plows (regrade and reseed as necessary). The most significantly damaged areas are (1)along the road edge across from Building 305, and (2) along the west side of the paved parking area.	Tire ruts and snow plow damage were filled in and grass seed was added during Round 10.
	Identified in Round 10: Repair and reseed soil ruts at roadway and parking lot edges, particularly in the area across from Building 305.	Repairing and reseeding soil ruts was completed during Round 10. Granite blocks were placed at the perimeter of the parking lot to prevent rutting in these areas.

TABLE A-1

OU3 LANDFILL COMPONENTS INSPECTION AND MAINTENANCE RECOMMENDATIONS - ROUND 10
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

System/Physical Features	Recommendations	Maintenance Recommendation Status
Vegetated Cover System (cont.)	Identified Rounds 9 and 10: Repair and reseed areas with no vegetative cover noted in the inspection report (e.g., areas of lawn mower damage and areas where ECB is exposed). An area of surficial soil erosion exists on the grassy slope in between Channel Chute No.1 and Channel Chute No. 2.	Areas should continue to be monitored during landfill components inspections and reseeded as needed.
Paved Cover System	Monitor parking lot use for equipment storage to ensure no point loads damage the pavement. Use boards under point loads to distribute the weight. Avoid storage of shipping containers in the parking lot.	Monitored in landfill components inspection. Shipyard has installed signs to restrict certain types of equipment storage. Shipyard regularly monitors parking lot use.
	Patch tire ruts in the soil/grass cover at the edges of the paved parking area with soil matching the adjacent soil type (e.g., by Gas Vent #27). Reseed the patched areas.	Tire ruts were filled and seeded around the edges of the parking lot during Round 10.
Storm Water Drainage System	Identified Round 10: Accumulated debris/sediment/vegetation within the channels/culverts may warrant removal.	Removed all debris/dead vegetation and fallen stones in culverts blocking flow in Round 10.

OU3 LANDFILL COMPONENTS INSPECTION AND MAINTENANCE RECOMMENDATIONS - ROUND 10
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

System/Physical Features	Recommendations	Maintenance Recommendation Status
Storm Water Drainage System (cont.)	Identified in Round 10: Regrade eroded portions of the jogging path.	Shipyard maintenance activity.
	Identified Round 10: Continue to monitor areas with surficial erosion.	Completed as a part of landfill components inspection.
	Identified in Round 10: Snow plow damage to roadside and upper ditch slope across from Building 305 and accumulated sediment (eroded soil) in the ditch (Grid E2).	Plow damage was repaired and reseeded during Round 10 maintenance activities.
Gas Monitoring System	Identified in Round 9: The asphalt should be repaired around the cover of gas probe G-7.	The area around gas probe G-7 was patched with asphalt during Round 10.
Groundwater Monitoring Wells	Identified Round 8: Replace missing or broken bolts at JW-13B and JW-23.	Completed during the well abandonment effort that was conducted November 2011.

TABLE A-1

OU3 LANDFILL COMPONENTS INSPECTION AND MAINTENANCE RECOMMENDATIONS - ROUND 10
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

System/Physical Features	Recommendations	Maintenance Recommendation Status
Groundwater Monitoring Wells (cont.)	Identified Round 9: Add a locking J-plug cap to WOT-5 so that it is secured.	Completed during the well abandonment effort that was conducted November 2011.
	Replace the flush-mounted road box casing for JW-13DB.	JW-13DB was abandoned during November 2011.
Shoreline Protection	Continue to monitor vegetative growth in the riprap of Jamaica cove to ensure that there is no significant damage to the riprap slope protection.	Completed as a part of landfill components inspection.
	Identified in March 2010 Episodic Inspection and in Round 9: Remove debris from the Clark Cove revetment (e.g., orange “life ring” box and post).	Completed during Round 10.

TABLE A-1

OU3 LANDFILL COMPONENTS INSPECTION AND MAINTENANCE RECOMMENDATIONS - ROUND 10
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

System/Physical Features	Recommendations	Maintenance Recommendation Status
Fencing and Miscellaneous Features	Continue the monitoring program in accordance with the OM&M Plan.	Completed as a part of landfill components inspection.
	Repair the speed limit signs, reflector posts, and post hole across the street from Building 337.	Reflector posts were repaired during Round 10. Traffic signs were repaired during the well abandonment activities conducted in November 2011.
	Repair the tilted traffic/landfill warning sign at the intersection of Ayer's Circle and Parker Avenue.	Tilted traffic sign was repaired during the well abandonment activities conducted in November 2011; landfill warning sign is a shipyard maintenance activity.
Settlement Monument Survey and Visual Settlement **Inspection Slope Stability Monitoring**	Continue the monitoring program in accordance with the OM&M Plan.	Completed as a part of landfill components inspection.

TABLE A-1

OU3 LANDFILL COMPONENTS INSPECTION AND MAINTENANCE RECOMMENDATIONS - ROUND 10
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

System/Physical Features	Recommendations	Maintenance Recommendation Status
Land Use (Parking Lot)	Limit/control the storage of heavy equipment in parking lot that may damage the asphalt pavement.	Shipyard has installed signs that limit storage of equipment. Shipyard regularly monitors parking lot use.
	Continue to monitor parking lot use for proper equipment storage. Continue to use boards under point loads to distribute the weight.	Completed as a part of landfill components inspection. Shipyard regularly monitors parking lot use.

APPENDIX A.2

OU1 THROUGH OU4 INSPECTION FORMS

Site Inspection Checklist

I. SITE INFORMATION	
Site name: OPERABLE UNIT 1	**Date of inspection:** August 10, 2011
Location and Region: Portsmouth Naval Shipyard, EPA Region 1	**EPA ID:** ME7170022019
Agency, office, or company leading the five-year review: Navy	**Weather/temperature:** Approximately 72 degrees, humid, overcast
Remedy Includes: (Check all that apply) ☒ Groundwater Monitoring ☒ Institutional controls ☒ Access controls ☐ Other ________________________________ ________________________________	
Attachments: ☒ Inspection team roster attached ☐ Site map attached	
II. INTERVIEWS (Check all that apply)	
1. **O&M site manager** __________ Name __________ Title ________ Date Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ________ Problems, suggestions; ☐ Report attached ____________________	
2. **O&M staff** __________ Name __________ Title ________ Date Interviewed ☐at site ☐at office ☐ by phone Phone no. ________ Problems, suggestions; ☐ Report attached____________________	

2. **Local regulatory authorities and response agencies** (Continued)

Agency ____USEPA___________________
Contact_Matthew R. Audet ___USEPA Remedial Project Manager ______ 617.918.1449
Name | Title | Date | Phone no.

Problems; suggestions; ☐ Report attached __Will provide input through review and comment on draft and draft final reports.___________________________________

Agency ____MEDEP___________________
Contact _Iver McLeod___ _MEDEP Remedial Project Manager ________ 207.287.8010
Name | Title | Date | Phone no.

Problems; suggestions; ☐ Report attached _Will provide input through review and comment on draft and draft final reports._______________________________________

3. **Other interviews** (optional) ☐ Report attached.

Community members will have the opportunity to provide input at RAB meeting for Draft Report and comment on Draft Report.

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

1. **O&M Documents**
   - ☐ O&M manual ☐ Readily available ☐ Up to date ☒ N/A
   - ☐ As-built drawings ☐ Readily available ☐ Up to date ☒ N/A
   - ☐ Maintenance logs ☐ Readily available ☐ Up to date ☒ N/A

   Remarks_Under preparation; Will be implemented after remedy construction is complete.____

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date ☒ N/A
   - ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A

   Remarks_Under preparation; Will be implemented after remedy construction is complete.____

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A

   Remarks_Under preparation; Will be implemented after remedy construction is complete.____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ 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_None needed.______________________________

5. **Groundwater Monitoring Records** ☐ Readily available ☐ Up to date ☒ N/A

   Remarks__Groundwater monitoring will begin after construction is complete.___________

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 (N/A – O&M has not begun)**
   - ☐ Readily available
   - ☐ Up to date
   - ☐ Funding mechanism/agreement in place

   Original O&M cost estimate_N/A_________________ ☐ Breakdown attached

   Total annual cost by year for review period if available

   From__________ To__________ __________________ ☐ Breakdown attached
   Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period** Describe costs and reasons: ___N/A – O&M has not begun ___________

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☒ N/A

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☒ N/A
   Remarks________________________________

B. Other Site Conditions

Remarks__No change in site use (industrial), asphalt has some cracking and pot holes, but no major areas of exposed soil are present.___________

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER MONITORING ☒ Applicable ☐ N/A

A. Monitoring Data

1. Monitoring Data
   ☐ Is routinely submitted on time ☐ Is of acceptable quality ☒ N/A

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining
   ☒ N/A

B. Groundwater Monitoring

1. **Monitoring Wells**
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☒ N/A
   Remarks:_Groundwater monitoring has not begun.___________

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.). Construction will begin in 2011. The Groundwater Sampling and Analysis Plan, as part of the proposed Long Term Management Plan is under preparation and implementation is anticipated for Winter 2011. The Land Use Control Remedial Design (LUC RD) is under preparation. The revised draft LUC RD was submitted in August 2011. Regulatory review and comment was delayed. The LUC RD will prevent residential use.
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. N/A at this time. See Section A.
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. N/A at this time. See Section A.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A at this time. See Section A.

Site Inspection Checklist

I. SITE INFORMATION	
Site name: OPERABLE UNIT 2	**Date of inspection:** August 10, 2011
Location and Region: Portsmouth Naval Shipyard, EPA Region 1	**EPA ID:** ME7170022019
Agency, office, or company leading the five-year review: Navy	**Weather/temperature:** Approximately 72 degrees, humid, overcast
Remedy Includes: (Check all that apply) ☒ Groundwater Monitoring ☒ Sediment Accumulation Monitoring ☒ Soil Cover/Containment ☒ Institutional controls ☐ Other ______	
Attachments: ☒ Inspection team roster attached ☐ Site map attached	
II. INTERVIEWS (Check all that apply)	
1. **O&M site manager** ______ Name ______ Title ______ Date Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ______ Problems, suggestions; ☐ Report attached ______	
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** (Continued)

Agency ____USEPA__________________
Contact_Matthew R. Audet __USEPA Remedial Project Manager ______ 617.918.1449
Name Title Date Phone no.

Problems; suggestions; ☐ Report attached __Will provide input through review and comment on draft and draft final reports.____

Agency ____MEDEP__________________
Contact _Iver McLeod__ _MEDEP Remedial Project Manager ________ 207.287.8010
Name Title Date Phone no.

Problems; suggestions; ☐Report attached _Will provide input through review and comment on draft and draft final reports.____

____

4. **Other interviews** (optional) ☐ Report attached.	
Community members will have the opportunity to provide input at RAB meeting for Draft Report and comment on Draft Report.	

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

1. **O&M Documents**
☐ O&M manual ☐ Readily available ☐ Up to date ☒ N/A
☐ As-built drawings ☐ Readily available ☐ Up to date ☒ N/A
☐ Maintenance logs ☐ Readily available ☐ Up to date ☒ N/A
Remarks___Design not completed; Remedial action not implemented._________________

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date ☒ N/A
☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
Remarks___Design not completed; Remedial action not implemented

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks_Design not completed; Remedial action not implemented_____________

4. **Permits and Service Agreements**
☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ 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__Design not completed; Remedial action not implemented__________________

5.	**Groundwater Monitoring Records** ☐ Readily available ☐ Up to date ☒ N/A Remarks__Design not completed; Remedial action not implemented

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 (N/A – Remedial action not implemented)** ☐ 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
3.	**Unanticipated or Unusually High O&M Costs During Review Period** Describe costs and reasons: None

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A	
A. Fencing	
1.	**Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A Remarks__Not yet implemented. May be implemented after the ROD is complete.
B. Other Access Restrictions	
1.	**Signs and other security measures** ☐ Location shown on site map ☒ N/A Remarks__Not yet implemented. May be implemented after the ROD is complete.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☒ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☒ N/A

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

Frequency ____________________

Responsible party/agency Navy

Contact ____________ ____________ ____________ ____________

Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☒ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☒ N/A

Violations have been reported ☐ Yes ☐ No ☒ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks____________________

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks____________________

2. **Land use changes on site** ☒ N/A

Remarks____________________

3. **Land use changes off site** ☒ N/A

Remarks____________________

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks____________________

B. Other Site Conditions

Remarks____________________

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
IX. GROUNDWATER AND SEDIMENT MONITORING ☐ Applicable ☒ N/A
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.). Not applicable at this time. See Section A
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. Not applicable at this time. See Section A
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. Not applicable at this time. See Section A
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Not applicable at this time. See Section A

Site Inspection Checklist

I. SITE INFORMATION	
Site name: OPERABLE UNIT 3	**Date of inspection:** April 11, 2011
Location and Region: Portsmouth Naval Shipyard, EPA Region 1	**EPA ID:** ME7170022019
Agency, office, or company leading the five-year review: Navy	**Weather/temperature:** Approximately 46 degrees, no precipitation

Remedy Includes: (Check all that apply)

☒ Landfill cover/containment ☒ Groundwater Monitoring ☒ Landfill Gas Monitoring
☒ Access controls ☒ Institutional controls
☐ Other ______________________________

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** ____________ ____________ ____________
   Name Title Date

   Interviewed ☐at site ☐at office ☐ by phone Phone no. ____________

   Problems, suggestions; ☐ Report attached ______________________________

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** (Continued)

Agency ____USEPA__________________
Contact_Matthew R. Audet _USEPA Remedial Project Manager ______ 617.918.1449
Name Title Date Phone no.

Problems; suggestions; ☐ Report attached __Will provide input through review and comment on draft and draft final reports.

Agency ____MEDEP__________________
Contact _Iver McLeod__ _MEDEP Remedial Project Manager ________ 207.287.8010
Name Title Date Phone no.

Problems; suggestions; ☐Report attached _Will provide input through review and comment on draft and draft final reports.

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

Community members will have the opportunity to provide input at RAB meeting for Draft Report and comment on Draft Report.

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

1. **O&M Documents**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks_______________________________

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
Remarks: Separate Health and Safety Plans are prepared for each round of O&M.

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks: Kept by company that performs the O&M.

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ 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_______________________________

5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks _Gas vapor is monitored but not gas generation. Gas vapor monitoring data is readily available._			
6.	**Settlement Monument Records**	☒ Readily available	☒ Up to date	☐ N/A
	Remarks			
7.	**Groundwater Monitoring Records**	☒ Readily available	☒ Up to date	☐ N/A
	Remarks			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
10.	**Daily Access/Security Logs**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks: _Access to PNS is restricted, but access to Jamaica Island Landfill (OU3) is not restricted within PNS._			

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 (Date)	To (Date)	Total cost	
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached

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** ☐Location shown on site map ☐ Gates secured ☒ N/A
Remarks; Access to enter the shipyard is restricted, but OU3 site access is not restricted within the shipyard.

B. Other Access Restrictions

1. **Signs and other security measures** ☒Location shown on site map ☐ N/A
Remarks: Signs restricting digging were installed by Navy. Photographs of the sign will be included in Appendix B.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	☐Yes	☒No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☒ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Inspection during O&M rounds
Frequency Annually and after episodic storms.
Responsible party/agency Navy, NAVFAC Mid-Atlantic
Contact Linda Cole RPM

Name	Title	Date	Phone no.
Linda Cole	RPM		

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

Other problems or suggestions: ☐ Report attached

____
____

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks______________________________

D. General		
1.	**Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident Remarks______	
2.	**Land use changes on site** ☐ N/A Remarks_None______	
3.	**Land use changes off site** ☒ N/A Remarks______	

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A	
1.	**Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks______

B. Other Site Conditions
Remarks_All hazardous waste was removed from Jamaica Cove and the wetland was constructed. The wetland is in excellent condition and plants are growing. Wetland maintenance is not part of the OU3 O&M responsibilities. Wetland construction does not match As-Built Drawing C1, but does match Red-Line Drawing G18 (OM&M Plan Revision 1, Tetra Tech, 2011). No visible seeps on face of wetland embankment.______

VII. LANDFILL COVERS ☒ Applicable ☐ 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__A few thin, long cracks in paved cover, with no exposed soil and little to no weed growth through the cracks. There is another thin (minor) crack in the concrete pad under the electrical control panel of the southernmost shed (Grid F7).______
3.	**Erosion** ☐ Location shown on site map ☐ Erosion not evident Areal extent__200 ft^2______ Depth__<3 in.______ Remarks____Several areas were found where cover had been damaged by vehicles. The eroded/damaged areas of the vegetated cover were repaired (regarded and reseeded) during the Round 10 monitoring event in April 2011.______

4.	**Holes** ☐ Location shown on site map ☐ Holes not evident Areal extent______________ Depth____________ Remarks__There are several small holes caused by burrowing animals. See the attached inspection report from the Round 10 sampling event for more information_______________
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__The paved cover system was inspected, and all portions were in good condition overall. More information can be found in the attached inspection report from the Round 10 sampling event.____
7.	**Bulges** ☐Location shown on site map ☒Bulges not evident Areal extent______________ Height____________ Remarks____
.	**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__The soccer field was very wet on the eastern half and had extensive ponding on the western half. Ponding and shallow puddles were found at several other locations, including ruts caused by vehicles, eroded areas, and grassy areas. The attached inspection report provides further details.______________________
9.	**Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability Areal extent______________ Remarks____Tilted gas vents and possible minor slope movement upslope of the access road east of the JILF parking lot. ____
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.)
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.)

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__ Asphalt needed to be repaired around the cover of gas probe G-7. This was patched during the Round 10 sampling event in April 2011.
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__ A few wells required maintenance as noted during the April 2011 inspection, but the maintenance will be completed prior to the five-year review, in Summer of 2011.
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	
F. Cover Drainage Layer ☐ Applicable ☒ N/A	
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A	
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__Minor soil/sediment accumulation around the stormwater catch basin in the southeast corner of the Auto Hobby Shop parking area. __________________________
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__There were several shallow erosion rivulets present. There is more detailed information in the Round 10 (April 2011) Inspection report.
4.	**Discharge Structure** ☒ Functioning ☐ N/A Remarks____
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A	
IX.. GROUNDWATER MONITORING ☒ Applicable ☐ N/A	
A. Monitoring Data	
1.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
2.	Monitoring data suggests: ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining Remarks__Groundwater concentrations are at or below action levels.____________________
B. 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.). ____The remedy is intended to prevent contact with contaminated soil and/or waste. The cover also minimizes infiltration of water to the landfill material. Institutional controls are to restrict land and fresh groundwater uses within the JILF boundary to prevent unacceptable human exposure to site contaminants. Institutional controls are also to prevent unrestricted disturbance of the hazardous waste landfill cover and shoreline erosion controls. ____The remedy currently appears to be functioning as designed. The cap prevents contact and infiltration. Several signs have been added around the perimeter to prevent digging. No indication of disturbance of the landfill cover or erosion controls, to a degree that could potentially affect protectiveness, was evident. Overall, exposure to site contaminants appears to be effectively prevented by the remedy.
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. _Overall, the condition of the asphalt, Clark Cove rip-rap, and Jamaica Cove wetland, and apparent condition of the gas vents, gas probes, and settlement plates is good. Minor issues have been identified as requiring maintenance, but nothing has been identified that would affect protectiveness at this time. __Due to a possible minor slope movement, a few gas vents are tilting upslope of East Road. This will be investigated further prior to the Third five-Year Review.

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. ____The possible slope movement mentioned in Section XI.B. above will be investigated further to determine if it presents an issue to function, cost, or scope of the remedy. ___
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. _Opportunities to optimize the groundwater and gas monitoring programs are discussed in Section 4.0 of the Five-Year Review._

Site Inspection Checklist

I. SITE INFORMATION	
Site name: OPERABLE UNIT 4	**Date of inspection:** August 10, 2011
Location and Region: Portsmouth Naval Shipyard, EPA Region 1	**EPA ID:** ME7170022019
Agency, office, or company leading the five-year review: Navy	**Weather/temperature:** Approximately 72 degrees, humid, overcast

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Monitored natural attenuation
- ☐ Access controls
- ☐ Groundwater containment
- ☐ Institutional controls
- ☐ Vertical barrier walls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other Monitoring sediment.

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** ______ Name ______ Title ______ Date

   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ______

   Problems, suggestions; ☐ Report attached ______

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** (Continued)

Agency ____USEPA__________________
Contact _Matthew R. Audet _USEPA Remedial Project Manager ______ 617.918.1449
Name / Title / Date / Phone no.

Problems; suggestions; ☐ Report attached __Will provide input through review and comment on draft and draft final reports.__________________________

Agency ____MEDEP__________________
Contact _Iver McLeod__ _MEDEP Remedial Project Manager ________ 207.287.8010
Name / Title / Date / Phone no.

Problems; suggestions; ☐Report attached _Will provide input through review and comment on draft and draft final reports.__________________________

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

Community members will have the opportunity to provide input at RAB meeting for Draft Report and comment on Draft Report.

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

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks____

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☒Up to date ☐ N/A
☐ Contingency plan/emergency response plan ☐ Readily available ☐Up to date ☒ N/A
Remarks_Separate Health and Safety plans are prepared for each round of O&M.

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks__O&M training is not necessary, because O&M is not included as part of the OU4 Interim Remedy. OSHA training records are kept by the company that performs the offshore sampling.

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒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____

5. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A
Remarks Access to PNS is restricted, but access to OU4 is not restricted within PNS.

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 (Date)	To (Date)	Total cost	
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached
			☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period** Describe costs and reasons:
NA - Second five-Year Review report provides the evaluation.

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☒ N/A

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☒ N/A
Remarks_______________

B. Other Site Conditions

Remarks MS 1 – no change in offshore area. MS 3/4 – Topeka Pier was removed in May 2011, no additional changes. A new pier will be built, but construction has not started. MS 5-9 – no changes in offshore areas. MS-11 – no changes in offshore area. MS-12 – did not see any change in the offshore area. Construction is in planning stages for Building 178, but has not yet begun.

VII. LANDFILL COVERS ☐ Applicable ☒ N/A
VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
IX.. GROUNDWATER MONITORING ☐ Applicable ☒ N/A
X. OTHER REMEDIES
Offshore monitoring is included as part of the remedy at OU4.
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.). Offshore monitoring is conducted every 2 to 5 years at OU4 until a permanent remedy is in place.
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. N/A
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. N/A
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. N/A
X.a. OFF-SHORE MONITORING ☒ Applicable ☐ N/A
1. **Performance Monitoring** Type of monitoring: Sediment sampling ☐ Performance not monitored Frequency: 2 to 5 years ☐ Evidence of breaching Remarks

A. Monitoring Data	
1.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
2.	Monitoring data suggests: ☐ Sediment continues to accumulate ☒ Contaminant concentrations are declining

Inspection Team Rosters

August 10, 2011 Site Visit (OU1, OU2, and OU4):

Deborah Cohen, Tetra Tech

April 11, 2011 Site Visit (OU3 Round 10 Inspection Team):

James Ropp, Tetra Tech

Lori Anderson, Tetra Tech

Terry Rojahn, Tetra Tech

APPENDIX A.3

DEPARTMENT OF NAVY INSTRUCTIONS

NAVSHPYDPTSMH INSTRUCTION 5090.6D, SOLID WASTE OPERATIONS, CHAPTER 7

COMMANDER, NAVY REGION, MID-ATLANTIC INSTRUCTION 5090.2, INSTALLATION RESTORATION; LAND USE CONTROLS AT NAVY REGION, MID-ATLANTIC INSTALLATIONS; ESTABLISHMENT AND MAINTENANCE

NAVSHPYDPTSMH INSTRUCTION 5090.6D,
SOLID WASTE OPERATIONS, CHAPTER 7

DEPARTMENT OF THE NAVY
PORTSMOUTH NAVAL SHIPYARD
PORTSMOUTH, N. H. 03804-5000

IN REPLY REFER TO:
NAVSHIPYD PTSMHINST
5090.6D (106.3)

13 NOV 2008

NAVSHIPYD PTSMH INSTRUCTION 5090.6D

From: Commander, Portsmouth Naval Shipyard

Subj: SOLID WASTE OPERATIONS

Ref: (a) OPNAVINST 5090.1, Navy Environmental and Natural Resources Program Manual
(b) State of Maine Solid Waste Management Regulations, Chapters 400-409

Encl: (1) Solid Waste Operations Manual

1. Purpose. To issue a revision to operating and management procedures for the Portsmouth Naval Shipyard Solid Waste Program. Enclosure (1) is Portsmouth's Solid Waste Operations Manual which also serves as the Shipyard's Solid Waste Management Plan.

2. Cancels. NAVSHIPYD PTSMHINST 5090.6C of 15 APR 2003

3. Effective Date. 24 NOV 2008

4. Background. The Navy is committed to operating its ships and shore facilities in a manner compatible with the environment. Reference (a) was issued to implement that goal. This document requires the Shipyard to issue a Solid Waste Management Plan and a Recycling Instruction. The Shipyard is also bound by the State of Maine's Solid Waste Regulations (reference (b)). These regulations require the Shipyard to issue a Solid Waste Operations Manual.

5. Scope. This instruction applies to all aspects of the Solid Waste Program on this Shipyard.

6. Responsibilities. All applicable codes, tenants and contractors will perform duties to support solid waste control efforts as described in Chapter 1, Section 1.6.

7. Leadership Overview. Occupational Safety, Health, and Environmental (OSHE) Office, Environmental Division (Code 106.3) will conduct an annual review of the effectiveness and contents of this instruction and revise as necessary.

KENNETH W. PLAISTED
By direction

Distribution:
A, B, E, W
106.3 (10)
862 (15)
910 (4)
919 (4)
250.2(2)
982(2)
914(2)
916.4(2)
971(3)
DRMO

PORTSMOUTH NAVAL SHIPYARD
PORTSMOUTH, NEW HAMPSHIRE

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Record of Changes
NAVSHIPYDPTSMH INST 5090.6D

Change Number	Date Recorded	Entered By
Original		

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PORTSMOUTH NAVAL SHIPYARD
PORTSMOUTH, NEW HAMPSHIRE

CHAPTER 7
CONTROL OF EXCAVATION ACTIVITIES

TABLE OF CONTENTS

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CHAPTER 7
CONTROL OF EXCAVATION ACTIVITIES

7.1 Purpose. To establish a protocol for monitoring excavation activities on Portsmouth Naval Shipyard to control the removal of excavated materials to ensure proper disposal or recycling, and to provide detailed information on the location of known filled areas at the Shipyard and specific restrictions on digging/excavating at these sites.

7.2 Scope. This chapter applies to all units, tenants, and activities aboard the Shipyard and pertains to any digging or excavation, for any reason, at any site located on the Shipyard including Installation Restoration (IR) sites, by Shipyard employees, contractors, or other personnel.

7.3 Background. The Shipyard has been in existence in excess of 200 years; areas of the Shipyard have been filled with various materials including industrial debris and wastes, as indicated in Appendix 12.6.1 and reference (m). The existence of these sites has required the United States Environmental Protection Agency (EPA) to designate the Shipyard as a National Priority List (NPL) site. As a result of this status, it is imperative that any digging or excavation in identified NPL sites termed IR sites by the Shipyard is controlled. Obviously soil that is excavated from these sites must be handled in accordance with all state and federal environmental regulations.

Soil from non-IR sites also has the potential to contain industrial debris and should not leave the Shipyard unless it has been determined to be clean.

7.4 Responsibilities

7.4.1 Environmental Division (Code 106.3)

7.4.1.1 Develop and maintain a Solid Waste Operations Manual for the control of all digging/excavation.

7.4.1.2 Review all requested excavation permits and approve or disapprove requests within two working days.

7.4.1.3 Oversee all excavations on the Shipyard.

7.4.1.3.1 Develop job and site specific boring/sampling plans consistent with Environmental Protection Agency (EPA) sampling standards, from information provided by

Code 910 and knowledge of areas of environmental concern on large excavations (those exceeding 50 cubic yards).

7.4.1.3.2 Provide Code 106.3 representation to act as a Contracting Officer Technical Representative (COTR) to assist in directing sampling contractor to designated sampling locations specified on the sampling plan.

7.4.1.3.3 Provide Code 134 with soil samples from small excavations in areas of environmental concern in accordance with reference (n), for analysis to determine Total Characteristic Leachate Process (TCLP) of Resource Conservation Recovery Act (RCRA) metals and Total Petroleum Hydrocarbon (TPH) levels within the samples.

7.4.1.4 Authorize the removal of all soil from the Shipyard.

7.4.1.5 Notify the State of Maine Department of Environmental Protection and the United States Environmental Protection Agency Personnel for any work proposed at an IR site.

7.4.1.6 Approve site-specific safety and health plans when required.

7.4.1.7 Coordinate a disposal plan through the Hazardous Waste Facility Manager prior to excavation.

7.4.1.8 Develop a sampling plan consistent with EPA sampling standards for the disposal of soil from the soil bins. The sampling plan shall be determined based on the soil and the sampling requirements of proposed disposal site.

7.4.2 FEAD Code 910

7.4.2.1 Ensure that all contractor personnel are aware of the restrictions imposed by this chapter.

7.4.2.2 Ensure that contractor personnel understand that no soil is to leave the Shipyard unless it is approved by Code 106.3.

7.4.2.3 Ensure that excavations are completed by the Shipyard Excavation Permit (Appendix 12.6.1) expiration date.

7.4.2.4 Instruct contractors to minimize digging and to reuse fill to the maximum extent possible.

7.4.2.5 Notify Code 106.32 two weeks prior to start date.

7.4.2.6 Provide Code 106.3 with copies of completed Excavation/Demolition Debris Removal Passes.

7.4.2.7 Monitor large excavations regularly to visually inspect materials excavated and direct the contractor on the proper handling and the location to which the material should be transported.

7.4.2.8 Inform Code 106.3 in the event that questionable material is unearthed during large excavations.

7.4.2.9 Enforce the use of reference (o) and supply Code 106.3 with copies of completed forms for materials removed from the Shipyard.

7.4.3 <u>Facilities and Maintenance Officer (Code 910)</u>

7.4.3.1 Prepare an excavation permit for all Code 910 work that involves digging or excavation of Shipyard soil.

7.4.3.2 Ensure that all Code 910 personnel digging or excavating on the Shipyard abide by the restrictions of this chapter.

7.4.3.3 Ensure that all Code 910 personnel understand that no soil is to leave the Shipyard unless it is approved by Code 106.3.

7.4.3.4 Update all contract language to incorporate controls of excavation as contained in this chapter within three months of the effective date of this chapter.

7.4.3.5 Ensure that contracts reflect the specific conditions for approval as directed by the Environmental Division, in the Excavation Permit (Appendix 7.6.1).

7.4.3.6 Provide Code 106.3 with a detailed plan description and sketches for large excavations at the time of National Environmental Policy Act (NEPA) Checklist submittal, in order to facilitate boring/sampling plan development.

7.4.3.7 Review site-specific boring/sampling plan developed by Code 106.3 to insure that locations marked for testing will not interfere with or destroy existing underground utilities or structures.

7.4.4 Shipyard Materials Testing Lab (Code 134). Provide laboratory analysis of soil samples provided by Code 106.3 from soil bins and small excavations for TCLP levels of RCRA metals content and TPH levels.

7.5 Action

7.5.1 Code 106.3 will provide environmental authorization and approval for all excavation activities at the Shipyard on non-NPL sites through a completed Shipyard Excavation Permit, Appendix 12.6.1, for the purpose of monitoring work sites for hazardous waste potential and to ensure proper disposal of all excess excavation material.

7.5.2 If in the performance of an excavation, to include outside the boundaries of the NPL sites, non-typical waste materials are uncovered (oily soil, ash, industrial debris, scrap metal, soil with a questionable consistency or odor, etc.); the Environmental Division, Code 106.3 (Extensions 1272 or 1060) must be notified immediately and work may be halted until proper containment and/or sampling can be provided. After hours emergency contact numbers for Code 106.3 will be provided for Contracting Officers.

7.5.3 Code 106.3 will provide environmental authorization and approval for all excavation activities at the Shipyard on National Priority List (NPL) Hazardous Waste Sites through a completed Shipyard Excavation Permit, Appendix 7.6.1.

7.5.4 Any department or contractor planning a project that requires digging or excavation on an NPL waste site, as identified by Appendix 12.6.2 must:

7.5.4.1 Obtain excavation approval via a completed Shipyard Excavation Permit (Appendix 7.6.1) from Code 106.3 prior to initiation of any digging or excavation.

7.5.4.2 Write and follow a Site-Specific Health and Safety Plan that complies with the requirements of reference (p), with the assistance of Code 106 personnel.

7.5.5 Contractors and Shipyard personnel must remove all excess excavation materials from the work site by the following procedure:

7.5.5.1 Excess excavated soil from non-IR site projects which appears free of industrial debris, upon notification to Building 357 will be removed from the work site and transported by the contractor to the soil bins at Building 357. No excavated material will be transported off the Shipyard by a construction or excavation contractor or Shipyard personnel for any reason, unless specifically authorized by the Contracting Officer with advisement from the Environmental Division.

7.5.5.2 Excess excavation material which appears to contain industrial debris, is from an IR site project, or directed by Code 106.3 for containment will be deposited in container(s) or a predetermined location as directed by the Hazardous Waste Facility Manager. No excavation material containing industrial debris will be transported from the Shipyard by a construction or excavation contractor or Shipyard personnel for any reason, unless specifically authorized the Contracting Officer with advisement from the Environmental Division.

7.5.5.3 Excess excavated material from large excavations that have been approved by Code 106.3 through the pre-excavation sampling procedure, must be taken to the soil control bins, a pre-determined location on the Shipyard for reutilization, or a Code 106.3 approved recycling or disposal facility.

7.6 Appendices

7.6.1 NAVSHIPYD PTSMH Excavation Permit

7.6.2 National Priority List (NPL) Hazardous Waste Sites at the Shipyard

7.6.1 NAVSHIPYD PTSMH EXCAVATION PERMIT

An Excavation Permit is required for ANY excavation of soil on the Shipyard by Shipyard employees, contractor or other personnel. Excavated material must be used as backfill whenever possible. Notify the Environmental Division (extension 1272 or 1060) and the Contracting Officer (X5551) immediately if any oil-soaked soil is unearthed, soil with a strong or unusual odor or consistency is encountered, industrial debris is discovered, or any abnormality is noted in the soil.

Today's Date:

Site to Be Excavated:

Contract Number: Work Request Number:

Work Description:

Approximate Start Date: Permit expiration date:

Estimated quantity of excess soil to be generated:

Permit requested by: Shipyard Extension:

Funding: Job Order # __________ ☐ NWCF ☐ Fleet ☐ Other__________

This Excavation Permit is (see below).

☐ Approved subject to the following restrictions:

☐ Excess soil is to be transported by the contractor to Bldg. 357 to be weighed. Direction on depositing the soil on the Shipyard issued by Code 106.32.

☐ Excess soil is to be deposited in containment provided at the work site.

☐ See Code 106.3 comments.

☐ Disapproved for the following reason(s):

Other Code 106.3 Comments:

Permit Reviewed By:
Name: Code: Date:

7.6.2 National Priority List (NPL) Hazardous Waste Sites at the Shipyard

Site 5 - Industrial Waste Outfalls
This site is the area in the immediate vicinity offshore of the berthing spaces inside the Controlled Industrial Area.

Site 6 - Defense Reutilization and Marketing Office (DRMO)
This site encompasses the entire area inside the fence surrounding the DRMO.

Site 8 - Jamaica Island Landfill (JILF)
This site includes the 22 acres on the south side of Parker Avenue. It includes the softball field, running track, parking lot, and boat storage area.

Site 9 - Mercury Burial (MB) Sites I and II
Theses two sites are within the boundary of the JILF. All the vaults have been removed from both sites. MBI is located within the running track area in the northeastern corner. MBII is located on the southwestern corner of the JILF in the area of the fenced in Moral Welfare and Recreation (MWR) boat storage area.

Site 11 - Former Waste Oil Tanks
This site (contained within the boundaries of Site 8 the JILF) is located adjacent to the western edge of the fence for the hazardous waste transfer facility, Building 357.

Site 10 - Battery Acid Tank Building 238
This site encompasses the paved area on the southern edge of Building 238 along Berth 4, as well as the basement area under the loading platform on the southern side of the building.

Site 21 - Acid/Alkaline Drain Tank
This site includes only the groundwater in the area of a former underground storage tank in Isaac Hull Street between Buildings 75 and 44.

Site 29 - Former Teepee Incinerator Site
This site is located at the bottom of the hill at the end of Lanman Street. The area extends from the shoreline fence to the pavement. The area under Building 298 (former Industrial Waste Treatment Plant) is also included in this

site. The boundary on western side of the site is the DRMO fence line.

Site 30 - Former Galvanizing Plant Building 184
This site is the area inside building 184 where the concrete slab in the center of the building covers the sub grade acid pit that once held the pickling tanks.

Site 31 - West Timber Basin
This site is inside the CIA. Eastern boundary of the site is the west wall of Building 92. Running through the plate yard and western edge of the site is the electrical substation Building 175. Northern side of site runs in front of the head of Dry Dock 3 to the AC switching station, Building 234. Southern boundary of the site is end of Building 92 and the railroad tracks.

Site 32 - Topeka Pier
This northern edge of this site is the shoreline running from berth 15/16 to the shoreline behind building 356 the propane storage tanks. Eastern edge of site runs between H-26 and H-29 to H-23. The southern boundary of the site extends from H-23 to parking lot on the south side of Goodrich Avenue by buildings 158 and 129. Also included is the area west of Buildings 132 and 168 on the south side of Goodrich Avenue. The eastern side of the site runs on the western side of Building 237 to the pier at berth 15/16.

Site 34 - Former Oil Gasification Plant, Building 62
This site consists of an ash pile directly behind the building extending the length of the building from foundation of the building to the pavement.

COMMANDER, NAVY REGION, MID-ATLANTIC

INSTRUCTION 5090.2, INSTALLATION RESTORATION;

LAND USE CONTROLS AT NAVY REGION, MID-ATLANTIC INSTALLATIONS;

ESTABLISHMENT AND MAINTENANCE

DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION, MID-ATLANTIC
6506 HAMPTON BLVD.
NORFOLK, VA 23508-1273

IN REPLY REFER TO:

COMNAVREG MIDLANT
INST 5090.2
REG ENG/Code 90

2 7 MAY 2003

COMNAVREG MIDLANT INSTRUCTION 5090.2

Subj: INSTALLATION RESTORATION; LAND USE CONTROLS AT NAVY REGION, MID-ATLANTIC INSTALLATIONS; ESTABLISHMENT AND MAINTENANCE

Ref: (a) DUSD (ES/CL) memo of 17 Jan 01
(b) Navy Environmental Policy Memo 99-02
(c) Navy-Marine Corps Installation Restoration Manual (COMNAVFACENGCOM Feb 97)
(d) OPNAVINST 5090.1 Series
(e) COMNAVREGMIDLANTINST 3120.1
(f) JAGMAN
(g) NAVREGS

1. Purpose. This instruction prescribes procedures for establishing and maintaining land use controls at sites remediated under the Navy Installation Restoration Program (IRP) and otherwise, and assigns mission, functions, and tasks necessary to successful management and maintenance of land use controls. References (a) through (d) pertain.

2. Applicability. This instruction applies to installations under the custody, control, and command of Commander, Navy Region, Mid-Atlantic (COMNAVREG MIDLANT). Reference (e) pertains.

3. Background

a. Land use controls restrict use of, and may also limit access to, real property at which contamination is allowed to remain in place. Land use controls, which are of two types, engineered controls[1] and institutional controls, are placed on IRP (and other) sites to protect human health and the environment until such time, if ever, as they are no longer needed. Engineered controls include fences, signs, and other physical means of regulating access to and use of real property. Institutional controls are legal and administrative restrictions on land use, such as notations on installation land use plans,

[1] "Engineering controls" is also used in some texts to refer to engineered controls. For purposes of this instruction these terms are synonymous.

notices recorded in public land records, and periodic site inspections.

b. Land use controls, which may be of indefinite duration, must be reviewed at least every 5 years for effectiveness. They are, or are part of, a clean-up remedy accepted by or approved for COMNAVREG MIDLANT by the Regional Engineer, as set forth, for example, in the Record of Decision[2] for an IRP site. After a Record of Decision or other decision document is finalized, terms and conditions for establishing and maintaining land use controls will be developed and memorialized in a Remedial Design (or other document), in the manner Atlantic Division, Naval Facilities Engineering Command (LANTNAVFACENGCOM) (or other Navy authority) shall recommend. Land use controls may be modified as site conditions change.

c. To be effective, land use controls must be timely imposed, and thereafter maintained for as long as necessary. Long-term maintenance of land use controls requires vigilance, diligence, cooperation, and funding. COMNAVREG MIDLANT, recognizing its role in protecting human health and the environment, has determined that a comprehensive, coordinated approach to land use controls is required for its installations. This approach requires close cooperation between the Regional Engineer, the Regional Program Manager for Facilities and Environmental programs, and LANTNAVFACENGCOM, the IRP program manager.

4. Action. The following action is directed:

a. Regional Engineer

(1) Execute Records of Decision, decision documents, and other land use control related documents on behalf of COMNAVREG MIDLANT.

(a) In so doing, coordinate closely with LANTNAVFACENGCOM, to ensure that operational flexibility, accomplishment of core mission requirements, combat readiness, security, force protection, and cost are taken into consideration in remedy selection.

---

[2] Records of Decision are issued under authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Land use controls are also imposed in clean-ups carried out under the Resource Conservation and Recovery Act (RCRA).

(2) Implement institutional controls in the manner and within the time prescribed in Records of Decision and other decision documents.

(a) In so doing, program and budget for the cost of maintaining land use controls the responsibility for which has transferred from LANTNAVFACENGCOM to COMNAVREG MIDLANT.

(3) Integrate land use controls into site approval processes, dig permits, infrastructure plans, installation maps, and geographic information systems, and, in the name of COMNAVREG MIDLANT, deny permission to conduct ground-disturbing activity at, make use of, or develop sites in a manner inconsistent with approved land use controls.

(a) In so doing, implement procedures and safeguards to withhold or deny site approval until it has been verified that no land use controls exist, or that the proposed use or development is consistent with existing land use controls, references (c) and (d), and other legal authorities. The site approval process is a key element of the regional program to protect human health and the environment through maintenance of land use controls.

(4) Establish procedures to conduct and budget for site inspections, other monitoring of land use controls, and 5-year reviews, and to notify and interact with regulators.

(5) Retain Records of Decision and other land use control documents for all sites to which this instruction applies.

(6) Inform Installation Commanders, Program Managers, and tenant activities at least annually, of land use controls at their installations and installations at which they conduct operations. This may be accomplished by inviting these parties' attention to a list of land use controls published on the Regional Engineer's website.

(7) Include information on land use controls and compliance obligations in statements of work prepared for facility support contracts and other contracts involving use of or ground-disturbing activity at IRP sites and other locations where land use controls have been imposed.

(8) Take appropriate steps to preclude ground-disturbing activity by Navy public works personnel (or contractors) that is inconsistent with approved land use controls.

b. Installation Commanders and Regional Program Managers

(1) Observe, adhere to, and publicize to their organizations (and, in the case of installation commanders, tenant activities), land use controls imposed on their installations and installations at which they conduct operations. This is especially important for Navy Family Housing and Morale, Welfare, and Recreation[3] facilities and activities.

(2) Take appropriate steps to preclude land use, site development, and ground-disturbing activity inconsistent with approved land use controls. This includes, but is not limited to, following site approval procedures, adhering to dig permit requirements, and incorporating land use controls into infrastructure plans and host/tenant support agreements.

(a) Commanders of installations not served by Environmental Compliance Departments of the Regional Environmental Group perform the functions assigned to the Regional Engineer in subparagraphs a (1)-(8) of this paragraph.

(3) Include information on land use controls and compliance obligations in statements of work prepared for contracts involving use of or ground-disturbing activity at IRP sites and other locations subject to land use controls.

(4) Report to the Regional Engineer all activity inconsistent with known land use controls and conditions, e.g., failure of an engineered control, which may affect human health or the environment. The Regional Engineer, in turn, will inform the cognizant LANTNAVFACENGCOM Remedial Program Manager.

c. Tenant Activities of COMNAVREG MIDLANT Installations

(1) Observe, adhere to, and publicize to their organizations, land use controls imposed on installations at which they conduct operations.

[3]The Support Services Program Manager will develop a standard clause for Non-Appropriated Fund Instrumentality contracts that requires contractors to comply with land use controls.

(2) Take appropriate steps to preclude land use, site development, and ground-disturbing activity inconsistent with approved land use controls. This includes, but is not limited to, consulting the Regional Engineer organization during the site approval process and when applying for dig permits.

(3) Include information on land use controls and compliance obligations in statements of work prepared for contracts involving use of or ground disturbing activity at IRP sites and other locations subject to land use controls.

(4) Report to the Regional Engineer all activity inconsistent with known land use controls and conditions, e.g., failure of an engineered control, which may affect human health or the environment. The Regional Engineer, in turn, will inform the cognizant LANTNAVFACENGCOM Remedial Program Manager.

5. Coordination with LANTNAVFACENGCOM

a. Per reference (d), COMNAVFACENGCOM is responsible for the IRP. LANTNAVFACENGCOM is the NAVFAC component that serves the installations to which this instruction applies. In carrying out its program responsibilities LANTNAVFACENGCOM works with Regional Engineer staff to:

(1) Consider operational flexibility, security, force protection, combat readiness, and maintenance costs in selecting land use controls;

(2) Develop land use controls, including but not limited to:

(a) Engineered and institutional controls;

(b) Remedial Designs and other similar land use control documents; and

(c) 5-year reviews and other long-term management;

(3) Report to the Regional Engineer activity, including performance of contracts supervised by Resident Officers in Charge of Construction, inconsistent with known land use controls, or conditions, e.g., failure of an engineered control, that may affect human health or the environment; and

(4) Include appropriate clauses in contracts for work to be performed on or affecting sites to which land use controls apply.

6. Oversight. Land use, site development, and ground-disturbing activity inconsistent with applicable land use controls may result in risk to human health and the environment, and may give rise to civil and criminal liability under Federal law. Thus, incidents of this nature should be reported per reference (d), investigated per reference (f), and when warranted, appropriate action should be taken to address personal accountability. Regional Program Managers, Installation Commanders, Commanding Officers, and Officers in Charge should work closely with the Regional Engineer to cooperate with regulatory agencies per reference (g). The Regional Engineer and the Regional Environmental Coordinator staff should be notified promptly of the commencement of any enforcement action related to breach or neglect of land use controls.

G. E. EICHERT
Chief of Staff

Distribution: www.cnrma.navy.mil

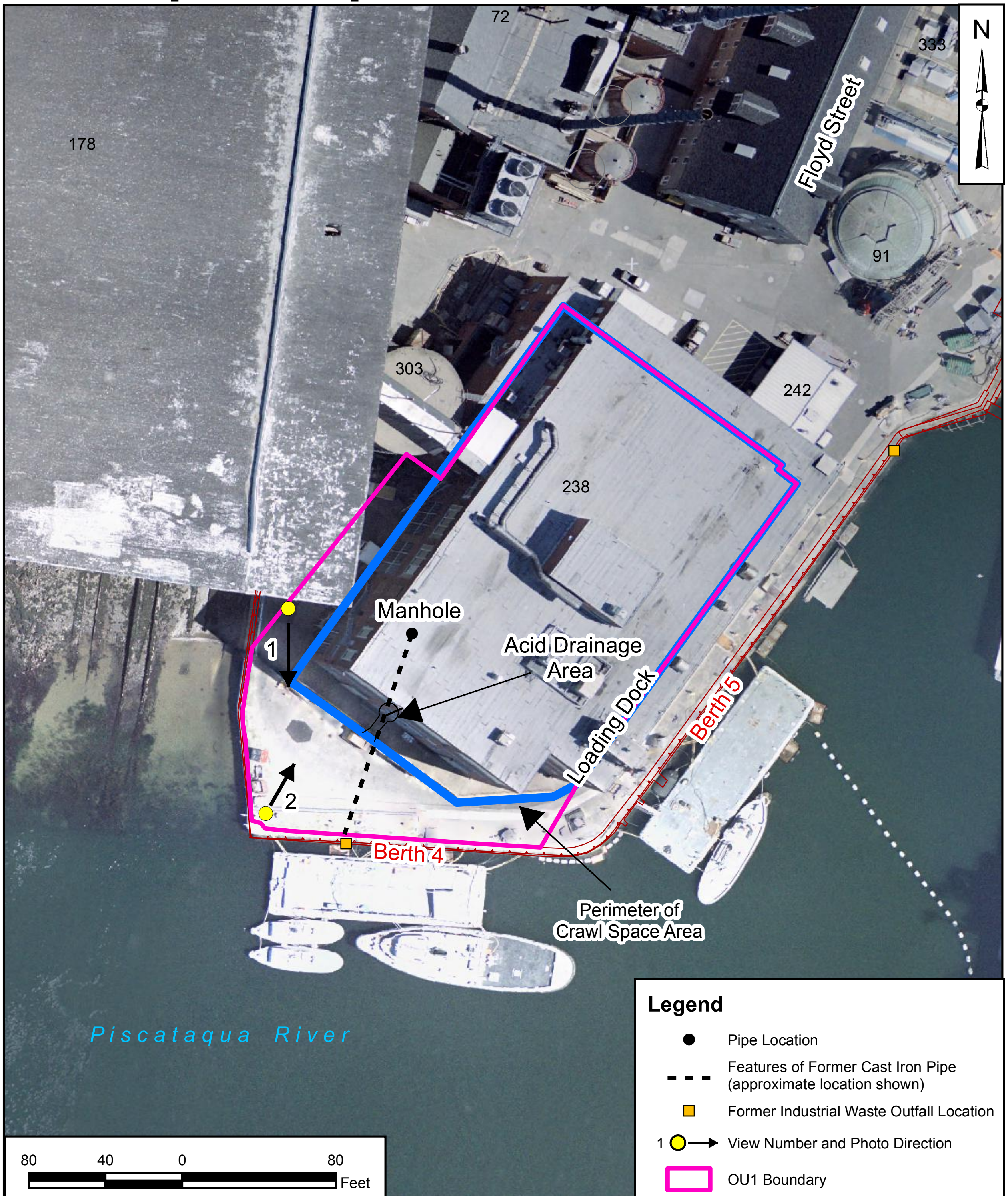
APPENDIX B

PHOTOGRAPH LOCATION
FIGURES AND PHOTOGRAPHS

APPENDIX B.1

PHOTOGRAPH LOCATION FIGURES

PGH P:\GIS\PORTSMOUTH_NSY\MAPDOCS\MXD\SITE10_PICTS.MXD 12/28/11 JEE

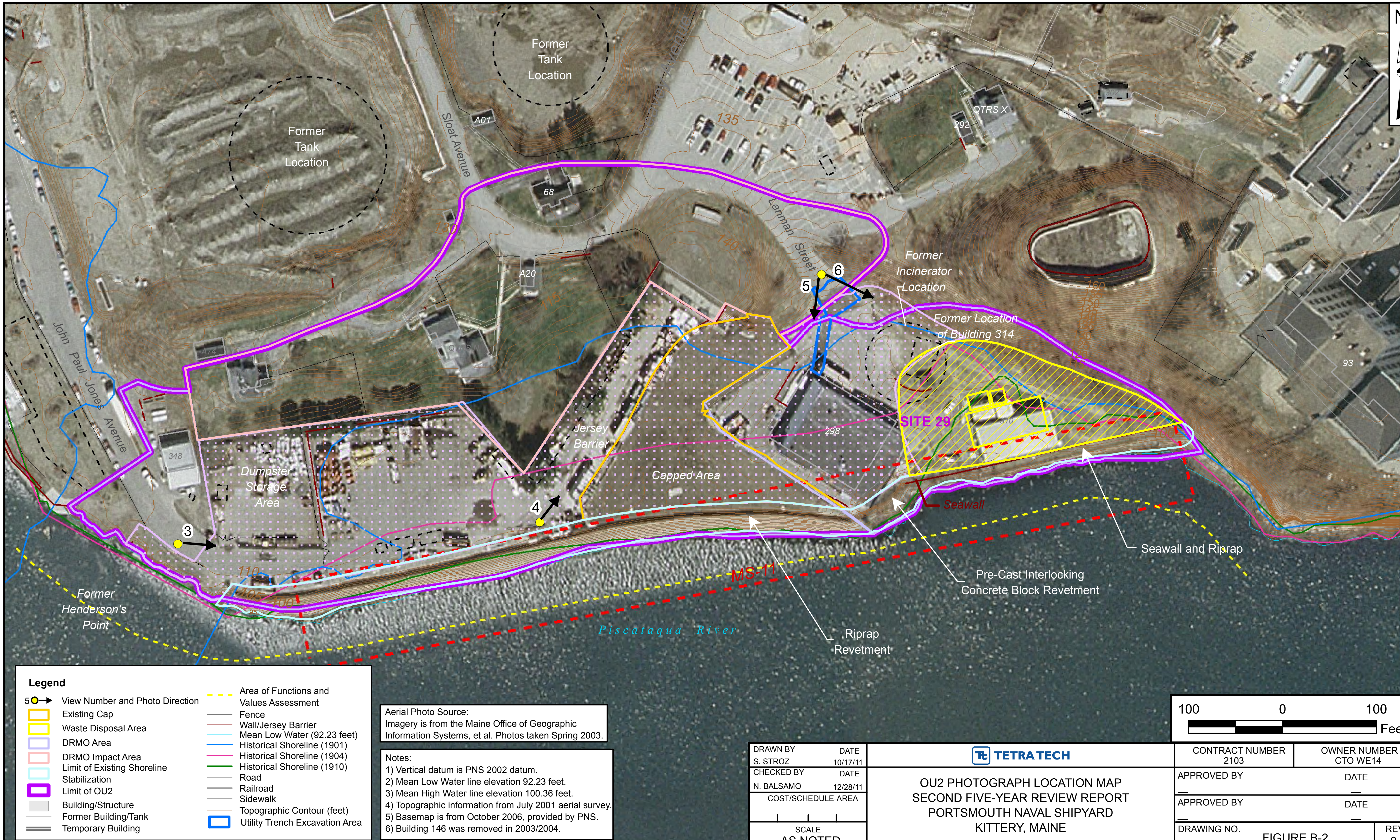


Legend

- Pipe Location
- Features of Former Cast Iron Pipe (approximate location shown)
- Former Industrial Waste Outfall Location
- 1 View Number and Photo Direction
- OU1 Boundary

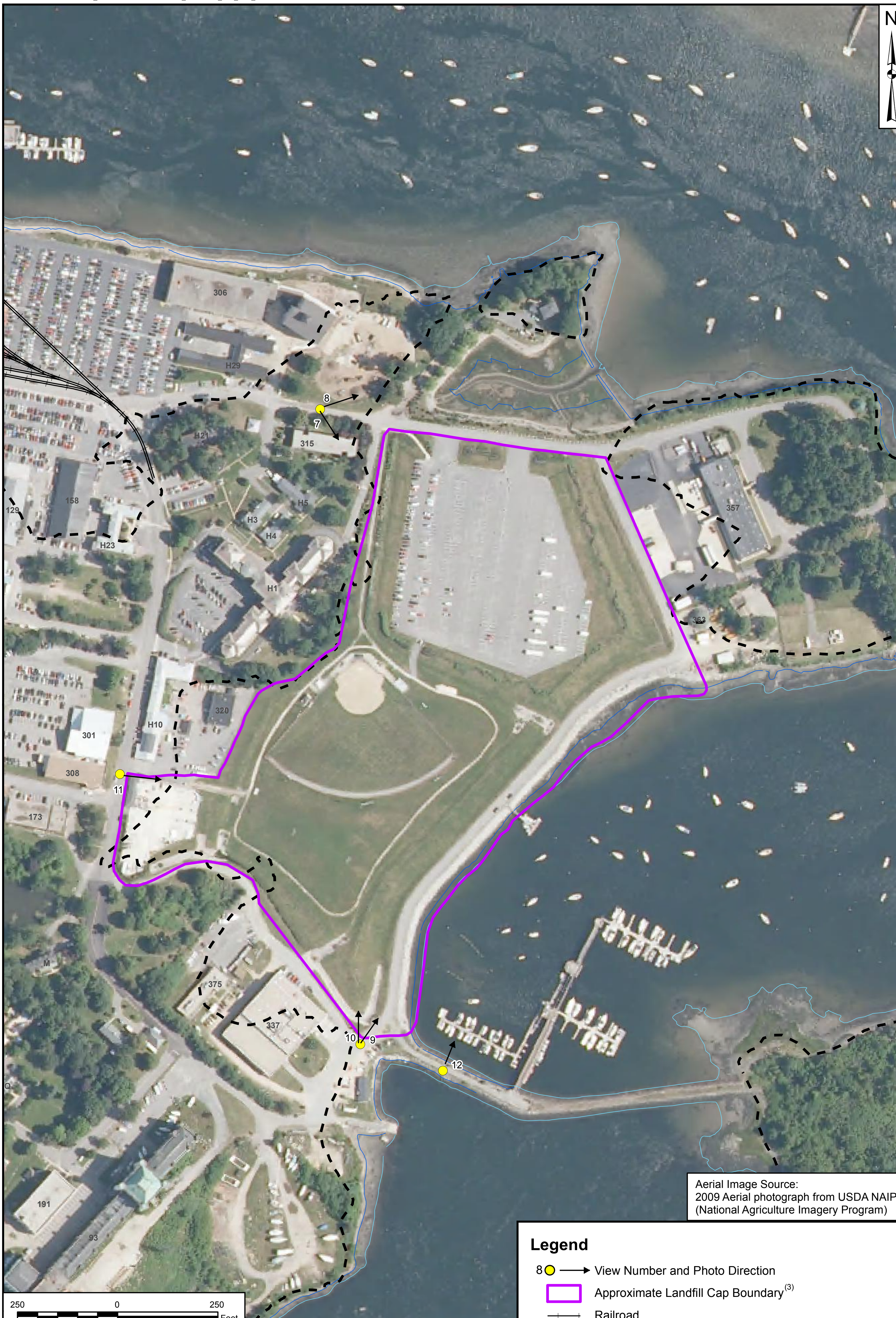
DRAWN BY S. STROZ / DATE 10/17/11	TETRA TECH	CONTRACT NUMBER CTO WE14	
CHECKED BY N. BALSAMO / DATE 12/28/11	OU1 PHOTOGRAPH LOCATION MAP SECOND FIVE-YEAR REVIEW REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY ___ / DATE ___	
COST/SCHEDULE AREA		APPROVED BY ___ / DATE ___	
SCALE AS NOTED		FIGURE NO. FIGURE B-1	REV 0

PGH P:\GIS\PORTSMOUTH_NSY\MAPDOCS\MXD\OU2_PHOTOGRAPHS.MXD 12/28/11 JEE



DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	OWNER NUMBER
S. STROZ	10/17/11		2103	CTO WE14
CHECKED BY	DATE	OU2 PHOTOGRAPH LOCATION MAP SECOND FIVE-YEAR REVIEW REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY	DATE
N. BALSAMO	12/28/11		APPROVED BY	DATE
COST/SCHEDULE-AREA			DRAWING NO. FIGURE B-2	REV 0
SCALE AS NOTED				

PGH P:\GIS\PORTSMOUTH_NSY\MAPDOCS\MXD\OU3_LANDFILL_MW_5YR_REVIEW.MXD 12/28/11 JEE



Legend

- 8 → View Number and Photo Direction
- Approximate Landfill Cap Boundary[3]
- Railroad
- Historic Shoreline (Circa 1880)
- Mean High Water (100.16 ft, Owen Haskill 2001 Survey)
- Mean Low Water (92.03 ft, Owen Haskill 2001 Survey)

Notes:
1.) Monitoring well is used for water levels only and is not sampled.
2.) JW-13B is currently being sampled only as a part of the Five-Year Review Sampling.
3.) The extent of the geomembrane drainage layer is within the approximate landfill cap boundary.

DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	CTO NUMBER
T. WHEATON	11/23/10		2103	WE14
CHECKED BY	DATE	OU3 PHOTOGRAPH LOCATION MAP	APPROVED BY	DATE
M. BOERIO	12/28/11	SECOND FIVE-YEAR REVIEW REPORT	___	___
REVISED BY	DATE	PORTSMOUTH NAVAL SHIPYARD	APPROVED BY	DATE
___	___	KITTERY, MAINE	___	___
SCALE			FIGURE NO.	REV
AS NOTED			FIGURE B-3	0

APPENDIX B.2

PHOTOGRAPHS

Photograph 1. OU2 Contractor Area/Building 172. Figure B-2 View #4.

Photograph 2. OU2 Former DRMO Storage Area. Figure B-2 View #3.

Photograph 3. OU2 Building 298. Figure B-2 View #5.

Photograph 4. OU2 Building 310. Figure B-2 View #6.

Photograph 5. OU3 Recreation Area Facing Towards Hospital. Figure B-3 View #10.

Photograph 6. OU3 Access Road. Figure B-3 View #9.

Photograph 7. OU3 View of Shoreline from Pier. Figure B-3 View #12.

Photograph 8. OU3 Wetlands. Figure B-3 View #8.

Photograph 9. OU3 Wetlands. Figure B-3 View #8.

Photograph 10. OU3 Sign and Parking Area. Figure B-3 View #7.

Photograph 11. OU3 Auto Hobby Shop (Foreground) and Recreation Fields (Background).
Figure B-3 View #11.

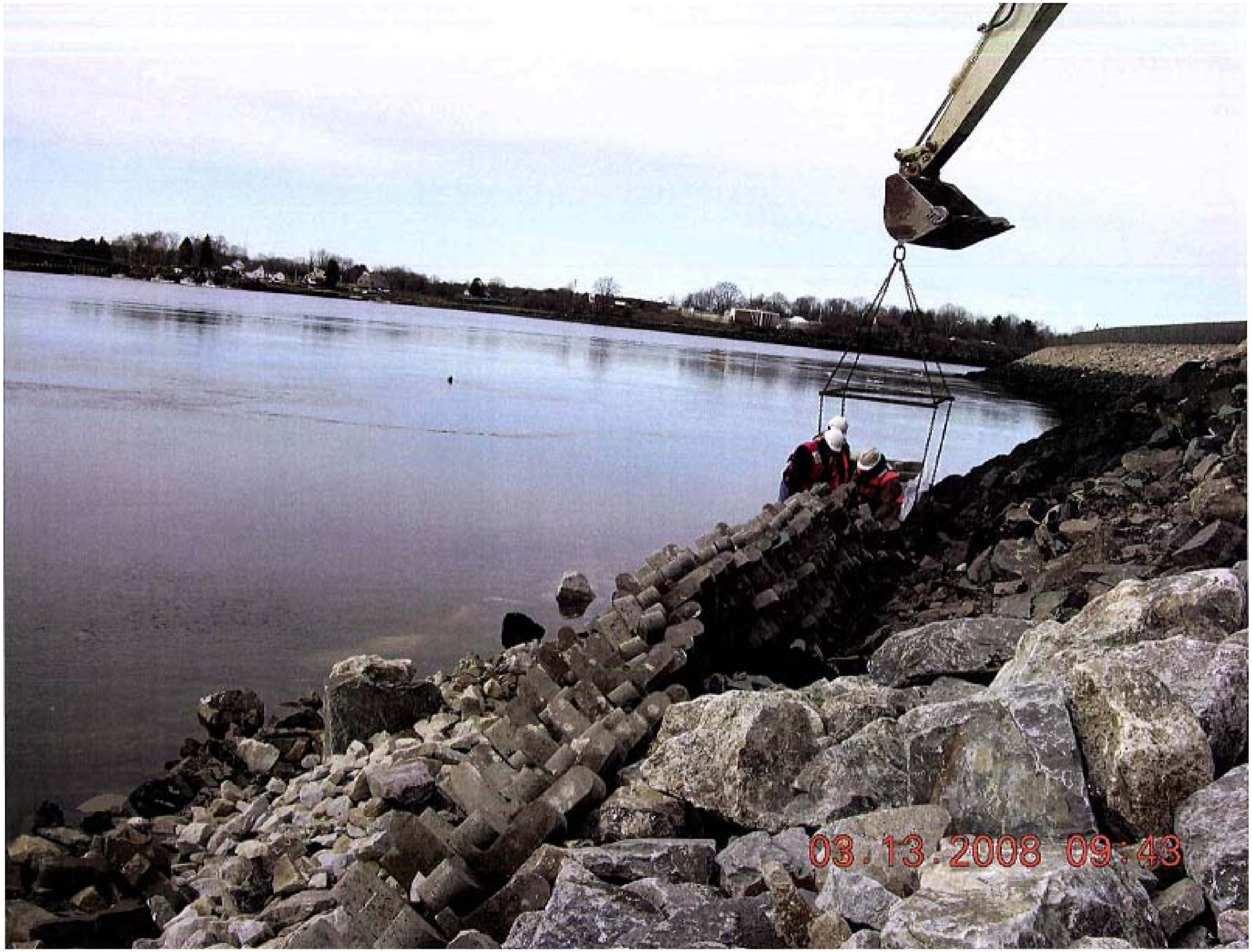
Photograph 12. OU1 South End of Building 238. Figure B-1 View #2.

Photograph 13. OU1 Closeup of South End of Building 238. Figure B-1 View #2.

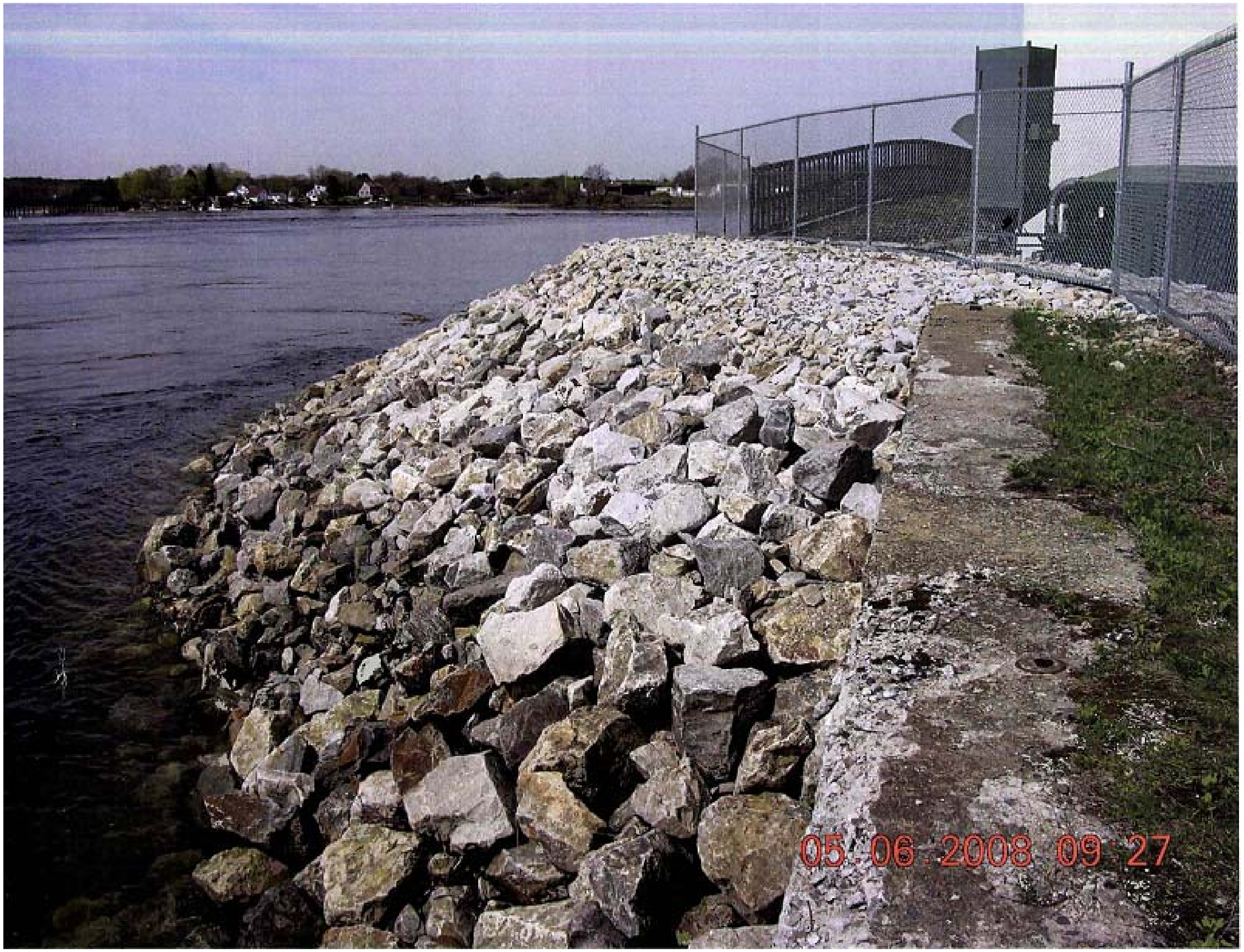
Photograph 14. OU1 Paved Area where Tank was Located. Figure B-1 View #1.

Photograph 15. Crawlspace under Building 238 showing area of depression where pipeline ran from lead-acid battery operations inside the building to tank (formerly location outside the building). The shovel is located at the southern end of the depression and the white material is location at the northern end of the depression.

Photograph 16. Photograph taken in April 2011 showing the offshore area of Site 6 (OU2). Shoreline controls were placed in 1999.



Photograph 17. Photograph taken in March 2008 showing upgrade of shoreline controls along the Site 29 shoreline east of Site 6 and west of the seawall.



Photograph 18. Photograph taken in May 2008 showing a portion of the Site 29 shoreline.

Photograph 19. Jamaica Cove Wetland at low tide, taken during the OU3 Round 9 OM&M (Round 9 Data Package).

Photo 20. Jamaica Cove Wetland at high tide, taken during the OU3 Round 9 OM&M (Round 9 Data Package).

APPENDIX C

ARARS TABLES AND ACTION LEVEL DEVELOPMENT UPDATES

APPENDIX C.1

OU1 ARARS TABLE FROM ROD

TABLE E-1

LIMITED EXCAVATION AND DISPOSAL WITH LAND USE CONTROLS AND MONITORING
CHEMICAL, LOCATION, AND ACTION-SPECIFIC ARARs AND TBCs
OPERABLE UNIT 1 - FEASIBILITY STUDY REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Medium/Activity	Requirement/ Citation	Status	Synopsis	Evaluation/Action To Be Taken
FEDERAL CHEMICAL-SPECIFIC TBCs				
Soil/Risk Assessment	OSWER Directive 9355.4-12	TBC	USEPA has provided recommended methodology for assessing risk caused by exposure to lead in surface soil under residential scenarios.	This remedy will meet the guideline for residential exposure by establishing land use controls that will prevent residential exposure to soil at OU1 with concentrations greater than the residential remediation goal.
Soil/Risk Assessment	Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. (USEPA, January 2003)	TBC	USEPA has provided recommended methodology for assessing risks to adult receptors caused by exposure to lead in soil under residential and commercial/industrial scenarios.	The guideline was used to develop site-specific remediation goals for adult current and future receptors. The remedy will meet the remediation goals by excavating lead-contaminated soil within the crawl space to reduce lead concentrations to less than the remediation goals.
Soil/Risk Assessment	USEPA Risk RfDs from IRIS	TBC	RfDs are estimates of daily exposure for human populations (including sensitive subpopulations) considered unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure over a lifetime.	The RfD for antimony was used to develop the remediation goal for residential exposure to antimony. Excavating lead-contaminated soil within the crawl space will also remove antimony-contaminated soil to reduce antimony concentrations to less that the residential remediation goal.
STATE CHEMICAL-SPECIFIC ARARs and TBCs: No ARARs or TBCs				

LIMITED EXCAVATION AND DISPOSAL WITH LAND USE CONTROLS AND MONITORING
CHEMICAL, LOCATION, AND ACTION-SPECIFIC ARARs AND TBCs
OPERABLE UNIT 1 - FEASIBILITY STUDY REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Medium/Activity	Requirement/ Citation	Status	Synopsis	Evaluation/Action To Be Taken
FEDERAL LOCATION-SPECIFIC ARARs and TBCs				
Coastal Zone	Coastal Zone Management Act (16 USC 1451 et seq.)	Applicable	This act provides for the preservation and protection of coastal zone areas. Federal activities that are in or directly affecting the coastal zone must be consistent, to the maximum extent practicable, with a federally approved state management program.	Excavation within the crawl space will not impact the coastal zone. Activities associated with LUCs (e.g., land use restrictions, posting of signs) and monitoring will also not impact the coastal zone. MEDEP will review remedial design and work plans to meet the substantive requirements of this act.
Historic Preservation	National Historic Preservation Act (16 USC 470 et seq., 36 CFR 800)	Applicable	Provides requirements relating to potential loss or destruction of significant scientific, historical, or archaeological data due to remedial actions at a site.	Prehistoric and historical archeological resource sensitivity for OU1 is low. Placement of surface cover and LUCs will not impact resources of historical value.
STATE LOCATION-SPECIFIC ARARs and TBCs: No ARARs or TBCs				
FEDERAL ACTION-SPECIFIC ARARs and TBCs:				
Hazardous Waste	RCRA Subtitle C, RCRA Regulations for Identification and Listing of Hazardous Water (40 CFR 261), and Standards Applicable to Generators of Hazardous Waste (40 CFR 262)	Applicable	RCRA regulations govern the generation transportation and disposal of hazardous waste. The State of Maine has RCRA delegation, and the Maine Hazardous Waste Management Rules provide references to the federal RCRA regulations where appropriate.	Excavated material will be analyzed to determine whether it is RCRA characteristic hazardous waste. If it is determined to be hazardous, the material will be managed, transported, treated, disposed, or stored in accordance with RCRA requirements. Based on the levels of lead in soil in the remediation areas, the excavated material is likely to be hazardous based on toxicity.

LIMITED EXCAVATION AND DISPOSAL WITH LAND USE CONTROLS AND MONITORING
CHEMICAL, LOCATION, AND ACTION-SPECIFIC ARARs AND TBCs
OPERABLE UNIT 1 - FEASIBILITY STUDY REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Medium/Activity	Requirement/ Citation	Status	Synopsis	Evaluation/Action To Be Taken
STATE ACTION-SPECIFIC ARARs and TBCs				
Hazardous Waste	Maine Hazardous Waste Management Rules (06-096 CMR 800-801, 850 – 853, 857)	Applicable	These regulations provide standards for the generation, transportation, treatment, storage, and disposal of hazardous waste. They set forth the state definition and criteria for establishing whether waste materials are hazardous and subject to associated hazardous waste regulations. They also provide standards for detailing groundwater monitoring requirements for hazardous waste facilities.	Excavation, staging, and disposal of hazardous wastes at OU1 will comply with these standards.
Waste	Maine Solid Waste Management Regulations (06-096 CMR 400, 411)	Applicable	Provides standards for generation, transportation, treatment, storage, and disposal of solid and special wastes. Also provides closure and post-closure maintenance standards.	Wastes generated during remedial actions will be disposed at appropriately licensed and permitted facilities.
Erosion	Erosion and Sedimentation Control (38 MRSA 420-C)	Applicable	Erosion control measures must be in place before activities such as filling, displacing, or exposing soil or other earthen materials occur. Prior MEDEP approval is required if the disturbed area is in the direct watershed of a body of water most at risk for erosion or sedimentation.	The remedial action design and work plans will address erosion and sedimentation controls necessary during excavation and staging activities.
Stormwater	Stormwater Management (38 MRSA 420-D; 06-096 CMR 500)	Applicable	Stormwater management measures must be in place before activities such as filling, displacing, or exposing soil or other earthen materials occur.	The remedial action design and work plans will address stormwater management controls necessary during excavation and staging activities.

TABLE E-1

LIMITED EXCAVATION AND DISPOSAL WITH LAND USE CONTROLS AND MONITORING
CHEMICAL, LOCATION, AND ACTION-SPECIFIC ARARs AND TBCs
OPERABLE UNIT 1 - FEASIBILITY STUDY REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Medium/Activity	Requirement/ Citation	Status	Synopsis	Evaluation/Action To Be Taken
STATE ACTION-SPECIFIC ARARs and TBCs (continued)				
Air Emissions	Visible Emissions Regulation (38 MRSA 584; 06-096 CMR 101).	TBC	These regulations establish opacity limits for emissions from several categories of air contaminant sources, including general construction activities.	Excavation will be conducted so that opacity limits would not be impacted. Any measures need to ensure compliance with these standards will be discussed in the remedial design and work plans.

ARAR – Applicable or Relevant and Appropriate Requirement
CMR - Code of Maine Rules
FR – Federal Register
MRSA - Maine Revised Statutes Annotated
TBC- To Be Considered
USC – United States Code
CFR - Code of Federal Regulations.
CWA – Clean Water Act
MEDEP - Maine Department of Environmental Protection
RCRA - Resource Conservation and Recovery Act
TSD – Treatment, storage, and disposal

APPENDIX C.2

OU2 ARARS TABLES FROM ROD

TABLE E-1

ALTERNATIVE WDA-3: SURFACE SOIL REMOVAL AND SOIL COVER WITH LAND USE CONTROLS AND MONITORING
CHEMICAL, LOCATION AND ACTION-SPECIFIC ARARs
OPERABLE UNIT 2 - RECORD OF DECISION
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
FEDERAL CHEMICAL-SPECIFIC ARARs				
Soil/Risk Assessment	Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-12	To be considered (TBC)	United States Environmental Protection Agency (USEPA) has provided recommended methodology for assessing risk caused by exposure to lead in surface soil under residential scenarios.	The remedy will meet the guideline for residential exposure by establishing land use controls (LUCs) that will prevent residential exposure to soil in the waste disposal area at OU2 with concentrations greater than the residential remediation goal (400 mg/kg).
	Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. (USEPA, January 2003)	TBC	USEPA has provided recommended methodology for assessing risks to adult receptors caused by exposure to lead in soil under residential and commercial/industrial scenarios.	Guidelines were used to develop risk-based cleanup levels for lead in soil for adult current and future receptors. The remedy will meet the remediation goals by excavating surface soil contaminated with lead, constructing a soil cover, and implementing LUCs to reduce exposure to acceptable levels.
	USEPA Risk Reference Doses (RfDs) from Integrated Risk Information System (IRIS)	TBC	RfDs are estimates of daily exposure for human populations (including sensitive subpopulations) considered unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure over a lifetime.	RfDs were used to develop risk-based soil cleanup levels for non-carcinogenic chemicals of concern (COCs) including antimony, copper, nickel, and polychlorinated biphenyls (PCBs).
	USEPA Human Health Assessment Group Cancer Slope Factors (CSFs) from IRIS	TBC	CSFs present the most up-to-date information on cancer risk potency for known and suspected carcinogens.	CSFs were used to develop risk-based soil cleanup levels for carcinogenic COCs including polycyclic aromatic hydrocarbons (PAHs) and PCBs.

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
	Guidelines for Carcinogen Risk Assessment EPA/630/P-03/001F (March 2005)	TBC	These guidelines are used to perform Human Health Risk Assessment (HHRA). They provide a framework for assessing possible cancer risks from exposures to pollutants or other agents in the environment.	These guidelines were used to develop risk-based soil cleanup goals for carcinogenic COCs including PAHs and PCBs
	Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens EPA/630/R-03/003F (March 2005)	TBC	These guidelines are used to perform HHRA and address a number of issues pertaining to cancer risks associated with early-life exposures in general and provide specific guidance on potency adjustment for carcinogens acting through a mutagenic mode of action.	This guidance was used to develop risk-based soil cleanup goals for carcinogenic COCs including PAHs and PCBs.
NO STATE CHEMICAL-SPECIFIC ARARs				
FEDERAL LOCATION-SPECIFIC ARARs				
Coastal Zone Management	Coastal Zone Management Act [16 United States Code (USC) 1451 *et seq.*]	Applicable	This act provides for the preservation and protection of coastal zone areas. Federal activities that are in or directly affecting the coastal zone must be consistent, to the maximum extent practicable, with a federally approved state management program.	Remedial activities, such as excavation and cover placement, that will take place in the coastal zone will be controlled according to the requirements of the Maine Department of Environmental Protection (MEDEP) program. MEDEP will review the Remedial Design and work plans to ensure that they meet the substantive requirements of this act. The requirements of the act will continue to apply during the operation and maintenance of the remedy.
Floodplain Management	44 CFR 9	Relevant and Appropriate	Federal Emergency Management Agency regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11988, Floodplain Management.	Remedial activities conducted within the 100-year floodplain of the Piscataqua River will be implemented in compliance with these standards.

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Wetlands and US Waters	Clean Water Act (CWA) Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material [40 Code of Federal Regulations (CFR) Part 230; 33 CFR Parts 320 and 323]	Applicable	These regulations outline the requirements for the discharge of dredged or fill material into US waters, including wetlands. No activity that adversely affects a US waters is permitted if a practicable alternative that has less effect is available. If there is no other practicable alternative, impacts must be mitigated.	Excavation of soil at the waste disposal area will be performed so as to not discharge excavated material to the offshore area. The requirements of the act will continue to apply during the operation and maintenance of the remedy.
Other Natural Resources	The Endangered Species Act of 1973 (16 USC 1531 *et seq*.; 50 CFR Parts 17 and 402)	Applicable	Provides for consideration of the impacts on endangered and threatened species and their critical habitats. Requires federal agencies to ensure that any action carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat. The entire State of Maine is considered a habitat of the federally listed endangered short-nosed sturgeon.	Remedial activities including excavation, construction of a soil cover, LUCs, and monitoring will be conducted so as to avoid any adverse effect under the act to the short-nosed sturgeon. The requirements of the act will continue to apply during the operation and maintenance of the remedy.
	Fish and Wildlife Coordination Act (16 USC 661 *et seq.*)	Applicable	This act requires any federal agency proposing to modify a body of water to coordinate with the United States Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) and appropriate state agencies if alteration of a body of water, including discharge of pollutants into a wetland or construction in a wetland, will occur as a result of remedial activities.	Although the Selected Remedy does not affect the shoreline revetment or wetlands, the Navy will coordinate with USFWS in the event that the final design disturbs the revetment or wetlands. The requirements of the act will continue to apply during the operation and maintenance of the remedy.

TABLE E-1

ALTERNATIVE WDA-3: SURFACE SOIL REMOVAL AND SOIL COVER WITH LAND USE CONTROLS AND MONITORING
CHEMICAL, LOCATION AND ACTION-SPECIFIC ARARs
OPERABLE UNIT 2 - RECORD OF DECISION
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
STATE LOCATION-SPECIFIC ARARs				
Natural Resources	Maine Natural Resources Protection Act Permit by Rule Standards [38 Maine Revised Statutes Annotated (MRSA) 480 et seq.; 06-096 Code of Maine Rules (CMR) Part 305, 1, 2, and 8]	Applicable	This act regulates activity conducted in, on, or over any protected natural resource or any activity conducted adjacent to and operated in such a way that material or soil may be washed into any freshwater or coastal wetland, great pond, river, stream or brook.	Excavation near the shoreline of the waste disposal area will be conducted so as to avoid washing any soil into the nearby Piscataqua River or adjacent wetlands. Stormwater management and erosion control practices will be used to prevent sediment from entering the river or adjacent wetlands during construction. The requirements of the act will continue to apply during the operation and maintenance of the remedy.
Wetlands	Maine Wetland Protection Rules (06-096 CMR Part 310)	Applicable	Standards are provided for protection of wetlands, as defined in MEDEP Chapter 1000 Guidelines for Municipal Shoreline Zoning Ordinances. Jurisdiction under the rules includes the area adjacent to the wetlands, which is the area within 75 feet of the normal high-water line. Activities that have an unreasonable impact on wetlands are prohibited.	A wetlands functions and values assessment was conducted that will be used to guide restorative efforts for adjacent wetlands that may be adversely impacted by remedial activities. Excavation activities will be conducted to avoid impacts to wetlands and coastal wetlands, which include tidal and subtidal lands. The requirements of the act will continue to apply during the operation and maintenance of the remedy.

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Coastal Zone	Maine Coastal Management Policies (38 MRSA 1801 *et seq.*) (06-096 CMR Chapter 1000)	Applicable	Regulates activities near great ponds, rivers and larger streams, coastal areas, and wetlands. Regulates shoreland activities and development, including (but not limited to) water pollution prevention and control, wildlife habitat protection, and freshwater and coastal wetlands protection. The law is administered at the local government level. Shoreland areas include areas within 250 feet of the normal high-water line of any river or saltwater body and areas within 75 feet of the high-water line of a stream.	Remedial activities such as excavation and backfilling that may affect storm water runoff, erosion and sedimentation, and surface water quality will be controlled according to these regulations. The requirements of the act will continue to apply during the operation and maintenance of the remedy.
FEDERAL ACTION-SPECIFIC ARARs				
Surface Water	CWA [33 USC § 1251 *et seq.*]; National Recommended Water Quality Criteria (NRWQC)	Relevant and Appropriate	These criteria are used to establish water quality standards for the protection of aquatic life.	Remedial activities will be conducted to reduce adverse impacts to the Piscataqua River. Stormwater management and erosion control practices will be used to prevent sediment and contaminants from entering the river during construction.
Water Management	CWA Section 402 National Pollutant Discharge Elimination System (NPDES) (40 CFR 122.26)	Applicable	CWA Section 402 requires NPDES permits for stormwater discharges to navigable waters.	Stormwater management will be implemented to minimize discharges of contaminants to the Piscataqua River and meet the substantive requirements of this act.

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
STATE ACTION-SPECIFIC ARARs				
Hazardous Waste	Identification of Hazardous Wastes 06-096 Part 850	Applicable	These standards establish requirements for determining whether wastes are hazardous based on either characteristic or listing. Wastes with PCB concentrations greater than or equal to 50 ppm are hazardous wastes in Maine.	Wastes generated during remedial actions will be analyzed to determine whether they are RCRA characteristic hazardous wastes. If determined to be hazardous waste, then the waste will be managed in accordance with regulatory requirements.
	Standards for Generators of Hazardous Waste (38 MRSA 1301 *et seq.*, 06-096 Part 851)	Applicable	These regulations contain requirements for the generators of hazardous waste.	Waste determined to be hazardous will be managed on site according to the regulation until disposed of off site.
Erosion and Sedimentation Control	Erosion and Sedimentation Control (38 MRSA Part 420-C)	Applicable	Erosion control measures must be in place before activities such as filling, displacing, or exposing soil or other earthen materials occur. Prior MEDEP approval is required if the disturbed area is in the direct watershed of a body of water most at risk for erosion or sedimentation.	These controls will be applicable to excavation and soil cover placement. Applicable plans will be coordinated with MEDEP before implementation.
Storm Water Management	Storm Water Management (38 MRSA Part 420-D; 06-096 CMR Part 500)	Applicable	Storm water management measures must be in place before activities such as filling, displacing, or exposing soil or other earthen material occur on land greater than or equal to 1 acre.	These regulations apply to earth disturbance activities equal to or greater than 1 acre and will be applicable to runoff resulting from earth disturbance activities. Although the area for excavation under Alternative WDA-3 is less than 1 acre, the combined area for the OU2 remedial action will be greater than 1 acre. Applicable plans will be coordinated with MEDEP before implementation.

TABLE E-1

ALTERNATIVE WDA-3: SURFACE SOIL REMOVAL AND SOIL COVER WITH LAND USE CONTROLS AND MONITORING
CHEMICAL, LOCATION AND ACTION-SPECIFIC ARARs
OPERABLE UNIT 2 - RECORD OF DECISION
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Air Emissions	Visible Emissions Regulation (38 MRSA Part 584; 06-096 CMR Part 101)	TBC	These regulations establish opacity limits for emissions from several categories of air contaminant sources, including fugitive emissions.	These regulations will be met for excavation and soil cover placement. Emission of particulate matter and fugitive matter (e.g., dust generation) during excavation of surface soil or placement of the soil cover will be controlled.

ALTERNATIVE DRMO-4: CONSTRUCTION WORKER EXCAVATION WITH OFF-YARD DISPOSAL, LAND USE CONTROLS, AND MONITORING
CHEMICAL, LOCATION AND ACTION-SPECIFIC ARARs
OPERABLE UNIT 2 - RECORD OF DECISION
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
FEDERAL CHEMICAL-SPECIFIC ARARs				
Soil/Risk Assessment	Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-12	To be considered (TBC)	United States Environmental Protection Agency (USEPA) has provided recommended methodology for assessing risk caused by exposure to lead in surface soil under residential scenarios.	The remedy will meet the guideline for residential exposure by establishing land use controls (LUCs) that will prevent residential exposure to soil in the Defense Reutilization and Marketing Office (DRMO) area of OU2 with concentrations greater than the residential remediation goal (400 mg/kg).
	Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. (USEPA, January 2003)	TBC	USEPA has provided recommended methodology for assessing risks to adult receptors caused by exposure to lead in soil under residential and commercial/industrial scenarios.	Guidelines were used to develop risk-based cleanup levels for lead in soil for adult current and future receptors. The remedy will meet the remediation goals by excavating soil contaminated with lead down to the rock fragment fill layer and implementing LUCs to prevent residential exposure.
	USEPA Risk Reference Doses (RfDs) from Integrated Risk Information System (IRIS)	TBC	RfDs are estimates of daily exposure for human populations (including sensitive subpopulations) considered unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure over a lifetime.	RfDs were used to develop risk-based soil cleanup levels for non-carcinogenic chemicals of concern (COCs) including antimony, copper, nickel, and polychlorinated biphenyls (PCBs).
	USEPA Human Health Assessment Group Cancer Slope Factors (CSFs) from IRIS	TBC	CSFs present the most up-to-date information on cancer risk potency for known and suspected carcinogens.	CSFs were used to develop risk-based soil cleanup levels for carcinogenic COCs including polycyclic aromatic hydrocarbons (PAHs) and PCBs.

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
	Guidelines for Carcinogen Risk Assessment EPA/630/P-03/001F (March 2005)	TBC	These guidelines are used to perform Human Health Risk Assessment (HHRA). They provide a framework for assessing possible cancer risks from exposures to pollutants or other agents in the environment.	These guidelines were used to develop risk-based soil cleanup goals for carcinogenic COCs including PAHs and PCBs.
	Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens EPA/630/R-03/003F (March 2005)	TBC	These guidelines are used to perform HHRA and address a number of issues pertaining to cancer risks associated with early-life exposures in general and provide specific guidance on potency adjustment for carcinogens acting through a mutagenic mode of action.	This guidance was used to develop risk-based soil cleanup goals for carcinogenic COCs including PAHs and PCBs.
NO STATE CHEMICAL-SPECIFIC ARARs				
FEDERAL LOCATION-SPECIFIC ARARs				
Coastal Zone Management	Coastal Zone Management Act [16 United States Code (USC) 1451 *et seq.*]	Applicable	This act provides for the preservation and protection of coastal zone areas. Federal activities that are in or directly affecting the coastal zone must be consistent, to the maximum extent practicable, with a federally approved state management program.	Remedial activities, such as excavation and backfilling, that will take place in the coastal zone will be controlled according to the requirements of the Maine Department of Environmental Protection (MEDEP) program. MEDEP will review the Remedial Design and work plans to ensure that they meet the substantive requirements of this act. The requirements of the act will continue to apply during the operation and maintenance of the remedy.

ALTERNATIVE DRMO-4: CONSTRUCTION WORKER EXCAVATION WITH OFF-YARD DISPOSAL, LAND USE CONTROLS, AND MONITORING
CHEMICAL, LOCATION AND ACTION-SPECIFIC ARARs
OPERABLE UNIT 2 - RECORD OF DECISION
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Floodplain Management	44 CFR 9	Relevant and Appropriate	Federal Emergency Management Agency regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11988, Floodplain Management.	Remedial activities conducted within the 100-year floodplain of the Piscataqua River will be implemented in compliance with these standards.
Wetlands and US Waters	Clean Water Act (CWA) Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material [40 Code of Federal Regulations (CFR) Part 230; 33 CFR Parts 320 and 323]	Applicable	These regulations outline the requirements for the discharge of dredged or fill material into US waters, including wetlands. No activity that adversely affects a US waters is permitted if a practicable alternative that has less effect is available. If there is no other practicable alternative, impacts must be mitigated.	Excavation of soil at the DRMO area will be performed so as to not discharge excavated material to the offshore area. The requirements of the act will continue to apply during the operation and maintenance of the remedy.
Other Natural Resources	The Endangered Species Act of 1973 (16 USC 1531 *et seq.*; 50 CFR Parts 17 and 402)	Applicable	Provides for consideration of the impacts on endangered and threatened species and their critical habitats. Requires federal agencies to ensure that any action carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat. The entire State of Maine is considered a habitat of the federally listed endangered short-nosed sturgeon.	Remedial activities including excavation and disposal, LUCs, and monitoring will be conducted so as to avoid any adverse effect under the act to the short-nosed sturgeon. The requirements of the act will continue to apply during the operation and maintenance of the remedy.

TABLE E-2

ALTERNATIVE DRMO-4: CONSTRUCTION WORKER EXCAVATION WITH OFF-YARD DISPOSAL, LAND USE CONTROLS, AND MONITORING
CHEMICAL, LOCATION AND ACTION-SPECIFIC ARARs
OPERABLE UNIT 2 - RECORD OF DECISION
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
	Fish and Wildlife Coordination Act (16 USC 661 *et seq.*)	Applicable	This act requires any federal agency proposing to modify a body of water to coordinate with the United States Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) and appropriate state agencies if alteration of a body of water, including discharge of pollutants into a wetland or construction in a wetland, will occur as a result of remedial activities.	Excavation of soil along the shoreline will require removal and replacement of the upper portion (above high tide) of the revetment. Remedial activities will be conducted to prevent discharge to the Piscataqua River. The Navy will coordinate with USFWS during the design. The requirements of the act will continue to apply during the operation and maintenance of the remedy.
Historic Preservation	National Historic Preservation Act (16 USC 470 *et seq*.; 36 CFR Part 800)	Applicable	Provides requirements relating to potential loss or destruction of significant scientific, historic, or archaeological data due to remedial actions at a site.	Based on the Portsmouth Naval Shipyard land use map, a portion of the DRMO area has archeological potential. This area is identified as being on the original island; however, borings indicate fill material and not native soil. The Navy will contact the State Historic Preservation Officer (SHPO) to determine the necessary actions, if any, to meet the substantive requirements of this act. The requirements of the act will continue to apply during the operation and maintenance of the remedy.

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
STATE LOCATION-SPECIFIC ARARs				
Natural Resources	Maine Natural Resources Protection Act Permit by Rule Standards [38 Maine Revised Statutes Annotated (MRSA) 480 *et seq*.; 06-096 Code of Maine Rules (CMR) Part 305, 1, 2, and 8]	Applicable	This act regulates activity conducted in, on, or over any protected natural resource or any activity conducted adjacent to and operated in such a way that material or soil may be washed into any freshwater or coastal wetland, great pond, river, stream or brook.	Excavation near to shoreline of the DRMO area will be conducted so as to avoid washing any soil into the nearby Piscataqua River or adjacent wetlands. Stormwater management and erosion control practices will be used to prevent sediment from entering the river or adjacent wetlands during construction. The requirements of the act will continue to apply during the operation and maintenance of the remedy.
Wetlands	Maine Wetland Protection Rules (06-096 CMR Part 310)	Applicable	Standards are provided for protection of wetlands, as defined in MEDEP Chapter 1000 Guidelines for Municipal Shoreline Zoning Ordinances. Jurisdiction under the rules includes the area adjacent to the wetlands, which is the area within 75 feet of the normal high-water line. Activities that have an unreasonable impact on wetlands are prohibited.	A wetlands functions and values assessment was conducted that will be used to guide restorative efforts for adjacent wetlands that may be adversely impacted by remedial activities. Excavation activities will be conducted to avoid impacts to wetlands and coastal wetlands which include tidal and subtidal lands. The requirements of the act will continue to apply during the operation and maintenance of the remedy.

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Coastal Zone	Maine Coastal Management Policies (38 MRSA 1801 *et seq.*) (06-096 CMR Chapter 1000)	Applicable	Regulates activities near great ponds, rivers and larger streams, coastal areas, and wetlands. Regulates shoreland activities and development, including (but not limited to) water pollution prevention and control, wildlife habitat protection, and freshwater and coastal wetlands protection. The law is administered at the local government level. Shoreland areas include areas within 250 feet of the normal high-water line of any river or saltwater body and areas within 75 feet of the high-water line of a stream.	Remedial activities such as excavation and backfilling that may affect storm water runoff, erosion and sedimentation, and surface water quality will be controlled according to these regulations. The requirements of the act will continue to apply during the operation and maintenance of the remedy.
FEDERAL ACTION-SPECIFIC ARARs				
Surface Water	CWA [33 USC § 1251 *et seq.*]; National Recommended Water Quality Criteria (NRWQC)	Relevant and Appropriate	These criteria are used to establish water quality standards for the protection of aquatic life.	Remedial activities will be conducted to reduce adverse impacts to the Piscataqua River. Stormwater management and erosion control practices will be used to prevent sediment and contamination from entering the river during construction.
Water Management	CWA Section 402 National Pollutant Discharge Elimination System (NPDES) (40 CFR, 122.26)	Applicable	CWA Section 402 requires NPDES permits for stormwater discharges to navigable waters.	Stormwater management will be implemented to minimize discharges of contaminants to the Piscataqua River and meet the substantive requirements of this act.

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
STATE ACTION-SPECIFIC ARARs				
Hazardous Waste	Identification of Hazardous Wastes 06-096 Part 850	Applicable	These standards establish requirements for determining whether wastes are hazardous based on either characteristic or listing. Wastes with PCB concentrations greater than or equal to 50 ppm are hazardous wastes in Maine.	Wastes generated during remedial activities will be analyzed to determine whether they are RCRA characteristic hazardous wastes. If determined to be hazardous, then the waste will be managed in accordance with regulatory requirements.
	Standards for Generators of Hazardous Waste (38 MRSA 1301 *et seq.*, 06-096 Part 851)	Applicable	These regulations contain requirements for the generators of hazardous waste.	Waste determined to be hazardous will be managed on site according to the regulation until disposed of off site.
Water Management	Maine Discharge Licenses (38 MRSA 413 *et seq.*) and Waste Discharge Permitting Program (06-096 CMR 520-629)	Applicable	These standards regulate the discharge of pollutants from point sources	These regulations are applicable to water management during soil excavation and discharges of treated water to a surface water body, if required. The substantive requirements will be met if any discharges of treated water to surface water bodies are required during the remedial action.
Erosion and Sedimentation Control	Erosion and Sedimentation Control (38 MRSA Part 420-C)	Applicable	Erosion control measures must be in place before activities such as filling, displacing, or exposing soil or other earthen materials occur. Prior MEDEP approval is required if the disturbed area is in the direct watershed of a body of water most at risk for erosion or sedimentation.	These controls will be applicable to excavation. Applicable plans will be coordinated with MEDEP before implementation.

ALTERNATIVE DRMO-4: CONSTRUCTION WORKER EXCAVATION WITH OFF-YARD DISPOSAL, LAND USE CONTROLS, AND MONITORING
CHEMICAL, LOCATION AND ACTION-SPECIFIC ARARs
OPERABLE UNIT 2 - RECORD OF DECISION
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Requirement	Citation	Status	Synopsis	Evaluation/Action To Be Taken
Storm Water Management	Storm Water Management (38 MRSA Part 420-D; 06-096 CMR Part 500)	Applicable	Storm water management measures must be in place before activities such as filling, displacing, or exposing soil or other earthen material occur on land greater than or equal to 1 acre.	These regulations apply to earth disturbance activities equal to or greater than 1 acre and will be applicable to runoff resulting from earth disturbance activities. Although the area for excavation under Alternative DRMO-4 is less than 1 acre, the combined area for the OU2 remedial action will be greater than 1 acre. Applicable plans will be coordinated with MEDEP before implementation.
Waste Management	Additional Standards Applicable to Waste Facilities Located in a Flood Plain (06-096 CMR 854.16)	Relevant and Appropriate	Any facility located or to be located within 300 feet of a 100-year flood zone must be constructed, operated, and maintained to prevent wash-out of any hazardous waste by a 100-year flood or have procedures in place which will cause the waste to be removed to a location where the waste will not be vulnerable to flood waters and to a location that is authorized to manage hazardous waste safely before flood water can reach the facility.	Portions of the DRMO area are within 300 feet of the 100-year flood zone of the Piscataqua River. Waste managed within 300 feet of the 100-year flood zone will be managed in compliance with these standards.
Air Emissions	Visible Emissions Regulation (38 MRSA Part 584; 06-096 CMR Part 101)	TBC	These regulations establish opacity limits for emissions from several categories of air contaminant sources, including general fugitive emissions.	These regulations will be considered for excavation. Emission of particulate matter and fugitive matter (e.g., dust generation) during excavation will be controlled.

APPENDIX C.3

OU3 ARARS TABLE FROM ROD AND 2005 ESD ARARS EXCERPT

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
Federal Chemical-Specific:				
Groundwater	Health Advisories, EPA Office of Drinking Water	To Be Considered	These advisories establishes short-term, long-term, and lifetime exposure limits for children and adults.	These advisories were used to document contaminant exceedances in groundwater (as part of the OU3 risk assessment).
Risk Assessment	EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are the concentrations considered unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure over a lifetime.	RfDs were used to estimate noncarcinogenic risks as part of the OU3 risk assessment.
Risk Assessment	EPA Human Health Assessment Group Cancer Slope Factors (CSFs)	To Be Considered	CSFs present the most up-to-date information on cancer risk potency for known and suspected carcinogens.	CSFs were used to estimate carcinogenic risks as part of the OU3 risk assessment.
State of Maine Chemical-Specific:				
Soil/Ground-water	Guidance Manual for Human Health Risk Assessments at Hazardous Substance Sites, June 1994	To Be Considered	This guidance manual prepared by the MEDEP and the Maine Department of Human Resources provides acceptable carcinogenic and noncarcinogenic risk levels ($1x10^{-5}$ and 1, respectively).	This guidance manual was considered in determining acceptable risk levels for RAOs related to the protection of human health.

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
Federal Location-Specific:				
Other Natural Resources	Fish and Wildlife Coordination Act (16 USC 661 et seq.;33 CFR 320; 40 CFR 6.302)	Relevant and Appropriate	This act requires any federal agency proposing to modify a body of water to consult with the U.S. Fish and Wildlife Service or National Marine Fisheries Service and appropriate state agencies if alteration of a body of water, including discharges of pollutants into a wetland or construction in a wetland, will occur as a result of off-site remedial activities. Consultation is strongly recommended for on-site actions.	Precautions will be taken to minimize the potential effect on fish and wildlife during construction and maintenance of the shoreline erosion controls.
Floodplains	Floodplain Management, Executive Order 11988 (40 CFR 6, Appendix A)	Applicable	Appendix A includes the federal policy on floodplain management. Under this order, federal agencies are required to avoid long-term and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid support of floodplain development wherever there is a practicable alternative. If no practicable alternative exists to performing cleanup in a floodplain, potential harm must be mitigated and actions taken to preserve the beneficial value of the floodplain.	Implementation of this alternative will include construction in the floodplain. No practicable alternative to this construction exists. However, best management practices will be used during remedial activities to reduce any adverse impacts to the floodplain. The shoreline erosion controls will be constructed so that they do not adversely affect the floodplain and will ensure the bank is sufficiently stabilized to contain the waste materials.

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
Floodplains	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	A hazardous waste facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood or result in no adverse effects on human health and the environment if washout were to occur.	The landfill cap will be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood and to result in no adverse effects on human health or the environment if washout were to occur.
Wetlands	Federal Protection of Wetlands, Executive Order 11990 (40 CFR 6, Appendix A)	Applicable	Appendix A includes the federal policy on wetlands protection. Under this order, federal agencies are required to minimize the destruction, loss, or degradation of wetlands and preserve and enhance natural and beneficial values of wetlands. If no practicable alternative exists to remedial activity that may adversely affect a wetland, impacts from implementing the chosen alternative must be mitigated.	Implementation of this alternative will include construction in tidal wetlands. No practicable alternative to this construction exists. However, best management practices will be used during remedial activities to reduce any adverse impacts to wetlands. The shoreline erosion controls will be constructed so that they do not adversely affect wetlands and will ensure the bank is sufficiently stabilized to contain the waste materials.
Wetlands	CWA Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR 230; 33 CFR 320-330)	Applicable	Section 404 of the CWA regulates the discharge of dredged or fill material into U.S. waters, including wetlands. The purpose of Section 404 is to ensure that proposed discharges are evaluated with respect to impacts on the aquatic ecosystem. No activity that adversely effects a wetland is permitted if a practicable alternative that has less effect is available. If there is no practicable alternative, impacts must be mitigated.	Remedial activities will involve dredged or fill material discharge to a tidal wetland. There is no practicable alternative to such discharge. However, the construction will be conducted to comply with these requirements.

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
Wetlands	Coastal Zone Management Act (16 USC 1451 et seq.)	Applicable	This act provides for the preservation and protection of coastal zone areas. Federal activities that are in or directly affecting the coastal zone must be consistent to the maximum extent practicable with a federally approved state management program.	Implementation of this alternative will include construction in the coastal zone. However, best management practices will be used during remedial activities to reduce any adverse impacts to the coastal zone. The remedial action will be consistent with Maine Coastal Management Policies. The shoreline erosion controls will ensure the bank is sufficiently stabilized to contain the waste material.
Navigable Waters	River and Harbors Act (33 USC 403; 33 CFR 320-323)	Applicable	Section 10 of the River and Harbors Act prohibits unauthorized obstruction or alteration of navigable waters. Activities involving excavation or deposition of materials in navigable waters or affecting such waters must serve the public interest, and benefits must outweigh adverse impacts on natural resources, aesthetics, and navigation.	The shoreline erosion control work in the Piscataqua River (at OU3) will meet the substantive requirements of Section 10 of the Act to prevent obstruction or alteration of navigable waters.

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
State of Maine Location-Specific:				
Wetlands	Maine Site Location of Development Law (38 MRSA 481 et seq.; 06-096 CMR 371-377)	Applicable	This statute and the related regulations prohibit any development from adversely affecting existing uses, scenic character or existing natural resources in or near a community. Remediation activities must not have adverse effect on the natural environment, historic sites, unusual natural areas, and wildlife and fisheries. Also, this act requires that activities shall not interfere with existing uses of the site.	Because the landfill cover will be more than 3 acres, this alternative will need to meet the substantive requirements of the statute and regulations. However, no adverse effects on the existing uses, scenic character, or existing natural resources will occur due to the construction of the cover.
Wetlands	Maine Natural Resources Protection Act (NRPA) Permit by Rule Standards (38 MRSA 480 et seq.; 06-096 CMR 305)	Relevant and Appropriate	This act requires a permit for any activity conducted in, on, or over any protected natural resource or any activity conducted on land adjacent to and operates in such a way that material or soil may be washed into any freshwater or coastal wetland, great pond, river, stream or brook.	Implementation of this alternative will include construction in tidal wetlands or the offshore. Remedial activities (grading/capping) will be performed in compliance with substantive requirements. Erosion and sediment controls will be included during implementation of the alternative. There will be little to no net loss of naturally vegetated areas after implementation of this alternative.
Wetlands	Maine Wetland Protection Rules (06-096 CMR 310)	Applicable	Standards are provided for wetlands protection. Activities that have an unreasonable impact on the wetlands are prohibited.	Implementation of this alternative will include construction in wetlands. However, the shoreline erosion controls will not adversely affect wetlands and will ensure the banks is sufficiently stabilized to contain the waste materials.

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
Coastal Zone	Maine Coastal Management Policies (38 MSRA 1801 et seq.)	Applicable	These policies provide for the regulation, conservation, beneficial use, and management of coastal resources.	The remedial action will be consistent with these policies. The shoreline reconstruction will ensure the bank is sufficiently stabilized to contain the waste materials.
Other Natural Resources	Maine Endangered Species Act (12 MRSA 7751 et seq.)	To Be Considered	The state of Maine has authority to research, list, and protect any species deemed endangered or threatened. The Maine Department of Inland Fisheries and Wildlife determines appropriate use(s) of various habitats on a case-by-case basis. The Maine lists may differ from the federal lists of endangered species.	No known endangered or threatened species or critical habitats are present at OU3. However, to prevent flushing of birds from their nests on Clark's Island, guidance from the Maine Department of Inland Fisheries and Wildlife to refrain from remedial activities from April 1 to August 15 within 0.25 miles of a nesting habitat will be considered.
Other Natural Resources	Maine Significant Wildlife Habitat Rules (06-096 CMR 335)	To Be Considered	These rules outline requirements associated with a NRPA permit for an activity impacting significant wildlife habitat, including certain seabird nesting islands.	No known endangered or threatened species or critical habitats are present at OU3. However, to prevent flushing of birds from their nests at Clark's Island, guidance from the Maine Department of Inland Fisheries and Wildlife to refrain from remedial activities from April 1 to August 15 within 0.25 miles of a nesting habitat will be considered.
Federal Action-Specific:				
Hazardous Waste	RCRA Subtitle C Standards for Owners and Operators of TSD Facilities (40 CFR 264)	Relevant and Appropriate	These regulations outline specifications and standards for design, operation, closure, and monitoring of performance for hazardous waste storage, treatment, and disposal facilities.	These regulations are relevant and appropriate, not applicable, because disposal of wastes at this site ceased prior to the promulgation of RCRA in 1980. However, substantive requirements will be met and adhered to on site.

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
Hazardous Waste	RCRA Subtitle C, Subpart F – Releases from Solid Waste Management Units (40 CFR 264.90-264.101)	Relevant and Appropriate	These regulations detail groundwater monitoring requirements for hazardous waste facilities. These regulations outline general groundwater monitoring standards, as well as standards for detection monitoring, compliance monitoring, and corrective action monitoring.	These regulations are relevant and appropriate, not applicable, because disposal activities at this site ceased prior to the promulgation of RCRA in 1980. However, the alternative will meet the substantive requirements of these regulations.
Hazardous Waste	RCRA Subtitle C, Subpart G – Closure and Post-Closure (40 CFR 264.110-264.120)	Relevant and Appropriate	These regulations detail general requirements for closure and post-closure of hazardous waste facilities, including installation of a groundwater monitoring program.	These regulations are relevant and appropriate, not applicable, because disposal activities at this site ceased prior to the promulgation of RCRA in 1980. However, design, monitoring, maintenance, and post-closure care will meet the substantive requirements of these regulations.
Hazardous Waste	RCRA Subtitle C, Subpart N – Landfills (40 CFR 264.310)	Relevant and Appropriate	This regulation contains closure and post-closure requirements for Subtitle C landfills.	This regulation is relevant and appropriate, not applicable, because disposal of wastes at this site ceased prior to the promulgation of RCRA in 1980. However, this alternative will meet the substantive requirements of this regulation with regard to cap design, monitoring, maintenance, and post-closure care.
Capping	Alternative Cap Design Guidance Proposed for Unlined, Hazardous Waste Landfills in the EPA Region I (memo dated 9/30/97)	To Be Considered	Guidance for design of a cover or cap for unlined, hazardous waste landfills in EPA Region I.	This guidance will be followed for design of the cap.

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
Capping	Amendment to Recommended Long Term Hydraulic Performance Criteria of the Geocomposite Drainage Layer in Landfill Cap Applications (memo dated 3/23/99	To Be Considered	Guidance for testing long-term performance characteristics of a geocomposite drainage layer.	This guidance will be followed for design of the cap.
Groundwater	Safe Drinking Water Act (SDWA), Maximum Contaminant Levels (MCLs) (40 CFR 141.11-141.16 and 141.60-141.65)	Relevant and Appropriate	MCLs have been promulgated for many common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers used for drinking water.	MCLs were used to document contaminant exceedances in groundwater (as part of the OU3 risk assessment). Until contaminant concentrations in the groundwater are below MCLs, a restriction on the use of groundwater within the OU3 compliance boundary will be established and maintained, and an appropriate monitoring program will be conducted.
Groundwater	SDWA Maximum Contaminant Level Goals (MCLGs) (40 CFR 141.50-141.51)	Relevant and Appropriate	MCLGs have been promulgated for many common organic and inorganic contaminants. These concentrations indicate the level of contaminants in drinking water at which no known or anticipated adverse effect on the health effect of a person would occur, allowing for an adequate margin of safety. MCLGs are non-enforceable public health goals.	Where MCLs have not been established, non-zero MCLGs were used to document contaminant exceedances in groundwater (as part of the OU3 risk assessment). Until contaminant concentrations in the groundwater are below non-zero MCLGs, a restriction on the use of groundwater within the OU3 compliance boundary will be established and maintained, and an appropriate monitoring program will be conducted.

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
Emissions	Air/Superfund National Technical Guidance (EPA/450/1-89/001 through 004)	To Be Considered	This guidance describes methodologies for predicting risks due to air release at a Superfund site.	Releases to air will be minimized by fugitive dust controls. Emissions of hazardous air pollutants are not anticipated.
State of Maine Action-Specific:				
Hazardous Waste	Maine Hazardous Waste Management Rules (06-096 CMR 800-802, 850, 851, 853-857)	Relevant and Appropriate	These regulations provide standards for the generation, transportation, treatment, storage, and disposal of hazardous waste. They set forth the state definition and criteria for establishing whether waste materials are hazardous and subject to associated hazardous regulations. They also provide standards for the location of facilities in a floodplain or within 300 feet of the floodplain and detail groundwater monitoring requirements for hazardous waste facilities. The regulations outline general groundwater monitoring standards, as well as standards for detection monitoring, compliance monitoring, and corrective action monitoring.	State requirements more stringent than federal requirements take precedence. At the completion of the remedial action, these remedial standards will be met under this alternative.
Emissions	Maine Air Pollution Control Law – Classification of Air Quality Control Regions (38 MSRA 583; 06-096 CMR 114)	Relevant and Appropriate	Air quality regions and classification of each region and ambient air quality and emission standards are established.	Emissions of criteria pollutants will be minimized by fugitive dust control during excavation, grading, and capping activities. Emissions of hazardous air pollutants are not anticipated during implementation of this alternative.

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
Emissions	Maine Ambient Air Quality Standards (38 MSRA 584; 06-096 CMR 110)	Relevant and Appropriate	Ambient air quality standards are established for particulate matter, sulfur dioxide, carbon monoxide, ozone, hydrocarbon, nitrogen dioxide, lead, and total chromium. Ambient increments that define the maximum ambient increase of a particular pollutant, which can be permitted for a given area, are defined.	Emissions of criteria air pollutants will be minimized by fugitive dust control during excavation, grading, and capping activities
Emissions	Maine Air Pollution Control Laws – Maine Emission License Regulations (38 MSRA 585 and 590; 06-096 CMR 115)	Relevant and Appropriate	Requires new sources of air emissions to demonstrate that its emissions do not violate ambient air quality standards. New sources must meet preconstruction monitoring and post-construction monitoring requirements.	Emissions of criteria air pollutants will be minimized by fugitive dust control during excavation, grading, and capping activities.
Groundwater	Maine Department of Human Services Rules Relating to Testing of Private Water Systems for Potentially Hazardous Contaminants (10-144E CMR 233, Appendix C)	Relevant and Appropriate	Maximum Exposure Guidelines (MEGs) are contained in Appendix C to these rules. MEGs include health advisories, which are maximum allowable concentrations of contaminants in drinking water.	Until contaminant concentrations in the groundwater are below MEGs, a restriction on the use of groundwater within the OU3 compliance boundary will be established and maintained, and an appropriate monitoring program will be conducted.

Medium/Activity	Requirement/ Citation	Status	Synopsis	Action To Be Taken
Groundwater	Maine Hazardous Waste Rules Relating to Performance Standards for Establishing, Constructing, Altering, and Operating Certain Types of Hazardous Waste Units (06-096 CMR 854)	Relevant and Appropriate	This requirements outlines the State of Maine's rules relating to establishing, constructing, altering, and operating certain types of hazardous waste units.	Until contaminant concentrations in the groundwater are below MEGs, a restriction on the use of groundwater within the OU3 compliance boundary will be established and maintained, and an appropriate monitoring program will be conducted.
Groundwater	Maine Department of Human Services Rules Relating to Drinking Water (10-144E CMR 231-233)	Relevant and Appropriate	Maine's primary drinking water standards are similar to federal MCLs as drinking water standards under the Maine Safe Drinking Water Rules. When state standards are more stringent that federal standards, and have been legally and constantly applied, the state levels shall be used.	Until contaminant concentrations in the groundwater are below Maine MCLs, a restriction on the use of groundwater within the OU3 compliance boundary will be established and maintained, and an appropriate monitoring program will be conducted.
Erosion	Erosion and Sedimentation Control (38 MRSA 420-C) and Stormwater Management (38 MSRA 420-D; 06-096 CMR 500 and 502)	Applicable	Erosion control measures must be in place before activities, such as filling, displacing, or exposing soil or other earthen materials occur. Prior MEDEP approval is required if the disturbed area is in the direct watershed of a water body most at risk.	Appropriate controls will be implemented to address erosion, sedimentation, and storm water and applicable plans will be coordinated with the MEDEP before implementation.
Waste	Maine Solid Waste Management Regulations (06-096 CMR 400-411)	To be Considered	Provides standards for generation, transportation, treatment, storage, and disposal of solid and special wastes. Also provides closure and post-closure maintenance standards.	Not applicable for a facility established before 1973. Capping performance standards are TBC for the conceptual cover design. The specific design standards are not appropriate for a landfill that has been closed since 1978.

sediment monitoring for the area offshore of OU3 is included in the Interim Offshore Monitoring for OU4.

Description of the Significant Difference

This ESD documents a modification to the OU3 ROD that significantly changes, but does not fundamentally alter, the selected remedy. The change to the remedy for the OU3 does not alter the decision to install a hazardous waste landfill cover or implement institutional controls, erosion controls, and monitoring. The OU3 remedy is modified to include management of migration as part of OU3. The remedy for OU3 with modifications based on the September 2003 ESD will meet the Applicable and Relevant and Appropriate Requirements (ARARs) and the RAO for groundwater migration from the JILF. The monitoring component of the OU3 remedy is affected by the addition of the ARARs and RAO for groundwater migration from the JILF.

The following ARARs are included in the OU3 remedy based on the addition of management of migration:

- Clean Water Act, Section 304(a), National Recommended Water Quality Criteria (33 USC 1251 et seq; 40 CFR 122.44; 40 CFR 131) (Relevant and Appropriate). These are non-enforceable guidelines developed for pollutants in surface water. States must develop water quality standards based on Ambient Water Quality Criteria (AWQC) to protect existing and attainable uses of surface waters that receive discharges of pollutants. These are health-based criteria developed for carcinogenic and noncarcinogenic compounds and water quality parameters. AWQC are set at levels that are guidelines for pollutants in surface water. AWQC are available for the protection of human health from exposure to contaminants in drinking water, ingestion of aquatic biota, and for protection of freshwater and saltwater aquatic life. These criteria are used as guidance for developing action levels for the monitoring program as part of the OU3 OM&M Plan.
- Maine Environmental Evaluation: Surface Water Toxics Control Program, Chapter 530.5 (38 MRSA 420 and 464, 06-096 CMR 530) (Applicable). This rule promulgates chemical standards for surface water, referred to as Maine Statewide Water Quality Criteria (SWQC) and procedures necessary to control levels of toxic pollutants in surface water. Maine SWQC are set at federal AWQC levels. The criteria are used for developing action levels for the monitoring program as part of the OU3 OM&M Plan.

The following RAO is added to the OU3 remedy based on the addition of management of migration:

- Ensure that the migration of groundwater contaminants does not adversely impact the offshore environment.

The post-remedial monitoring program for OU3 addresses the ARARs and RAO for groundwater migration and provides for the collection and evaluation of groundwater data to determine whether additional investigation and/or evaluation is needed to ensure that human health and the environment are protected from migration of groundwater from the JILF. As provided in the OU3 OM&M Plan, chemicals in the landfill may enter the groundwater and subsequently discharge offshore at levels that may pose unacceptable risks to human and ecological receptors. To maintain the effectiveness of the OU3 remedy, the Navy needs to ensure that chemicals from the landfill are not in the groundwater at concentrations that will adversely impact human health and the environment after the groundwater discharges to the offshore. Action levels to initiate additional evaluation or investigation are based on protection of offshore and intertidal receptors. The decisions for monitoring were developed to meet the RAOs for source control and for migration of OU3 groundwater offshore.

The OM&M Plan provides decision trees that consider whether chemical concentrations in groundwater are greater than action levels and provide for evaluation of risks to determine

APPENDIX C.4

OU4 ARARS TABLE FROM INTERIM ROD

TABLE C-1

CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAIN

Medium or Activity	Requirement	Status	Requirement Synopsis	Evaluation/Action to Be Taken
FEDERAL				
Water	Clean Water Act (CWA); Federal Ambient Water Quality Criteria (AWQC); (33 USC §§1251 et seq, 40 CFR § 122.44; 40 CFR Part 131)	Relevant and Appropriate	CWA AWQC are health-based criteria developed for carcinogenic and noncarcinogenic compounds and water quality parameters. AWQC are set at levels that are guidelines for pollutants in surface water. AWQC are available for the protection of human health from exposure to contaminants in drinking water as well as from ingestion of aquatic biota and for the protection of freshwater and saltwater aquatic life.	AWQCs for the protection of freshwater and saltwater aquatic life will be used to develop PRGs, as appropriate.
Water	U.S. Food and Drug Administration (FDA) Action Levels (21 U.S.C. §§301 et seq)	TBC	Under Section 408 of the Federal Food, Drug, and Cosmetic Act, FDA action levels are established above which the FDA can take legal action to remove a food product from the market.	FDA action levels for fish and shellfish will be used to develop PRGs, as appropriate.
Sediment	EPA Proposed Sediment Quality Criteria, 59 Fed. Reg. 2652 (Jan. 18, 1994)	TBC	These sediment quality criteria for the protection of benthic organisms are proposed for acenaphthene, dieldrin, endrin, fluoranthene, and phenanthrene.	These criteria will be used to develop PRGs, as appropriate.
Sediment	National Oceanographic Atmospheric Administration (NOAA) Incidence of Adverse Biological Effects within Ranges of Chemical Concentration in Marine and Estuarine Sediments.	TBC	This document provides chemical concentration effects distributions that describe the observed or predicted chemical concentrations associated with biological effects. Effects range low (ER-L) and effects range median (ER-M) represent the tenth and fiftieth percentile of reported effects.	ER-L and ER-M concentrations will used to develop PRGs, as appropriate.
Other Natural Resources	NOAA National Status and Trends Program Approach, Informal Guidelines Mussel Watch Data (1991).	TBC	Chemical concentrations in blue mussel tissues located in coastal waters of the US are monitored under this program. Data from the program have been compiled to characterize the national distribution of chemical concentration levels (O'Connor, 1990).	Data will be considered in PRG development as appropriate.
STATE				
Water	Maine Surface Water Toxics Control Program (06-096 CMR 530)	Relevant and Appropriate	The regulations implementing this program set Statewide ambient water quality criteria for toxic pollutants and procedures necessary to control levels of toxic pollutants in surface water are identified. Statewide criteria are set at Federal AWQC levels.	Federal AWQCs, which have been adopted as state criteria, will be used to develop PRGs, as appropriate.

TABLE C-2

LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

Medium or Activity	Requirement	Status	Requirement Synopsis	Evaluation/Action to Be Taken
FEDERAL				
Wetlands	Protection of Wetlands – Executive Order 11990 (40 CFR Part 6, Appendix A)	Applicable	Requires Federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance natural and beneficial values of wetlands.	Wetlands are located in various locations around PNS. Monitoring activities will meet the requirements of 11990.
Wetlands	Coastal Zone Management Act (16 USC 1451 et seq.)	Applicable	This act provides for the preservation and protection of coastal zone areas. Coastal zone development must be managed in such a way as to minimize the effects on coastal zone resources. Activities in coastal zone areas must be consistent to the maximum extent practicable with a Federally approved state management program.	Monitoring activities will be in compliance with this act.
Other Natural Resources	Fish and Wildlife Coordination Act (16 USC 661 et seq.; 40 CFR § 6.302)	Relevant and Appropriate	This act requires any federal agency proposing to modify a body of water, must consult with the U.S. Fish and Wildlife Service, National Marine Fisheries Services, and other related state agencies.	Notification is not required for actions taken on-site at a CERCLA site. However, monitoring activities will be conducted so as to minimize impacts to wetlands.
Other Natural Resources	Endangered Species Act (16 USC 1531 et seq; 50 CFR Parts 200, 402)	Relevant and Appropriate	Federal agencies are required to consider the impacts on endangered and threatened species and their critical habitats (listed in 50 CFR Part 17).	No known endangered threatened or protected species or critical habitats are located on the site; however, Clark's Island is used by nesting birds. Monitoring activities will be in compliance with this act.

TABLE C-2

LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

Medium or Activity	Requirement	Status	Requirement Synopsis	Evaluation/Action to Be Taken
STATE				
Water	Water Classification Program (38 MRSA §§ 464-470)	Relevant and Appropriate	Establishes a water quality classification system to allow the State to manage its surface waters so as to protect the quality of those waters.	Monitoring activities will be in compliance with this law.
Wetlands	Maine Natural Resources Protection Act Permit by Rule Standards (38 MRSA 480-A et seq.; 06-096 CMR 305)	Relevant and Appropriate	These Standards require a permit for any activity conducted in, on, or over any protected natural resource or any activity conducted adjacent to and operated in such a way that material or soil may be washed into any coastal wetland, great pond, river, stream or brook, and some freshwater wetlands.	Monitoring activities will not require a permit, but will comply with the substantive requirements of these standards.
Wetlands	Maine Wetland Protection Rules (06-096 CMR 310)	Applicable	These standards are provided for wetlands protection. Activities that have an unreasonable impact on the wetlands are prohibited.	Monitoring activities will be in compliance with these rules.
Other Natural Resources	Maine Endangered Species Act (12 MRSA §§ 775)	Relevant and Appropriate	The State of Maine has authority to research, list, and protect any species deemed endangered or threatened. The Maine Department of Inland Fisheries and Wildlife determines appropriate use(s) of various habitats on a case-by-case basis. The Maine lists may differ from the federal lists of endangered species.	No known endangered or threatened species or critical habitat is located on the site; however, Clark's Island is used by nesting birds. Monitoring activities will be in compliance with this act.
Other Natural Resources	Maine Significant Wildlife Habitat Rules (06-096 CMR 335)	Relevant and Appropriate	These rules outline the requirements associated with a Natural Resources Protection Act permit for an activity impacting significant wildlife habitat, including certain seabird nesting islands.	No significant wildlife habitat is located on the site; however, Clark's Island is used by nesting birds. Monitoring activities will be in compliance with these rules.

TABLE C-3

ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, ADVISORIES, AND GUIDANCE
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAIN

Medium or Activity	Requirement	Status	Requirement Synopsis	Evaluation/Action to Be Taken
STATE				
Water/Sediment	Regulations Relating to Sampling Procedures and Analytical Procedures (06-096 CMR 580)	Relevant and Appropriate	Establishes standards whereby all sampling and analysis will be performed according to accepted technical procedures for chemical and biological analysis.	Monitoring activities will be in compliance with this law.
Other Natural Resources	Special License (12 MRSA 6074)	Applicable	Special license for research issued by Maine Department of Marine Resources that exempts holder from one or more marine resources' laws as to the time, place, length, condition, amount, and manner of taking or possessing a marine organism.	Monitoring activities will not require a permit but will comply with the substantive requirements.

APPENDIX C.5

ACTION LEVEL DEVELOPMENT UPDATES

ACTION LEVEL DEVELOPMENT UPDATES
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Risk-based site-specific human health action levels and criteria-based ecological action levels are used for evaluation of groundwater data as part of the Operable Unit 3 (OU3) Operation, Maintenance, and Monitoring (OM&M) Program. As part of the second five-year review evaluation of criteria and action level changes, the methodology for development of the human health action levels was reviewed and updates identified as discussed herein. The human health action levels were updated and are presented in Section 4 of the Second Five-Year Review Report. Updates to the criteria-based ecological action levels are also provided in Section 4.

Attachment 1 provides the development update for recreational exposure to intertidal surface water screening levels that were used to support calculation of human health action levels for OU3 except for thallium and lead. Thallium and lead were evaluated separately as discussed in Attachments 2 and 3.

ATTACHMENT 1

INTERTIDAL SURFACE WATER
RISK-BASED SCREENING LEVEL DEVELOPMENT UPDATE
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Screening levels were calculated for intertidal surface water for Portsmouth Naval Shipyard (PNS) using the methodology presented in the 2002 Technical Memorandum for Development of Facility-Specific Intertidal Surface Water and Sediment (Tetra Tech, December 2002), which is attached. The screening levels developed for a recreational user in the intertidal area of PNS considered exposure via ingestion and dermal contact with intertidal surface water.

The original methodology for the dermal screening level calculations used the Risk Assessment Guidance for Superfund (RAGS) Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment Interim Final), September 2001 (USEPA, 2001). In July 2004, RAGS Part E was updated from an Interim Final to a Final document (USEPA, 2004). None of the changes made to the RAGS Part E guidance between the 2001 Interim Final and the 2004 Final affected these screening level calculations; therefore, no updates to the surface water screening calculations were necessary based on RAGS Part E (USEPA, 2004).

As provided in the 2002 Technical Memorandum, the methodology used to calculate ingestion screening levels was based on the RAGS Volume 1: Human Health Evaluation Manual Part A, Interim Final (USEPA, 1989), which has not been updated; therefore, values used from RAGS Part A, such as input parameters, were not updated.

Toxicity criteria (cancer slope factors and reference doses) and gastrointestinal absorption factors (GIABS) used in previous screening level calculations were updated with the values published in the Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites Tables (USEPA, November 2011) and screening levels recalculated except for thallium. Thallium was evaluated separately as discussed in Attachment 2 because of uncertainty in the updated reference dose for thallium.

The trichloroethene screening level is based on a screening level calculated using the kidney oral cancer slope factor for the mutagenic mode of action and a screening level calculated using the non-Hodgkin lymphoma and liver non-mutagenic oral slope factor.

References

Tetra Tech, December 2002. Technical Memorandum: Development of Facility-Specific Human Health Risk Screening Levels For Intertidal Surface Water And Sediment, Portsmouth Naval Shipyard, Kittery, Maine. December 2.

USEPA, 1989. Risk Assessment Guidance for Superfund - Volume I - Human Health Evaluation Manual (Part A) - Interim Final. EPA/540/1-89/002. Office of Emergency and Remedial Response.

USEPA, 2001. Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual – Part E, Supplemental Guidance for Dermal Risk Assessment – Interim Final. Office of Superfund Remediation and Technology Innovation.

USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual – Part E, Supplemental Guidance for Dermal Risk Assessment – Final. Office of Superfund Remediation and Technology Innovation.

USEPA, November 2011. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/region9/superfund/prg/.

TECHNICAL MEMORANDUM
DEVELOPMENT OF FACILITY-SPECIFIC HUMAN HEALTH RISK SCREENING LEVELS FOR INTERTIDAL SURFACE WATER AND SEDIMENT PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

1.0 INTRODUCTION

This technical memorandum presents the development of human health screening levels that can be used to select chemicals of potential concern (COPCs) when evaluating human recreational receptor exposure to chemical concentrations in intertidal surface waters (including seeps) and sediments at Portsmouth Naval Shipyard (PNS). In this memorandum, the intertidal area is the area along the shoreline that is exposed at low tide but is under water at high tide. Intertidal waters include surface water in the intertidal zone as well as seep water that is exposed at low tide. The sediments include the sediment located in the intertidal zone, both within and outside the boundary of the seep.

These screening levels are developed for purposes of COPC selection only and are intended for use generically across the shipyard. They can not be used for purposes of estimating site-specific seep/surface water/sediment risks at PNS because the exposure assumptions underlying the screening levels are ***intentionally designed to be very conservative*** and inherently overestimate the potential risk, even for the reasonable maximum exposed (RME) individual. Risks will be calculated using site-specific exposure assumptions as part of a site-specific risk assessment for chemicals that are retained as COPCs. These risk calculations will be presented in separate documents.

A small recreational beach area exists in Clark Cove and boat launch locations exist in two areas (e.g., Topica Pier, Sullivan's Point) around the shipyard. However, human exposure to intertidal surface waters and sediments at PNS is likely to be infrequent because of the rocky nature of much of the shoreline and intertidal area.

2.0 METHODOLOGIES FOR CALCULATING SCREENING LEVELS

The screening levels for intertidal surface water and sediments consider human exposure via the ingestion (incidental) and dermal contact routes of exposure. The screening levels were calculated assuming that the receptor is a resident living in proximity to or on PNS and is exposed over a 30-year duration, including exposure that may occur during childhood and adolescent years. Therefore, the following three receptors were considered in the evaluation:

- Adult
- Adolescent child (approximately age 7 through 16)
- Young child (approximately age 4 through 6)

The 0 to 3 year old child was not included in the risk assessment because young children are unlikely to play in seeps or sediment since the shore is rocky and not safe for young children. (See Section 4.0 Uncertainty Associated with Screening Levels, for a more detailed discussion.)

2.1 METHODOLOGY FOR CALCULATING DERMAL SCREENING LEVELS

The assessment methodology for the dermal route of exposure considers the most current U.S. Environmental Protection agency (USEPA) guidance, Risk Assessment for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim (EPA/540/R/99/005) (USEPA, September 2001) (Attachment 1). The methodology also considers guidance from USEPA Region 1 (and guidance from other USEPA regions) as well as comments from the Maine Department of Environmental Protection (MEDEP) and the Restoration Advisory Board (RAB) in correspondences dated February 8, 2002.

The following equation was used to calculate the dermal absorbed dose hypothetically resulting from dermal exposure to COPCs in the intertidal waters:

$$DAD = (DA_{event} * EV * ED * EF * SA) / (BW * AT)$$

The terms of the equation are defined in the following table:

	Receptors		
Parameter	Adult	Adolescent	Young child
Dermal absorbed dose (DAD) (mg/kg/day)	Calculated	Calculated	Calculated
Adsorbed dose per event (DA_{event}) – (mg/cm^2)	Calculated[(1)]	Calculated[(1)]	Calculated[(1)]
Events/day (EV)	1	1	1
Exposure duration (ED) (years)	17	10	3
Exposure frequency (EF) (days/year)	26	26	26
Skin surface area exposed (SA) – (cm^2)	4500	4290	4000
Body weight (BW) (kg)	70	45	20
Averaging time (AT) for Carcinogens – (days) (AT = 70 yr * 365 days/yr)	25550	25550	25550
Averaging time (AT) for Non-carcinogens – (days) (AT = ED * 365days/yr)	6205	3650	1095

1 - The DA_{event} term is calculated based on the chemical concentration, chemical specific permeability constant, and other intermediate terms as demonstrated in Attachment 1.

An exposure frequency of 26 days/year was used based on the assumption that a receptor may visit the shoreline an average of 2 days per week over the course of the summer (June, July, and August; 13 weeks). The combined exposure duration of 30 years is the duration typically recommended by USEPA for evaluation of the residential land use scenario (USEPA, December 1989) and assumes that the receptor lives on or in close proximity to PNS and routinely visits the shoreline. The skin surface area exposed for the adult, adolescent, and young child assumes that 25 percent, 33 percent, and 50 percent, respectively, of the total skin surface area is directly contacting the water. (The total skin surface areas [50^{th} percentile values] and body weights of the receptors are based on information presented in RAGS E and the 1997 version of the Exposure Factors Handbook [EFH]) (USEPA; August 1997) (see Attachment 2).

The DA_{event} term (i.e., the absorbed chemical dose per event) is calculated based on the chemical concentration in the surface water, the chemical specific dermal permeability coefficient, the exposure time (a 4 hour exposure time was assumed), and several other intermediate terms and calculations as demonstrated in Attachment 1. Based on comments on the Operable Unit 6 (OU6) Data Quality Objecives (DQOs), a 4-hour exposure time was recommended. Given the rocky nature of most of the PNS shoreline, the low flow of most seeps, and the location of the seeps within the tidal zone, this exposure time is very conservative for some PNS areas and not plausible for other areas. However, because these screening levels were developed for use across the shipyard, they were calculated using assumptions that may be appropriate in some area, but not others (i.e., the screening levels may significantly over-estimate risk in some cases).

The following equation was used to calculate the dermal absorbed dose hypothetically resulting from dermal exposure to COPCs to intertidal sediments:

DAD = (Conc * CF * EV * ED * EF * SA * AF* ABS) / (BW * AT)

The DAD, EV, ED, EF, SA, BW, and AT terms were defined previously for dermal exposure to surface water. ABS (unitless) is the chemical specific absorption factor as specified in RAGS Part E (see Attachment 3). Other terms presented in the equation are defined in the following table:

		Receptors	
Parameter	Adult	Adolescent	Young child
Chemical concentration In sediments (Conc) (mg/kg)	Measured	Measured	Measured
Conversion Factor (CF) (kg/mg)	10^{-6}	10^{-6}	10^{-6}
Sediment adherence factor (AF) – (mg/cm^2)	1	1	1

A sediment adherence factor of 1 mg/cm^2 was selected for the calculation of the screening levels because it was used as the RME adherence factor in past baseline risk assessments conducted for PNS, it is the RME value suggested in the 1992 Dermal Guidance (USEPA, 1992), and because there is no default sediment adherence factor suggested in RAGS Part E. The value is conservative given most of the data and recommendations presented in RAGS Part E and the fact that much of the shoreline around the shipyard is rocky and sandy. (Selected data are presented in Attachment 3.)

2.2 METHODOLOGY FOR CACULATING INGESTION SCREENING LEVELS

The assessment methodology for the ingestion route of exposure considers USEPA guidance, Risk Assessment for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part A) Interim Final (EPA/540/1-89/002) (USEPA, December 1989) as well as many of the exposure assumptions already presented for the evaluation for the dermal route of exposure. Also, note that the ingestion pathway considered in this memorandum refers to incidental ingestion only because the intertidal surface water can not be used as a domestic drinking water supply due to salinity.

The following equation was used to calculate the exposure dose hypothetically resulting from ingestion of COPCs in intertidal waters:

Dose = (Conc * IR* ET * ED * EF) / (BW * AT)

The ED, EF, BW, and AT terms were defined above. Other terms presented in the equation are defined in the following table:

Parameter	Adult	Receptors Adolescent	Young Child
Chemical concentration In seep surface water (Conc) (ug/L)	Measured	Measured	Measured
Seep surface water ingestion Rate (IR) – (L/hr)	0.05	0.05	0.05
Exposure time per day (ET) – (hrs/day)	4	4	4

The surface water ingestion rate of 0.05 L/hr was recommended in USEPA, RAGS Part A as the ingestion rate appropriate for a recreational swimming scenario (USEPA, December 1989). Based on the Navy's observations and the lack of a formal swimming area, people do not typically swim in the intertidal areas of PNS (a wading scenario is more typical and plausible) and swimming in the actual seeps is not possible. Consequently, the 0.05 L/hr surface water ingestion rate, which is appropriate for swimming, is conservative when used to develop screening levels.

The following equation was used to calculate the exposure dose hypothetically resulting from ingestion of COPCs in seep sediments:

Dose = (Conc * IR* CF * FI * ED * EF) / (BW * AT)

The ED, EF, CF, BW, and AT terms were defined above. Other terms presented in the equation are defined in the following table:

Parameter	Adult	Receptor Adolescent	Young child
Chemical concentration In Inter-tidal sediment (Conc) (mg/kg)	Measured	Measured	Measured
Fraction ingested from source (FI) – unitless	0.5	0.5	0.5
Sediment ingestion Rate (IR) – (mg/day)	50	100	200

The intertidal sediment ingestion rates for the adult and young child receptors are daily ingestion rates recommended by the USEPA for soil ingestion assuming a residential land use scenario. The sediment ingestion rate for the adolescent receptor is based on professional judgment. The "fraction ingested (FI) from source" term is an adjustment of the ingestion rate based on the assumption that the receptor is not "residing" in the intertidal area.

3.0 CALCULATED SCREENING LEVELS

The screening levels for intertidal surface water and sediments derived using the preceding equations are presented in Table 1. Intertidal surface water screening levels are presented for the ingestion route of exposure, the dermal route of exposure, and the both exposure routes combined, because of the uncertainties associated with some of the dermal values (see Section 4.0). Supporting risk calculation spreadsheets are found in Attachment 1. The screening levels were developed for surface waters and sediments using a two-step process. First, risk estimates are calculated for a 1 ug/L concentration of a chemical in surface water or 1 mg/kg concentration of a chemical in sediment.

The exposure point concentration (EPC) (i.e., 1 ug/L or 1 mg/kg) and resulting risk estimate for that EPC may be used to calculate the screening level using a simple ratio-ing technique:

EPC (ug/L or mg/kg) -- Risk Estimate for EPC (Cancer risk estimate or hazard index for all receptors exposed)	=	Screening Level ?? --------------------- Target risk (e.g., cancer risk = 1×10^{-6} or hazard index of 1)

The screening levels presented in Table 1 are set at the 1×10^{-6} for carcinogenic chemicals and at a hazard index of 0.1 for non-carcinogenic chemicals.

4.0 UNCERTAINTY ASSOCIATED WITH SCREENING LEVELS

There are three primary sources of uncertainty that should be considered when using the screening levels developed for the intertidal surface water and sediments.

- ***There are no published data available regarding the appropriate exposure assumptions for an individual potentially exposed to intertidal surface waters and sediments along rocky shorelines such as those existing at PNS.*** Consequently, the screening levels presented in Table 1 were developed, in large part, by adapting USEPA exposure assumptions for soil ingestion and exposure assumptions typically used to evaluate a swimming scenario. Professional judgment and comments received from USEPA, MEDEP, and RAB were also considered in the development of the screening levels. Given that the PNS shoreline is unlikely to attract recreational receptors for long periods of time and given that the potential for exposure is limited by the tides, COPC selection using the screening levels will likely overestimate the potential for risk.

- ***The USEPA RAGS Part E guidance document and associated exposure models are currently designated "interim draft".*** As discussed below and in Attachment 3, there is considerable uncertainty attached to risk estimates/screening levels that may be developed for dermal exposure to certain organic chemicals in water (e.g., polyaromatic hydrocarbons (PAHs), polychlorinated hydrocarbons (PCBs), TCDDs). Page A-40, second paragraph..."Accordingly, the final dose and risk estimates should be considered highly uncertain." Also, the guidance focuses on soils and domestic use of a water supply. There is minimal guidance regarding evaluation of exposure to chemicals in surface waters and sediments during recreational activities. Additionally, information provided during conversations with USEPA (or E-mails from USEPA) indicates that risk management decisions should not be made based on the screening levels or risk estimates calculated using the RAGS Part E dermal absorption model for certain chemicals in water (e.g., the PAHs, PCBs, TCDDs). (Personal communication from Dr. Ted Simon to Tom Jackman; Personal communication from Dr. Daniel Stralka to Lee Ann Sinagoga, April 26, 2002). USEPA advises that the agency intends to prepare and distribute an "Implementation Memorandum" providing guidance regarding the use of the RAGS Part E dermal absorption model for chemicals in water.

- ***The USEPA RAGS Part E model assumes that the receptor is in constant contact with the water source for the time specified as T_{event}.*** Given the limited nature of the seeps, a receptor is not likely to be constant contact with the seeps. He/she is likely to be sporadically contacting the seep as they recreate along the beach.

RAGS Part E discusses in detail the uncertainties attached to the absorbed doses calculated using the RAGS Part E Model for chemicals in surface water. The uncertainties are very high for the following compounds with permeability coefficients "outside the effective predictive domain of the model":

- PAHs
- PCBs
- TCDD (all dioxins and furans)
- DDT (and degradation by-products)

The RAGS Part E model may over-estimate the absorbed dose for these chemicals. Consequently, the USEPA recommends that the analyst conduct "reality checks" when using the RAGS Part E model to evaluate these chemicals. "Reality checks" may include a comparison of the screening level developed for the ingestion route of exposure versus the screening level developed for the dermal route of exposure. Large differences between these 2 screening levels (i.e., when the dermal screening level is considerably lower than the ingestion screening level) can be (but is not always) an indication of an over-prediction chemical absorption by the RAGS Part E model. A comparison of screening levels versus other standards and criteria commonly used in human health risk assessment also provides perspective.

For example, the screening levels presented for 2,3,78-TCDD, some of the PAH compounds (e.g., benzo(a)pyrene [B(a)p], benzo(b)fluoranthene [B(b)f], dibenzo(ah)anthracene [d(ah)a]), and the PCB compounds on Table 1 (and in Attachment 1) are as follows:

Parameter	Facility-Specific Screening Level Ingestion Route of Exposure (ng/L)	Facility-Specific Screening Level Dermal Route of Exposure (ng/L)	SDWA MCL (ng/L)	USEPA Region 9 Tap-water (PRGs)(1) (ng/L)
B(a)p	1,100	8	200	9.2
B(b)f	11,000	78	200	92
D(ah)a	1100	5.1	200	9.2
2,3,7,8-TCDD	0.053	0.00042	0.03	0.00045
PCBs	4000	34	500	34

1: USEPA Region 9 preliminary remediation goals for tap water.

The preceding table indicates that the screening levels for the ingestion route of exposure are two orders of magnitude greater than screening levels for the dermal route of exposure. All of the calculated dermal screening levels ***are less than*** the current federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) for drinking water, where available. All of the calculated dermal screening levels ***are less than (or approximate)*** the current USEPA Region 9 preliminary remediation goals (PRGs) for tap water. COPC selection and risk estimation based on these dermal screening levels should be considered highly uncertain. Although the screening levels based on dermal absorption are similar to the tap-water PRGs, this is more of a coincidence than anything else, because the tap-water PRGs do not account for dermal absorption (USEPA, October 2002). The tap-water PRGs were expected to be much lower than the ingestion screening levels developed in this document for several reasons. The PRGs assume that adults and children will drink 2 and 1 liters of water per day, respectively, and they assume that those levels are consumed every day. Humans will not ingest these volumes of intertidal surface water, especially since it is brackish. The screening levels assume that humans will drink 0.2 liters per 4-hour exposure, or approximately 6.7 ounces of intertidal surface water per exposure. This is still a very conservative value, especially for the ingestion of seep water, given the low volume of most of the seeps. It is also unlikely that humans would ingest 6.7 ounces of intertidal surface water while wading along the shoreline.

Additional sources of uncertainty for the screening levels include the following:

- ***The screening levels do not consider exposures to a very young child (0 to 3 years of age).*** However, exposure to children in this age group is not a likely scenario because of the physical nature of the shoreline and intertidal areas (i.e., much of the shoreline is rocky and would be physically hazardous for very young children, the mudflat areas are not conducive to recreational activities). More importantly, the screening levels were derived using exposure assumptions conservative enough to account for the young child who, on a rare occasion, might walk/crawl in the intertidal area of the PNS.

- ***The skin surface adherence factors for solid media (soils or sediments) vary greatly depending on the nature of the media (i.e., silt, sand, mud, etc.).*** For example, soil adherence factors for mud can exceed the 1 mg/cm^2 adherence factor selected for the development of the sediment screening levels. (The geometric mean value for children exposed to mud in the RAGS Part E guidance document is 22 mg/cm^2; the uncertainties associated with this value are significant.) However, the default skin adherence factor recommended for typical childhood exposure to soils in RAGS Part E is 0.2 mg/cm^2. Given that a receptor recreating along the shoreline would contact a variety of different materials ("rock-like", "sand-like", "soil-like", and "mud-like"), the 1 mg/cm^2 is a reasonable and conservative compromise of the adherence factors associated with each of these materials. Additionally, the sediment screening levels were derived using exposure assumptions conservative enough to account for the fact that receptors will occasionally contact "mud-like" media while recreating along the shoreline at the PNS.

- ***The current cancer slope factor for 2,3,7,8-TCDD [1.5 $x10^{+5}$ $(mg/kg/day)^{-1}$] is under review and may be increased to 1.0$x10^{+6}$ $(mg/kg/day)^{-1}$.*** If the proposed cancer slope factor for 2,3,7,8-TCDD is approved for use in human health risk assessment by the USEPA, the MEDEP, and the Navy, the screening levels presented in Table 1 would decrease by approximately one order of magnitude (see footnotes to Table 1).

- Dermal exposure to chemicals in the intertidal surface water is more likely to occur than the exposure via ingestion because only small amounts of surface water will be incidentally ingested during wading, the most likely exposure scenario. However, because the screening values for some of the organic chemicals (i.e., the carcinogenic PAHs, DDT and related compounds, PCBs, and dioxin) are based on the ingestion exposure route, there are uncertainties in using these screening values to select COPCs for human health risk assessment. These uncertainties are not expected to change the overall conclusions of the risk evaluation because of the conservative nature of the screening levels and the small amount of exposure to the seeps that is actually expected to occur.

- As summarized below, the human health sediment screening levels that are presented are reasonable when compared to the USEPA soil screening levels (Region 9 PRGs and Region 3 Risk Based Concentrations (RBCs) (USEPA, October 2002)). The sediment screening levels are similar to the industrial Region 9 PRGs and Region 3 RBCs, which is expected under an recreational scenario.

	Region 9 PRG Soil(1)		Region 3 RBC Soil(1)		Draft PNS Recreational Sediment Screening Level(1)
Parameter	Residential (mg/kg)	Industrial (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	(mg/kg)
Copper	310	4,100	310	8,200	7,400
Zinc	2,300	100,000 (max)	2,300	61,000	60,000
Fluoranthene	230	2,200	310	8,200	18,000
Benzo(a)pyrene	0.062	0.21	0.087	0.78	0.36

1 - The RBCs, PRGs, and screening levels presented in this table for non-carcinogenic compounds are set at a hazard quotient of 0.1. The RBCs and PRGs presented in the Region 9 and Region 3 guidance documents are set at a hazard quotient of 1.

5.0 RECOMMENDED SCREENING LEVELS

Table 1 presents the calculated facility-wide screening levels for intertidal surface waters and intertidal sediments. For sediments, the screening values are the lesser of the actual calculated risk-based concentration (one-tenth the risk-based concentration for the non-carcinogens is considered to address the potential for multiple non-carcinogenic chemicals impacting the same target organ), the soil saturation concentration (if appropriate), or a 100,000 mg/kg ceiling level. The consideration of the soil saturation concentration and a ceiling value of 100,000 mg/kg is recommended in the current USEPA Region 9 PRGs guidance document (USEPA, October 2002). For the intertidal surface waters, the screening values for both the ingestion pathway and dermal contact pathway are presented. As discussed in Section 4.0, there are considerable uncertainties associated with some of the dermal screening levels for exposure to surface water. Therefore, only the ingestion screening levels will be used to select COPCs for PCBs, PAHs, TCDD, and DDT (and by-products). As noted for the sediments, one-tenth the risk-based concentration for the non-carcinogens is considered to address the potential for multiple non-carcinogenic chemicals impacting the same target organ.

REFERENCES

USEPA (United States Environmental Protection Agency). 1989. Risk Assessment Guidance for Superfund – Volume I – Human Health Evaluation Manual (Interim Final). EPA/540/1-89/002, Washington, D.C. December.

USEPA (United States Environmental Protection Agency). 1992. Dermal Exposure Assessment: Principles and Applications. Office of Health and Environmental Assessment, Washington, D.C. EPA/600/8-91/011B. January.

USEPA (United States Environmental Protection Agency). 1996. Soil Screening Guidance: Technical Background Document. EPA/540/R-95/128. Office of Solid Waste and Emergency Response, Washington, D.C. May.

USEPA (United States Environmental Protection Agency). 1997. Exposure Factors Handbook. EPA/600/P-95/002Fa. Office of Research and Development, Washington, D.C. August.

USEPA (United States Environmental Protection Agency). 2001. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, Review Draft for Public Comment. EPA/540/R99/005. Office of Emergency and Remedial Response, Washington, D.C. September.

USEPA, Region 9 (United States Environmental Protection Agency). 2002. Preliminary Remediation Goals. October.

ATTACHMENT 2

THALLIUM RISK-BASED ACTION LEVEL UPDATE
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Previously a risk-based site-specific human health action level for thallium was calculated for groundwater for the OU3 OM&M Program using the screening level methodology discussed in Attachment 1. Although there were recent changes to USEPA toxicity criteria for thallium, an updated screening level/action level was not calculated because of the uncertainty associated with the thallium reference dose (RfD) provided in the USEPA Regional Screening Level (RSL) table (USEPA, June 2011). The following text discusses the uncertainty and provides the rational for updating the thallium action level to “Not Available” for the second five-year review.

The USEPA Office of Superfund Remediation and Technology Innovation (OSRTI) updated the hierarchy of toxicity values for use in human health risk assessments (HHRAs) as follows (USEPA, December 2003):

1) USEPA’s Integrated Risk Information System (IRIS)
2) USEPA’s Provisional Peer-Reviewed Toxicity Values (PPRTVs)
3) Other (peer review) toxicity values, including California Environmental Protection Agency (Cal EPA) values, Minimal Risk Levels (MRLs) produced by the Agency for Toxic Substances and Disease Registry, and USEPA’s Health Effects Assessment Summary Table (HEAST) values.

IRIS is USEPA’s preferred source of toxicity values because it generally contains RfDs, reference concentrations (RfCs), cancer slope factors, drinking water unit risk values, and inhalation unit risk values that have gone through peer review and a USEPA consensus review process (USEPA, December 2003). PPRTVs (USEPA’s secondary source of toxicological data) are developed by the USEPA Office of Research and Development Nation Center for Environmental Assessment Superfund Risk Technical Support (STSC) group for one of two reasons:

- STSC conducting a batch wise review of HEAST values to update
- A Regional Superfund Office requests a PPRTV for contaminants lacking an IRIS value. (USEPA, December 2003).

PPRTVs are developed according to a Standard Operating Procedure (SOP) after a review of relevant scientific literature using the same methods, source of data, and USEPA guidance generally used for the USEPA IRIS program (USEPA, October 2010). Third tier source toxicity data may be used in some cases. Priority should be given to sources that provide toxicity information based on similar methods and procedures used for the development of Tier I and II values (USEPA, December 2003). Generally, toxicity values are not appropriate to use until draft assessments have been through peer review, a public comment period, and a revised draft has been issued (USEPA, December 2003).

Currently, the USEPA RSL table lists an oral RfD for thallium that is derived in the appendix of the PPRTV profile. The document, Provisional Peer-Reviewed Toxicity Values for Thallium Compounds (Thallium PPRTV Document), states that provisional toxicity values alone tell very little about the adverse effects of a chemical or the quality of evidence on which the value is based; therefore, users are strongly advised to read the entire PPRTV document and understand the strengths and limitations of the derived provisional values (USEPA, October 2010). The Thallium PPRTV Document explains that no toxicity values are posted in the IRIS database because of limitations in the database of toxicology information. For example, available human studies do not support an oral RfD derivation for thallium because those studies either lack objective tests for toxicity, are limited by a reliance of incidence of symptoms obtained from questionnaires or by characterization of chronic thallium exposure by measuring levels in urine and hair at a single point in time, or the studies provide no conclusive associations between thallium exposure and any specific health effects. Furthermore, numerous animal studies were considered for RfD derivation during the IRIS review; however, those studies were considered inadequate. The conclusion reached in the IRIS Toxicological Review of Thallium and Compounds (USEPA, September 2009) was that the available toxicity database for thallium contains studies that are generally of poor quality; therefore, an RfD for soluble thallium salts was not derived.

Appendix A of the Thallium PPRTV Document provides a RfD for thallium even though the first sentence of the appendix states,

> "*For reasons stated in the main document, it is inappropriate to derive a provisional subchronic or chronic provisional reference dose (p-RfD) for thallium. However, information is available which, although insufficient to support derivation of a provisional toxicity value, under current guidelines, may be of limited use to risk assessors."*

Appendix A then develops chronic and subchronic RfDs for thallium based upon an animal study that IRIS reviewed and decided was inadequate to develop RfDs (USEPA, October 2010).

An action level for thallium was not calculated due to the uncertainty associated with the RfD provided in the USEPA RSL table (USEPA, June 2011) because:

1) IRIS (the USEPA's primary toxicological resource) determined the available toxicological studies were generally of poor quality, and
2) the PPRTV appendix value provided in the USEPA RSL table (USEPA, June 2011) was developed based on a single animal study the IRIS review determined to be inadequate to develop RfDs.

3) highly uncertain toxicity values such as the PPRTV appendix value for thallium are of limited utility for site decisions and should not be the sole toxicity information used to decide that remedial actions should be taken for a site.

References

USEPA, December 2003. USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53. Memorandum: Human Health Toxicity Values in Superfund Risk Assessments.

USEPA, September 2009. Toxicological Review of Thallium and Compounds. http://www.epa.gov/iris/toxreviews/1012tr.pdf

USEPA, October 2010. Provisional Peer-Reviewed Toxicity Values for Thallium Compounds.

USEPA, June 2011. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/region9/superfund/prg/.

ATTACHMENT 3

INTERTIDAL SURFACE WATER LEAD SCREENING LEVEL DEVELOPMENT UPDATE
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

A lead screening level was calculated for intertidal surface water using the methodology presented in the 2005 Technical Memorandum: Derivation of Lead Screening Levels for Recreational Users Exposed to Intertidal Surface Water and Construction Workers Exposed to Shallow Groundwater at Portsmouth Naval Shipyard, Kittery, Maine (Tetra Tech, August 2005), which is attached. The screening level developed for intertidal surface water considered child recreational receptors exposed through the dermal pathway and incidental ingestion. This screening level is used as the action level for the OU3 OM&M Program.

The USEPA Integrated Exposure Uptake Biokinetic Model (IEUBK) for Lead in Children was used to calculate a surface water screening level. USEPA updated the IEUBK Model since 2005 (see the attached Overview of Changes From IEUBKwin version 1 build 264 to IEUBKwin version 1.1, June 2009). The updated version of the IEUBK Model and the exposure assumptions described in the 2005 Technical Memorandum were used to calculate the updated lead intertidal surface water screening value. The calculation is discussed below and probability distribution curve to support the calculation is attached.

Based on the methodology provided in the 2005 Technical Memorandum (Approzch Number 2), the alternative lead intake value was updated and was used as the alternate source input for children ages 3 to 7 years old in the updated version of the IEUBK Model (version 1.1, build 11). Using the updated intake value of 26.3 µg/day in the model corresponds to an intertidal surface water lead concentration of 455 µg/L. The resulting probability distribution curve results in a lead geometric mean less than 10 µg/dL and a probability that less than 5 percent of the population would exceed the 10 µg/dL lead blood concentration (USEPA target risk goals). Therefore, 455 µg/L is the updated screening level. This updated lead intertidal surface water screening value is greater than the 2005 screening level due to updates in the IEUBK model including lower default dietary lead intake values and lower baseline maternal blood lead concentration assumptions built into the model (see attached Overview of Changes From IEUBKwin version 1 build 264 to IEUBKwin version 1.1).

TECHNICAL MEMORANDUM

DERIVATION OF LEAD SCREENING LEVELS FOR RECREATIONAL USERS EXPOSED TO INTERTIDAL SURFACE WATER AND CONSTRUCTION WORKERS EXPOSED TO SHALLOW GROUNDWATER AT PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

This technical memorandum presents the approaches used to develop aqueous lead screening levels for recreational users and construction workers to use in assessing potential human health risks from lead at Installation Restoration Program (IRP) sites at Portsmouth Naval Shipyard (PNS) that have brackish/saline groundwater and the intertidal surface water is saline. The human health screening level for groundwater and intertidal surface water that has been used previously for evaluation of lead at the PNS IRP sites is the Federal Safe Drinking Water Act (SDWA) action level of 15 ug/L. However, many of the IRP sites at PNS have brackish/saline groundwater and the intertidal surface water is saline so a screening level based on a drinking water level is not appropriate for risk screening. This technical memorandum presents alternative screening levels for two receptors hypothetically exposed to lead in aqueous media: 1) a child recreational user exposed to lead in water along the shoreline of a site (intertidal area), and 2) a construction worker exposed to lead in shallow groundwater at a site. The screening levels presented are based on the incidental ingestion route of exposure and dermal contact. Exposure to lead by dermal contact was considered in the calculations even though dermal uptake of lead is typically not considered significant for lead (USEPA, July 2004, ATSDR, online, March 2004). The screening levels presented herein were derived to facilitate human health risk assessment and risk management decisions at PNS. The screening levels were identified based on information developed using the two approaches as described below. Per USEPA guidelines, the screening levels presented in this technical memorandum incorporate exposure factor assumptions reflective of a reasonable maximum exposure (RME) case. The RME case is generally "defined as the highest exposure that is reasonably expected to occur at a site." The intent of the RME is to estimate an exposure that is well above the average but is still within the range of possible exposure possibilities.

1.0 Approach No. 1: Derivation of a Screening Level for a Construction Worker Exposed to Shallow Groundwater Using the Adult Lead Model (ALM)

A screening level for construction workers exposed to lead in water may be developed by estimating an acceptable daily intake based on the Adult Lead Model (ALM) equations. The ALM was developed to estimate blood-lead levels for adults exposed to lead in soil in non-residential exposure scenarios (i.e., industrial and recreational). An industrial soil remediation goal of 800 mg/kg based on the ALM has already been published by the USEPA. This value is expected to be protective of workers who work primarily indoors (i.e., work is not soil contact intensive) and the fetuses of workers. The 800 mg/kg value was based on an ingestion rate of 50 mg-soil per day, 219 days/year (ALM Frequently Asked Questions [FAQs] online at http://www.epa.gov/superfund/programs/lead/almfaq.htm; last updated April 29, 2004).
The ALM makes use of the following equation for calculating screening levels for soil:

General Adult Lead Model (ALM) Equation for Soil Exposures:

$$\textbf{Screening Level(soil)} = \frac{([PbB_{95}fetal/(R^*(GSD_i^{1.645}))]-PbB_0)^*AT_{S,D}}{BKSF^*(IR_{S+D}^*AF_{S,D}^*EF_{S,D})}$$

where:

$PbB_{fetal,\,0.95}$	95th percentile blood lead concentration (PbB) in fetus (Goal is 10 ug/dL)
$R_{fetal/maternal}$	Fetal/maternal PbB ratio = 0.9
BKSF	Biokinetic Slope Factor = 0.4 ug/dL per ug/day
GSD_i	Geometric standard deviation PbB = 2
PbB_0	Baseline PbB = 2 ug/dL
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust
$AF_{S,\,D}$	Absorption fraction (same for soil and dust) = 0.12
$EF_{S,\,D}$	Exposure frequency = 150 days/yr
$AT_{S,\,D}$	Averaging time = 365 days/yr

The ALM approach for developing lead screening levels for soil may be used to develop a screening level for construction worker exposures to groundwater by modifying the basic equation for soil presented above, as follows:

Equation for Calculating a Construction Worker Screening Level Based on Incidental Ingestion of Lead in Water:

$$\textbf{Screening Level (iw)} = \frac{([PbB_{95}fetal/(R^*(GSD_i^{1.645}))]-PbB_0)^*AT_w}{BKSF^*(IR_w^*AF_{w,}^*EF_{constw})}$$

where:

$PbB_{fetal,\,0.95}$	95th percentile blood lead concentration (PbB) in fetus (Goal is 10 ug/dL)
$R_{fetal/maternal}$	Fetal/maternal PbB ratio = 0.9
BKSF	Biokinetic Slope Factor = 0.4 ug/dL per ug/day
GSD_i	Geometric standard deviation PbB = 2
PbB_0	Baseline PbB = 2 ug/dL
IRw	Water ingestion rate = 0.02 L/day (0.01 L/hour x 2 hours)
AF_w	Absorption fraction for adults (water) = 0.60**
EF_{constw}	Exposure frequency for construction workers = 150 days/yr
AT_w	Averaging time for exposure to water = 365 days/yr

** Bowers, S.B., Beck, B.D., Karam, H.S. Assessing the Relationship Between Environmental Lead Concentrations and Adult Blood Lead Levels. Risk Analysis Vol. 14, No. 2, 1994.

Some of the suggested exposure factors presented above are default values suggested in the ALM model. However, the recommended receptor exposure time (2 hours per day), exposure frequency (150 days/year), and water ingestion rate (0.01 L/hour) are based on professional judgment to a certain extent. The following items provide the rationale for the exposure factor values suggested for these parameters:

- The 2-hour per day groundwater exposure time suggested for the construction worker reflects the fact that the anticipated exposure is expected to be limited. The recommended value is less than the 4-hour per day exposure time listed for recreational activities in Section 2 of this memorandum and in the *December 2002 Technical Memorandum titled, Human Health Risk Screening Levels for Intertidal Surface Water and Sediment* because the exposure incurred by a construction worker is likely to be sporadic and truly incidental when compared to exposure occurring during recreational activities. For example, receptors often desire/seek exposure to both surface waters and sediments during recreational activities. In contrast, the construction worker contacts the shallow groundwater in an excavation pit on an incidental basis only (e.g., while he/she is retrieving a piece of equipment out of the pit).

- The suggested ingestion rate for the construction worker exposed to groundwater in the excavation pit (0.01L per hour) is less than that suggested for recreational activities (0.05 L per hour) in Section 2 of this memorandum and in the aforementioned December 2002 Technical Memorandum because of the nature of receptor activities. Although relatively constant, direct contact with surface water (and thus incidental ingestion of surface water) while swimming is very likely; constant, direct contact with the shallow groundwater in an excavation pit is very unlikely.

- The construction worker is not anticipated to be exposed to the groundwater in the excavation pit on a daily basis. As indicated in the preceding bullets, it was assumed that exposure would occur *occasionally only* as work tasks require the construction worker to enter the excavation pit. Please note that the 150 days per year exposure frequency is the exposure frequency typically assumed for construction worker exposure to both groundwater and soils for PNS risk assessments conducted in the recent past.

The 2 ug/dL baseline adult blood level selected to compute the screening level for the construction worker is within the summary default parameter value range presented in the January 2003 version of the *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil (OSWER Directive #9285.7-54).* More importantly, the value is in agreement with data presented for the Northeast Region of the United States in the USEPA document titled, *Blood Lead Concentrations of U.S. Adult Females: Summary Statistics from the Phases 1 and 2 of the National Health and Nutrition Evaluation Survey (NHANES III)* (OSWER #9285.7-52, March 2002, Tables 3a and 3c).

Calculation of Construction Worker Screening Level for Incidental Ingestion of Lead in Water:

$$\textbf{Screening Level (iw)} = \frac{([10\text{ug/dL}/(0.9*(2.0^{1.645}))]-2.0\text{ ug/dL})*365\text{ days/yr}}{0.4\text{ ug/dL per ug/day }*(0.02\text{L/day}*0.6*150\text{ days/yr})}$$

Screening Level (iw) = 800 ug/L

Equation for Calculating a Construction Worker Screening Level Based on Dermal Contact with Lead in Water:

$$\textbf{Screening Level (dw)} = \frac{([PbB_{95}fetal/(R*(GSD_i^{1.645}))]-PbB_0)*AT_w}{BKSF*(Kp*ET*CF*A*EF_{constw})}$$

where:

$PbB_{fetal,\ 0.95}$	95th percentile blood lead concentration (PbB) in fetus (Goal is 10 ug/dL)
$R_{fetal/maternal}$	Fetal/maternal PbB ratio = 0.9
BKSF	Biokinetic Slope Factor = 0.4 ug/dL per ug/day
GSD_i	Geometric standard deviation PbB = 2
PbB_0	Baseline PbB = 2 ug/dL
Kp	permeability coefficient = 0.0001 cm/hour
ET	Exposure Time = 2 hr/day
CF	conversion factor (0.001 L/cm^3)
A	skin surface area available for contact = 3,300 cm^2
EF_{constw}	Exposure frequency for construction workers = 150 days/yr
AT_w	Averaging time for exposure to water = 365 days/yr

Most of the exposure factors values presented above are default values presented in the ALM model or were defined in the preceding evaluation of the ingestion route of exposure. The skin surface available for contact (3,300 cm^2) is the recommended value presented in the current version of *USEPA RAGS Part E, Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance for Dermal Risk Assessment,* for the evaluation of worker exposure to soils (USEPA, July 2004).

Calculation of Construction Worker Screening Level for Dermal Contact with Lead in Water:

$$\textbf{Screening Level (dw)} = \frac{([10ug/dL/(0.9*(2.0^{1.645}))]-2.0\ ug/dL)*365\ days/yr}{0.4ug/dL/ug/day*(0.0001cm/hr*2hr/day*0.001L/cm^3*3,300cm^2*150\ days/yr)}$$

Screening Level (dw) = 14,500 ug/L

The preceding calculations and screening levels suggest that receptor intake for the ingestion route of exposure is greater than receptor intake for the dermal contact route of exposure by a factor of approximately 18. A screening level derived assuming receptor contact by *both* the ingestion and dermal routes of exposure would be approximately **750 ug/L** (i.e., a screening level slightly less than the 800 ug/L value derived for the ingestion route of exposure). The calculation of the combined screening level is attached.

2.0 Approach No. 2.0. Derivation of a Screening level for Child Recreational User Exposed to Intertidal Surface Water, Based on the USEPA Integrated Exposure Uptake Biokinetic Model (IEUBK) for Lead in Children

A lead screening level for a child recreational user can be derived using the IEUBK model by use of the Model's Alternate Source Data option. The ***Alternate Source Data option*** allows the user to input lead concentrations from atypical sources (i.e., *alternative lead intakes* not addressed by the Model's main menu options). Examples include the direct ingestion of lead-based paint and the use of cosmetics or home remedies. In the case of PNS, the alternate source would be exposure to lead in river water or seep water by a child recreating in the intertidal area. The child (3 to 7 years of age) is expected to be exposed 4 hours/day, 26 days/year and to incidentally ingest 0.05 L of the saline water per hour. The exposure time (4 hours per day), exposure frequency (26 days per year), and incidental surface water ingestion rate (0.05 Lper hour) factors used to develop the screening level for the recreational-type of exposure are those specified in the aforementioned *December 2002 Human Health Risk Screening Levels for Intertidal Surface Water and Sediment Technical Memorandum.* The exposure time/frequency factors suggested for this analysis and the State of Maine default exposure time/frequency factors for recreational activities (2.6 hours per day and 40 days per year) yield the same overall exposure time when receptor exposure is presented in terms of exposure hours per year (i.e., both sets of time factors yield 104 exposure hours per year).

Depending on the averaging time selected (i.e., 90 days, 180 days, and 365 days) the preceding recommended exposure factors yield screening levels that range from 300 to 700 ug/L as discussed below. The averaging time is the period over which exposure is averaged. (Dermal contact is not included in these calculations because the IEUBK model does not consider dermal contact.)

The ***alternate lead intake value*** input into the Model is calculated as follows:

Step 1. Calculate liters of surface water ingested per year.

0.05 L/hour x 4 hours/day x 26 days/year = 5.2 L/year

Step 2. Calculate the amount of lead ingested per year by assuming a range of possible lead concentrations. If the concentration of lead is assumed to be 300 ug/L, the amount of lead ingested is as follows:

5.2 L/year x 300 ug/L = 1,560 ug/year

Step 3. Calculate the amount of lead ingested per day (the Model requires that the units of Alternate Source Data variable have units of ug/day). This value is calculated by dividing the amount ingested per year by an averaging time. Assumptions concerning averaging time (the period over which exposure is averaged) can vary. A typical averaging time used for lead is 365 days, as shown in Section 3. If 365 days is selected as the averaging time, the alternate lead intake value is:

1,560 ug/year / 365 days/year = 4.3 ug/day

Assuming a shorter averaging time would increase the intake value. For example, if the exposure is assumed to occur during the summer months (as is assumed for the PNS recreational exposure scenario), the averaging time may be 90 days/year and the alternate lead intake value input value becomes:

1,560 ug/year / 90 days/year = 17 ug/day

As demonstrated above, the shorter the averaging time, the larger the daily intake of lead, and, consequently, the smaller the screening level. The effects of averaging time on the value of the screening level are presented in Section 5.0. It should be noted that 180 and 365 days per year averaging times were included in this analysis for purposes of discussion only. As indicated in Section 6, the 90-day averaging time is the basis for the screening level recommended for the recreational user in this technical memorandum because the 90-day averaging time frame most likely reflects how exposure may occur at PNS (i.e., most recreational exposures involving direct contact with surface waters are likely to occur in the warm summer months).

The ***lead screening level*** for a child recreational user's exposure to intertidal surface water is calculated as follows:

Step 1. Enter the alternate lead intake value into the Model and run the Model.

Step 2. Check the Model output to see whether the projected child blood lead level is less than the USEPA goal of 10 ug/dL and the probability of exceeding 10 ug/dL is less than the USEPA goal of 5 percent. Determining the final screening level is a trial and error process which requires several repetitions of process outlined above First, an intertidal surface water concentration must be assumed and a daily intake be derived, as shown above. The daily intake is then entered in the Alternate Source Option menu, the Model run, and the output is compared to the USEPA benchmarks. If the projected blood lead levels or probabilities are not acceptable, a different intertidal surface water concentration is assumed and the process is repeated. The repetitions are continued until acceptable blood lead levels and probabilities are predicted by the model. The intertidal surface water concentration which generates acceptable results is selected as the recommended screening level.

The intertidal surface water screening level developed by this approach has the advantage of being derived directly from the IEUBK model and site-specific assumptions. All of the model's default background levels are used. Thus, background contributions from air, soil, drinking water, diet, and maternal contributions are considered and reflected in the alternate water screening level. In addition, the screening level is not based on sources and extrapolations which may not be completely defensible.

Although the screening level is specific to the child recreational user, it would also be protective of dermal contact by a construction worker, because dermal contact with lead in water is not likely to be an important exposure route due to the low permeabilities of lead from water.

5.0 Uncertainty Analysis

The screening levels presented in this technical memorandum are subject various sources of uncertainty, including the following:

- *The screening level calculated for the recreational receptor did not consider exposures incurred by very young children (i.e., 0 to 3 year old children).* However, exposure to very young children is likely to be very limited because of the physical nature of much of the shoreline and intertidal areas at PNS. In many areas, the shoreline at the facility is rocky and would be physically hazardous for very young children; very young children would rarely play unsupervised along this type of shoreline due to safety considerations. The mudflat areas of the shoreline are also not conducive to recreational activities or not safe for very young children. Consequently, exposure time and exposure frequency for the very young child are anticipated to be very limited when compared to the older-child age group (3 to 7 years old) considered for the development of the screening level for recreational user. Because of the anticipated significant differences in exposure times and frequencies, the screening level derived for the 3 to 7 year older child would be protective for the very young child who, on a rare occasion, might walk/crawl in the intertidal area of the PNS.

- *The screening levels presented in this memorandum are based on the USEPA's goal of controlling lead exposure in children/fetuses so that no more that 5 percent of receptors experience a blood lead level exceeding 10 ug/dL. However, all health-based goals, standards, or criteria are subject to change over time as new toxicity information becomes available.* The toxicity of lead continues to be actively investigated by the scientific and regulatory community and is the subject of much debate. Both USEPA and State of Maine goals regarding lead exposure may change in the future as more definitive toxicity information becomes available for lead.

- *Standard exposure factors guidelines and recommendations (e.g., recommendations for appropriate exposure frequencies) are limited for the risk evaluation/screening level development for the recreational land use scenario.* A consideration of site-specific conditions and professional judgment is often necessary in the determination of appropriate exposure factors. For example, the screening levels presented in this technical memorandum for the recreational user assume that the receptor in exposed two days per week during the warm weather months (i.e., 26 days over the course of the summer [90 days]). This assumption is based on climatic conditions for the northeast region of the United States and on the fact that much of the shoreline at PNS is not attractive for recreational use. The recommended screening levels would be lower if it was assumed that exposure were to occur more frequently. However, assuming that lead concentrations in the surface water equal the recommended screening level for the recreational user (300 ug/L), lead intakes predicted for the recreational user would only exceed the lead intake associated with routine domestic use of a water supply containing 15 ug/L if it were assumed that the recreational receptor were exposed four days per week during the warm weather months.

6.0 Summary and Recommendations

This technical memorandum presents the approaches used to develop aqueous lead screening levels for recreational users and construction workers to use in assessing potential human health risks from lead at PNS IRP sites which have brackish/saline groundwater and the intertidal surface water is saline. The methods involved the use of the USEPA Adult or Child Lead Models. Screening levels developed by the approaches are presented in the following table. The Navy recommends the lead screening level based on the 90-day averaging time (300 ug/L)) for the recreational user because the 90-day averaging time frame most likely reflects how exposure may occur at PNS (i.e., most recreational exposures involving direct contact with surface waters are likely to occur in the warm summer months). The aqueous lead screening level recommended for construction worker exposure is 750 ug/L.

SUMMARY OF POTENTIAL LEAD SCREENING LEVELS

Approach 1 – Calculation of Screening Levels for Construction Workers Using Equations and Input Parameters from the Adult Lead Model (ALM)		
Incidental Ingestion	Dermal Contact	Incidental Ingestion plus Dermal Contact
800 ug/L	14,500 ug/L	**750 ug/L**
Approach 2 – Calculation of Screening Levels for Incidental Ingestion of Water by Child Recreational Users Using the Child Lead Model (IEUBK)		
Averaging time of 90 days	Averaging time of 180 days	Averaging time of 365 days
300 ug/L	500 ug/L	700 ug/L

References

Agency for Toxic Substances and Disease Registry (ATSDR), accessed on-line March 2004. Toxicological Profile for Lead, U.S. Department of Health and Human Services, Public Health Services (http://www.atsdr. cdc.gov/toxpro2.html).

USEPA, July 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final, EPA/540/R/99/005, OSWER 9285.7-02EP, PB99-963312.

USEPA, March 2002. Blood Lead Concentrations of U.S. Adult Females: Summary Statistics from the Phases 1 and 2 of the National Health and Nutrition Evaluation Survey (NHANES III) (OSWER #9285.7-52).

Attachments

Check Calculation for Screening Level for Construction Worker.

Responses to Comments on the Technical Memorandum on Derivation of Aqueous Lead Screening Levels, Portsmouth Naval Shipyard (PNS), Kittery, Maine.

Conference Call Notes from the February 3, 2005 Discussion of the Technical Memorandum on Derivation of Aqueous Lead Screening Levels, Portsmouth Naval Shipyard (PNS), Kittery, Maine.

Responses to Follow-up Comments on the Technical Memoradum on Derivation of Aqueous Lead Screening Levels, Portsmouth Naval Shipyard, Kittery, Maine.

June 2009

Overview of Changes From IEUBKwin version 1 build 264 to IEUBKwin version 1.1

The following changes made have been made in this version of the Integrated Exposure Uptake Biokinetic (IEUBK) model software:

- updated model input variables for dietary lead exposure
- updated baseline maternal blood lead concentration (PbB) to make it consistent with recent data from the National Health and Nutrition Examination Survey (NHANES)
- replaced the discontinuous function relating age and bone weight with a continuous function
- changed the graphical user interface (GUI) to add a beginner mode to simplify use of the model for beginner users
- implemented a function to simplify calculation of Preliminary Remediation Goals (PRGs)
- simplified the help file structure.

Dietary Lead Update

Version 1.1 reflects new data on food lead concentrations from the Food and Drug Administration's (FDA) market basket survey. The updated default dietary intake values are based on data obtained by an analysis of the FDA Total Diet Study (FDA, 2006) and food consumption data from NHANES III (CDC, 1997).

Table 1. Default values for dietary lead intake in the IEUBK model.

Age Category (months)	IEUBK v1.0 Default Dietary Lead Intake (µg/day)	Previous Recommended Update Dietary Lead Intake (1991-1999 TDS data) (µg/day)	IEUBK v1.1 Updated Dietary Lead Intake Estimate (1995-2003 TDS data) (µg/day) [0.1LOD–0.9LOD]
0-11	5.53	3.16	2.26 [1.51–3.01]
12-23	5.78	2.60	1.96 [1.18–2.74]
24-35	6.49	2.87	2.13 [1.24–3.03]
36-47	6.24	2.74	2.04 [1.18–2.90]
48-59	6.01	2.61	1.95 [1.13–2.77]
60-71	6.34	2.74	2.05 [1.17–2.92]
72-84	7.00	2.99	2.22 [1.26–3.18]

Maternal Blood Lead Concentration

The default value of the maternal blood lead concentration variable has been changed from 2.5 to 1.0 µg/dL. This variable is used to specify the maternal blood lead concentration at childbirth. The updated value is based on an analysis of blood lead concentration data for women of child-bearing age (17-45 years) from NHANES 1999-2004.

Addressing the Discontinuity in Bone Weight Equation

In 2005, the National Academy of Science (NAS) recommended that the two functions relating age and bone weight in the IEUBK model be replaced with a single continuous function (NAS, 2005). The original equations (1a and 1b) produced a minor discontinuity in the age-bone weight relationship at age 12 months

The following equations were used in the IEUBK model to calculate bone weight:

For i = 0-12 months: $WTBONE[i] = 0.111 WTBODY[i]$ Equations 1a

For i =13-84 months: $WTBONE[i] = 0.838 + 0.020i$ Equations 1b

Equation 2 reproduces the age-bone weight relationship of Equations 1a and 1b and eliminates the discontinuity at t=12 months.

$$WTBONE[i] = 0.40000 - 1.2748E\text{-}07(WTBODY[i])^4 + 2.5425E\text{-}05(WTBODY[i])^3 - 1.74500E\text{-}03(WTBODY[i])^2 + 6.7836E\text{-}02 WTBODY[i] \quad \text{Equation 2}$$

IEUBKwin Version 1.1 replaces Equations 1a,b with Equation 2 and eliminates this discontinuity. As indicated by the NAS, this discrepancy was not likely to impact model results. We found this to be true; the change had negligible impact on model results.

Changes to the GUI

IEUBKwin Version 1.1 implements several changes to the GUI to make the model easier to use and understand. The model now presents users with 2 modes of operation: Advanced Mode and Beginner Mode. The Advanced Mode is similar to the operation of previous versions. The Beginner Mode guides new users through data entry using a wizard.

The GUI of IEUBKwin Version 1.1 also simplifies calculation of soil preliminary remediation goals (PRGs).

Changes to Help File Structure

The help file has been simplified to point users to internet-based guidance.

References

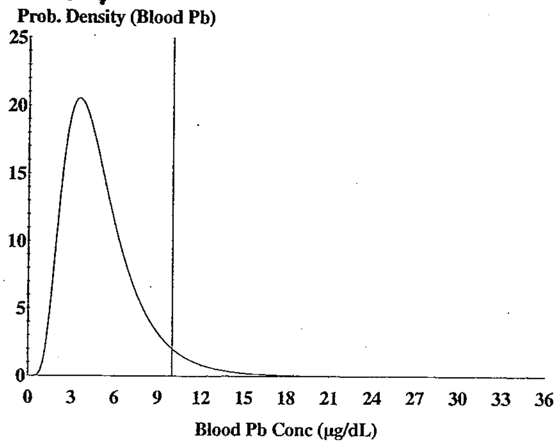
National Academy of Science. 2005. Superfund and Mining Megasites – Lessons from the Coeur d'Alene River Basing. National Academies Press, Washington, D.C. December. Available on-line at: http://www.epa.gov/superfundreports/coeur.htm.

U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention (CDC). 1997. National Health and Nutrition Examination Survey, III 1988-1994. CD-ROM Series 11, No. 1 (July 1997).

U.S. Food and Drug Administration (FDA). 2006. Total Diet Study. U. S. Food and Drug Administration Center for Food Safety and Applied Nutrition Office of Plant and Dairy Foods and Beverages (Accessed on May 16, 2006). Available online at The U.S. Food and Drug Administration Center for Food Safety and Applied Nutrition Web site (http://www.cfsan.fda.gov/~comm/tds-toc.html).

Lead Intertidal Surface Water Screening Level Calculation

The following graph is the output from the IEUBK Lead Model Version 1.1 Build 11 when using standard default values and an alternate intake value of 23.6 ug/day for ages 3 to 7 where the alternate absorption fraction percent = 50%.



Cutoff = 10.000 µg/dl
Geo Mean = 4.605
GSD = 1.600
% Above = 4.950
% Below = 95.050

Age Range = 0 to 84 months

Run Mode = Research

Alternate Lead Intake Value Input:

$$\frac{0.05\ L}{hr} \cdot \frac{4\ hr}{day} \cdot \frac{26\ day}{year} = \frac{5.2\ L}{year}$$

$$\frac{5.2\ L}{year} \cdot \frac{455\ ug}{L} = \frac{2366\ ug}{year}$$

$$\frac{2366\ ug}{year} \cdot \frac{1\ year}{90\ days} = \frac{26.3\ ug}{day}$$

Result:

When the lead surface water concentration is set to 455 ug/L the IEUBK output projects a child blood lead level less than the USEPA goal of 10 ug/dL and the probability of exceeding 10 ug/dL is less than the USEPA goal of 5 percent.

TABLE C5-1

AQUEOUS PROJECT ACTION LEVEL CHANGES SUMMARY
OU3 POST-REMEDIAL OM&M PROGRAM
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

Parameter	Ecological Action Levels					Human Health Action Levels		
	Acute Value (μg/L) (1)		Chronic Value (μg/L) (2)		Source	Action Level (μg/L) (3)		Carcinogen (C) or Noncarcinogen (N)
	Previous Value	Current Value	Previous Value	Current Value		Previous Level	Current Level	
Polycyclic Aromatic Hydrocarbons								
2-METHYLNAPHTHALENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	590	590	N
ACENAPHTHENE	NA	NA	15000	15000	USEPA, Jan. 1996	8800	8800	N
ACENAPHTHYLENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	7200	7200 (6)	N
ANTHRACENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	24000	24000	N
BENZO(A)ANTHRACENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	50	50	C
BENZO(A)PYRENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	5	5	C
BENZO(B)FLUORANTHENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	50	50	C
BENZO(G,H,I)PERYLENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	160	42000* (7)	N
BENZO(K)FLUORANTHENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	500	500	C
CHRYSENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	5000	5000	C
DIBENZO(A,H)ANTHRACENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	5	5	C
FLUORANTHENE	NA	NA	4125	4125	USEPA, Jan. 1996	1800	1800	N
FLUORENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	4300	4300	N
INDENO(1,2,3-CD)PYRENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	50	50	C
NAPHTHALENE	235	235 (4)	8812	525*	Buchman, 2008	5300	5300	N
PHENANTHRENE	NA	NA	3113	3113	USEPA, Jan. 1996	2400	2400 (7)	N
PYRENE	30	30 (4)	1125	1125 (5)	Buchman, 2008	1600	1600	N
Inorganics								
ALUMINUM	750	750 (8)	32625	32625 (8)	USEPA, 2009	1300000	1300000	N
ANTIMONY	1500	1500	187500	187500	Buchman, 2008	366	366	N
ARSENIC	69	69 (9)	13500	13500 (9)	USEPA, 2009	49	49	C
BARIUM	50000	1000*	18750000	75000*	Buchman, 2008	131000	131000	N
BERYLLIUM	3.5	1500*	247.5	37500*	Buchman, 2008	226	226	N
CADMIUM	40	40 (9)	3300	3300 (9)	USEPA, 2009	270	270	N
CALCIUM	NA	NA	NA	NA	NA	NA	NA	NA
CHROMIUM	1100	1,100 (9) (10)	18750	18750 (9) (10)	USEPA, 2009	569	569 (10)	N
COBALT	1500	1,500 (8)	8625	8625 (8)	Suter and Tsao, 1996	390	390	N
COPPER	4.8	4.8 (9)	1163	1163 (9)	USEPA, 2009	52000	52000	N
IRON	NA	NA	375000	375000 (8)	USEPA, 2009	910000	910000	N
LEAD	210	210 (9)	3038	3038 (9)	USEPA, 2009	950	455* (11)	NA
MAGNESIUM	NA	NA	NA	NA	NA	NA	NA	NA
MANGANESE	2300	2,300 (8)	45000	45000 (8)	Suter and Tsao, 1996	11200	11200	N
MERCURY	1.8	1.8 (9)	353	353 (9)	USEPA, 2009	200	200 (12)	N
NICKEL	7.4	74 (9)	3075	3075 (9)	USEPA, 2009	20100	20100	N
POTASSIUM	NA	NA	NA	NA	NA	NA	NA	NA
SELENIUM	290	290 (9)	26625	26625 (9)	USEPA, 2009	6500	6500	N
SILVER	1.9	1.9 (9)	71.3	71.3 (5)	USEPA, 2009	3190	3190	N
SODIUM	NA	NA	NA	NA	NA	NA	NA	NA
THALLIUM	213	213 (4)	7988	6375*	Buchman, 2008	84	NA* (13)	N
VANADIUM	280	280 (8)	7500	7500 (8)	Suter and Tsao, 1996	6500	6500	N
ZINC	90	90 (9)	30375	30375 (9)	USEPA, 2009	402000	402000	N

NA = Not Applicable.

* The action level changed since the 2009 update to support the OU3 Rounds 1 through 9 Data Evaluation Report (Tetra Tech, April 2011b). Acute and chronic ecological action level changes were based on updated marine values or updated source of criteria. Updates to human health action levels were based on changes in toxicity criteria or risk calculation methodology. Appendix C.5 provides a discussion of the updated human health risk methodology.

1 - Ecological acute values apply only to seeps that emerge above the mean mid-tide line and cause furrows in the sediment above mid-tide.

2 - Chronic ecological value presented is the chronic screening level multiplied by a diulition factor of 375 (minimum calculated dilution factor for OU3).

3 - The human health action levels presented in this table correspond to an incremental lifetime cancer risk of 1×10^{-5} or a hazard index of 1. These action levels are based on recreational exposure to surface water in the intertidal area. The action levels were calculated in accordance with the methodology presented in Appendix C.5.

4 - Acute value was calculated by multiplying the acute lowest observable effect level (LOEL) by 0.1 (to estimate an acute no observable effect level [NOEL]). Chronic value was calculated by multiplying acute value by 0.1.

5 - Chronic vaule was calculated by multiplying the acute LOEL by 0.01 to estimate a chronic NOEL.
6 - The reference dose for acenaphthene was used as a surrogate reference dose for calculation of the acenaphthylene human health action level.
7 - The reference dose for pyrene was used as a surrogate reference dose for calculation of the benzo(g,h,i)perylene and phenanthrene human health action levels.
8 - Value is based on freshwater criterion.
9 - Value is based on dissolved concentration.
10 - Action level for hexavalent chromium is presented.
11 - The action level for lead was calculated in accordance with the methodology presented in Appendix C.5.
12 - The reference dose for mercuric chloride was used for calculating the mercury humaan health action level.
13 - Based on uncertainty in the thallium reference dose value, an action level was not calculated for thallium. See Appendix C.5 for additional information.

Sources:

Buchman, M. F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, 34 pages. http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html

Suter, G.W. II. and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Constituents of Concern for Effects on Aquatic Biota:1996 Revision. Environmental Sciences Division, Oak Ridge National Laboratory. ES/ER/TM-96/R2.

USEPA (United States Environmental Protection Agency), 1996. ECO Update, Ecotox Threshold, Office of Solid Waste and Emergency Response. Intermittent Bulletin, Volume 3, Number 2. EPA540/F-95/038. January.

USEPA, 2009. National Recommended Water Quality Criteria: 2009. Office of Water.

TABLE C5-2

AQUEOUS SCREENING LEVEL CHANGES SUMMARY
OU3 POST-REMEDIAL OM&M PROGRAM
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

	Ecological Screening Levels					Human Health Screening Levels		
	Acute Value (µg/L) [1]		Chronic Value with Dulition (µg/L) [2]			Screening Level (µg/L) [3]		
Parameter	Previous Value	Current Value	Previous Value	Current Value	Source	Previous Level	Current Level	Carcinogen (C) or Noncarcinogen (N)
Volatile Organic Compounds								
1,1,1-TRICHLOROETHANE	3120	3120 (4)	117000	117000 (5)	Buchman, 2008	17000	120000*	N
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	NA	NA	NA	NA	NA	1300000	1300000	N
1,1,2,2-TETRACHLOROETHANE	902	902	33825	33825 (5)	Buchman, 2008	21	21	C
1,1,2-TRICHLOROETHANE	1800	NA*	352500	712500*	Buchman, 2008	82	82	C
1,1-DICHLOROETHANE	NA	830* (6)	NA	17625* (6)	Suter and Tsao, 1996	17000	830*	C
1,1-DICHLOROETHENE	450	450 (6)	9375	9375 (6)	Suter and Tsao, 1996	3400	3400	N
1,2,3-TRICHLOROBENZENE	NA	NA**	NA	3000** (6)	Buchman, 2008	NA	14**	N
1,2,4-TRICHLOROBENZENE	16	16 (4)	4837.5	2025*	Buchman, 2008	160	29*	C
1,2-DIBROMO-3-CHLOROPROPANE	NA	NA	NA	NA	NA	3	4.5*	C
1,2-DIBROMOETHANE	NA	NA	NA	NA	NA	2.9	2.9	C
1,2-DICHLOROETHANE	11300	11300 (4)	423750	423750 (5)	Buchman, 2008	62	62	C
1,2-DICHLOROBENZENE	197	197 (4)	4837.5	15750*	Buchman, 2008	2400	2400	N
1,2-DICHLOROPROPANE	1030	1030 (4)	114000	114000 (7)	Buchman, 2008	65	120*	C
1,3-DICHLOROBENZENE	NA	197* (4)	NA	7388* (5)	Buchman, 2008	63	NA*	NA
1,4-DICHLOROBENZENE	197	197 (4)	4838	4838 (7)	Buchman, 2008	60	270*	C
2-BUTANONE	240000	240000 (6)	5250000	5250000 (6)	Suter and Tsao, 1996	77000	77000	N
2-HEXANONE	1800	1800 (6)	37125	37125 (6)	Suter and Tsao, 1996	NA	560*	N
4-METHYL-2-PENTANONE	2200	2200 (6)	63750	63750 (6)	Suter and Tsao, 1996	NA	9000*	N
ACETONE	28000	28000 (6)	562500	562500 (6)	Suter and Tsao, 1996	120000	120000	N
BENZENE	510	510 (4)	26250	41250*	Buchman, 2008	60	60	C
BROMOCHLOROMETHANE	NA	NA**	NA	NA**	NA	NA	NA**	N
BROMODICHLOROMETHANE	1200	1200 (4)	240000	240000 (7)	Buchman, 2008	82	82	C
BROMOFORM	NA	2300* (6)	NA	120000* (6)	Suter and Tsao, 1996	700	700	C
BROMOMETHANE	NA	NA	NA	6000* (6)	Buchman, 2008	160	160	N
CARBON DISULFIDE	17	17 (6)	345	345 (6)	Suter and Tsao, 1996	5600	5600	N
CARBON TETRACHLORIDE	5000	5000 (4)	187500	187500 (5)	Buchman, 2008	21	40*	C
CHLOROBENZENE	16	NA*	4837.5	48750* (6)	Buchman, 2008	780	780	N
CHLOROETHANE	NA	NA	NA	NA	NA	1700	NA*	N
CHLOROFORM	2890	490* (6)	46500	675* (6)	Buchman, 2008	840	150*	C
CHLOROMETHANE	NA	NA	NA	NA	NA	NA	NA	C
CIS-1,2-DICHLOROETHENE	22400	22400 (4)	840000	840000 (5)	Buchman, 2008	700	140*	N
CIS-1,3-DICHLOROPROPENE	79	79 (4)	2962.5	2962.5 (5)	Buchman, 2008	44	44	C
CYCLOHEXANE	NA	NA	NA	NA	NA	NA	NA	N
DIBROMOCHLOROMETHANE	1200	1200 (4)	240000	240000 (7)	Buchman, 2008	64	64	C
DICHLORODIFLUOROMETHANE	1200	NA*	240000	NA*	NA	15000	15000	N
ETHYLBENZENE	43	43 (4)	1612.5	9375*	Buchman, 2008	2700	130*	C
ISOPROPYLBENZENE	NA	NA	NA	NA	NA	1700	1700	N
METHYL ACETATE	NA	NA	NA	NA	NA	130000	130000	N
METHYLCYCLOHEXANE	NA	NA	NA	NA	NA	NA	NA	NA
METHYLENE CHLORIDE	1200	1200 (4)	240000	240000 (7)	Buchman, 2008	790	790	C
METHYL TERT-BUTYL ETHER	NA	NA	NA	1875000*	Buchman, 2008	1600	3500*	C
STYRENE	NA	NA	NA	12000* (6)	Buchman, 2008	6500	6500	N
TETRACHLOROETHENE	1020	1020 (4)	16875	16875 (7)	Buchman, 2008	3	3	C
TOLUENE	630	630 (4)	187500	80625*	Buchman, 2008	3000	3000	N
TOTAL 1,2-DICHLOROETHENE	NA	22400* (4)	NA	840000* (5)	Buchman, 2008	NA	140* (9)	N
TRANS-1,2-DICHLOROETHENE	22400	22400 (4)	840000	840000 (5)	Buchman, 2008	1600	1600	N
TRANS-1,3-DICHLOROPROPENE	79	79 (4)	2963	2963 (5)	Buchman, 2008	55	55 (8)	C
TRICHLOROETHENE	200	200 (4)	7500	7500 (5)	Buchman, 2008	9	14*	N
TRICHLOROFLUOROMETHANE	1200	1200 (4)	240000	240000 (7)	Buchman, 2008	18000	18000	N
VINYL CHLORIDE	NA	NA	NA	348750* (6)	Buchman, 2008	4	4	C
O-XYLENES	NA	NA*	NA	131250* (6)	Buchman, 2008	NA	5700*	N
TOTAL XYLENES	230	230 (6)	4875	4875 (6)	Suter and Tsao, 1996	5600	5600	N

NA = Not Available

* The screening level changed since the 2008 update to support the OU3 Rounds 1 through 4 Data Evaluation Report (Tetra Tech, July 2009). Acute and chronic ecological changes were based on updated marine values or updated source of criteria. Updates to human health levels were based on changes in toxicity criteria or risk calculation methodology. Appendix C.5 provides a discussion of updated human health risk calculation methodology.

** Additional analyte included in Target Compound List Volatile Organic Compound analysis in Round 10.

Footnotes:

1 - Ecological acute values apply only to seeps that emerge above the mean mid-tide line and cause furrows in the sediment above mid-tide.

2 - Chronic ecological value presented is the chronic screening level multiplied by a diulition factor of 375 (minimum calculated dilution factor for OU3).

3 - The human health screening levels presented on this table correspond to an incremental lifetime cancer risk of 1×10^{-6} or a hazard index of 0.1. These screening levels are based on recreational exposure to surface water in the intertidal area. The screening levels were calculated in accordance with the methodology presented in Appendix C.5.

4 - Acute value was calculated by multiplying the acute lowest observable effect level (LOEL) by 0.1 (to estimate an acute no observable effect level [NOEL]). Chronic value was calculated by multiplying acute value by 0.1.

5 - Chronic vaule was calculated by multiplying the acute LOEL by 0.01 to estimate a chronic NOEL.

6 - Value is based on freshwater criterion.

TABLE C5-2

AQUEOUS SCREENING LEVEL CHANGES SUMMARY
OU3 POST-REMEDIAL OM&M PROGRAM
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

7 - Value was calculated by multiplying the chronic LOEL by 0.1 to estimate a chronic NOEL.
8 - 1,3-Dichloropropene used as a surrogate.
9 - Cis-1,2-dichloroethene value used as a surrogate.

Sources:

Buchman, M. F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, 34 pages. http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html

Suter, G.W. II. and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Constituents of Concern for Effects on Aquatic Biota:1996 Revision. Environmental Sciences Division, Oak Ridge National Laboratory. ES/ER/TM-96/R2.

Intermittent Bulletin, Volume 3, Number 2. EPA540/F-95/038. January.

USEPA, 2009. National Recommended Water Quality Criteria: 2009. Office of Water.

APPENDIX D

OU3 AND OU4 DATA EVALUATION AND TREND PLOTS

APPENDIX D.1

OU3 DATA EVALUATION AND TREND PLOTS

OU3 DATA EVALUATION AND TREND PLOTS
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Groundwater monitoring data for the chemicals of concern (COCs) for Rounds 1 through 10 of the OU3 OM&M Program were evaluated as part of the Second Five-Year Review Report to determine whether the remedy remains protective and to identify any significant changes in concentrations. The following discusses the evaluation of the data to identify which COCs [polycyclic aromatic hydrocarbons (PAHs) and metals] require trend plots for data evaluation, and provides the evaluation of the trend plots that were developed. The selected trend plots are attached. Although not COCs for OU3, volatile organic compounds (VOCs) are being analyzed as part of five-year sampling rounds to support the five-year review at the request of the Maine Department of Environmental Protection (MEDEP). Therefore, VOC data are also evaluated herein. Recommendations for modification to future rounds of monitoring are also discussed herein.

Background

The Rounds 1 through 9 groundwater monitoring data were evaluated in the Rounds 1 through 9 Data Evaluation Report (Tetra Tech, April 2011b) and the results indicated that no concentrations of chemicals exceeded human health and chronic ecological action levels for the COCs. The data were evaluated in accordance with decision flow charts for identifying which COCs to continue for long-term monitoring based on potential human health and ecological (chronic) exposure to intertidal surface water. Exposure to seeps in the intertidal area (acute ecological exposure) was not evaluated because seeps that meet the definition for exposure (above mid-tide and create a furrow) are not present in the OU3 intertidal area. The identification of COCs for continued monitoring is based on evaluating the 95 percent upper prediction bands and 95 percent confidence bands. Based on the decision diagram, annual monitoring is to be conducted for COCs that are predicted to exceed the action level during the next five years. COCs that are not predicted to exceed the action level in the next five years will be monitored again at the next five-year sampling round. Five-year sampling for COCs will be conducted for each COC until there are three consecutive five-year sampling rounds during which the COC concentration is not predicted to exceed the action level in the next five years. After three consecutive five-year sampling rounds without predicted exceedance, the COC will be removed from the OM&M Program.

The Rounds 1 through 9 Data Evaluation is the first five-year evaluation and based on the evaluation arsenic was the only COC identified for annual monitoring because the arsenic concentration in JW-13D was predicted to exceed the human health action level during the next 5 years. The other COCs (PAHs and other metals) do not require annual monitoring and will be analyzed at the next five-year sampling round.

VOCs were included in the first four rounds of monitoring and based on the Rounds 1 through 4 Data Evaluation Report (Tetra Tech, July 2009) were recommended for removal from the OM&M Program because detected concentrations were much lower than screening levels. Round 5 was conducted before the report was finalized and therefore, VOCs were analyzed in Round 5. Subsequently, VOCs were not analyzed in Rounds 6 through 9. During preparation of the updated OM&M Plan, MEDEP requested that VOC analysis be continued as part of the five-year evaluation and that a shallow bedrock well (JW-13B) also be analyzed for VOCs during the five-year evaluation. The request was made because the overburden (JW-13D) and bedrock (JW-13B) monitoring wells had the maximum detections of several VOCs (although at concentrations less than screening levels). The Navy agreed to include VOCs analysis at the OU3 OM&M monitoring wells and JW-13B for the five-year review sampling rounds.

Data Evaluation for COCs for the Second Five-Year Review Report

Table 4-2 in the Second Five-Year Review Report provides the updated action levels and Table 4-3 in the Second Five-Year Review Report provides a summary of Rounds 1 through 9 data and Round 10 data for the COCs. As shown on Table 4-2, ecological acute and chronic values and human health values were updated. Only human health and chronic ecological action level comparisons are discussed herein. Although acute ecological action levels are shown in this table, seeps that meet the definition for potential acute exposure are not present in the OU3 intertidal area and therefore, these action levels are not discussed further herein. Chronic values were updated for one PAH (naphthalene) and a few metals (barium, beryllium, and thallium). The updates did not change the general conclusion regarding groundwater concentrations in comparison to ecological action levels because groundwater detections are more than 100 times less than the ecological chronic action levels and most of the ecological action levels are greater than the human health action levels. Human health action levels were updated for benzo(g,h,i)perylene (increased), lead (decrease), and thallium (now Not Available). Except for thallium, the changes did not change the general conclusions regarding metals because benzo(g,h,i)perylene has not been detected in any round and lead concentrations are more than 10 times less than the human health action level. The potential impact of the change in thallium action level is discussed further herein.

A comparison of data from Rounds 1 through 9 to Round 10 shows that PAHs were detected in upgradient monitoring wells; these detections were infrequent and at low concentrations. PAHs were not detected in downgradient wells. Three PAHs have been detected over the 10 rounds of OM&M sampling; 2-methylnaphthalene was detected once (at JW-9 in Round 6), fluorene was detected once (at HW-2 in Round 1), and naphthalene was detected three times (at JW-7A in Rounds 9 and 10 and at HW-2 in Round 1). The concentrations of 2-methylnaphthalene, fluorene, and naphthalene were all low (less than 5 ug/L) and were more than 100 times less than the human health and ecological action levels.

Various metals were detected in Rounds 1 through 10 and the concentrations in Round 10 remain similar to the concentrations in Rounds 1 through 9. For most metals, the concentrations are more than 10 times less than the human health and ecological action levels. Therefore, the conclusions in the Rounds 1 through 9 Data Evaluation Report for these metals has not changed with the addition of the Rounds 10 data. Arsenic was further evaluated by preparing trend plots to see whether arsenic was still trending to potentially exceed the human health action level. Thallium was further evaluated by preparing trend plots because the maximum detection in Round 10 was greater than the maximum detection previously. Because there is uncertainty in toxicity criteria for thallium, the human health action level was updated from 84 ug/L to Not Available (see Appendix C.5). Concentrations of thallium were more than 100 times less than the ecological action level (6,375 ug/L). For evaluation of thallium, the potential change in concentration trend was evaluated to determine any potential increase in concentration trends.

Figures D.1.1 through D.1.10, attached, provide the trend plots for total arsenic concentrations in the OU3 OM&M wells. Concentrations of arsenic at JW-13D are less than the human health action level, but are still predicted to exceed the action level in the next five years (Figure D.1.1). The trend is greatly influenced by the maximum detection of arsenic in Round 6, which may be an anomaly. Arsenic concentrations remain less than human health action levels and are predicted to remain less than human health action levels for the other OU3 OM&M monitoring wells (Figures D.1.2 through D.1.10). Although the groundwater concentration in JW-13D is predicted to exceed the human health action level in the next five years, exposure to contaminated groundwater from JW-13D exiting in the intertidal zone is not a current potential exposure scenario because there is no intertidal zone offshore of JW-13D. Therefore, potential future unacceptable risks are not anticipated based on current site conditions.

Figures D.1.11 through D.1.20, attached, provide the trend plots for total thallium in the OU3 OM&M wells. Round 10 concentrations of thallium remain similar to or less than Rounds 1 through 9 concentrations at most of the monitoring wells; however, thallium was detected in downgradient monitoring wells JW-21 and JW-22 during Round 10 only. The detected concentrations from JW-21 and JW-22 are within the range of half of the non-detected results from previous rounds and do not suggest a change in thallium concentrations in these wells. The Round 10 thallium concentration was also higher than previous detections at upgradient well JW-9. The data do not show a significant increase in concentrations in Round 10. All concentrations are more than 100 times less than the ecological action level. Although a human health action level is not currently available, the offshore areas where groundwater from JW-21 and JW-22 would discharge are not recreational areas. Groundwater in the vicinity of JW-21 discharges to the western portion of Clark Cove where the shoreline is mostly covered with rip rap and groundwater in the vicinity of JW-22 discharges to a constructed wetland. Therefore, potential future unacceptable risks are not anticipated based on current site conditions.

Data Evaluation for VOCs for the Second Five-Year Review Report

Table 4-4 in the Second Five-Year Review Report provides the updated VOC screening levels and Table 4-5 in the Second Five-Year Review Report provides a summary of Rounds 1 through 5 data and Round 10 data for the VOCs. Comparison of data from Rounds 1 through 5 to Round 10 shows that VOCs continue to be infrequently detected and the detections are at low concentrations in the OU3 OM&M monitoring wells. All detections were less than screening levels. VOCs were mostly detected in upgradient monitoring wells JW-8, JW-9, and HW-3 and in downgradient well JW-13D. VOCs were also detected in the shallow bedrock well collocated with JW-13D (JW-13B). The VOCs detected in upgradient wells are 1,1,2 trichlorotrifluoroethane, chloroform, chloromethane, methyl tert-butyl ether, and methylene chloride. These VOC were detected at concentrations more than 100 times less than the screening levels and except for 1,1,2-trichlorotrifluoroethane, were sporadically detected. Detections of 1,1,2-trichlorotrifluoroethane have been consistent at JW-9 and HW-3. VOCs detected at JW-13D are cis-1,2-dichloroethene, total 1,2-dichloroethene, and trichloroethene, and the concentrations were more than 100 times less than the screening levels. One VOC was detected at downgradient well JW-20 (1,1-dichloroethane) and the detection was more than 100 times less than the screening levels.

Table D.1 provides the Rounds 1 to 5 (2006 to 2008) and Round 10 (2011) VOC results for JW-13D and JW-13B. The results of comparison of JW-13D and JW-13B VOC concentrations in Round 10 are consistent with the Rounds 1 through 9 Data Evaluation Report; more VOCs were detected at JW-13B than JW-13D and the detected concentrations were greater at JW-13B than JW-13D. The Round 10 VOC concentrations detected in JW-13D and JW-13B were consistent with detections in Rounds 1 through 5. No increase in concentrations was noted in Round 10 from previous rounds. A comparison between the VOCs detected at both wells shows that concentrations of cis-1,2-dichloroethene, total 1,2-dichloroethene, and trichloroethene were 2 to 20 times greater at JW-13B than JW-13D; however, the concentrations were low compared to screening levels (generally 10 times less than the screening level). Additionally 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichlorobenzene, acetone, chlorobenzene, dichlorodifluoromethane, and vinyl chloride were detected in JW-13B but were not detected in JW-13D. Except for 1,1-dichloroethane and vinyl chloride, these VOCs were detected at concentrations more than 100 times less than the screening levels. Detections of 1,1-dichloroethane ranged from 10 to 17 ug/L, but were still much lower than the screening levels. Vinyl chloride was detected at concentrations approximately 2 times less than the screening level (detections ranging from 1 to 2 ug/L compared with the human health screening level of 4 ug/L).

Conclusions and Recommendations

Round 10 concentrations are generally consistent with Rounds 1 through 9 and do not change the conclusions of the Rounds 1 through 9 Data Evaluation Report.

For the OU3 OM&M program, only arsenic warrants annual monitoring in the OU3 OM&M wells until the next five-year sampling round. PAHs and other metals will be monitored at the next five-year sampling round. The arsenic concentration trend should continue to be evaluated to determine whether the Round 6 detection of arsenic is an anomaly or whether an increasing trend may exist. In accordance with the decision flow diagram, the arsenic concentration trend was evaluated to estimate whether concentrations are predicted to exceed action levels in the next five years and whether the frequency of monitoring for arsenic can be reduced. For PAHs and other metals, in accordance with the decision flow, two more five-year sampling rounds are necessary before any of these chemicals can be removed from the OU3 OM&M Program. Therefore, at this time, additional reduction in the OU3 OM&M groundwater analytical program is not recommended. However, it is recommended that prediction bands for chemicals that do not have any action levels should not be plotted, because no decision can be made based on prediction bands exceeding action levels.

Although VOC concentrations are much lower than screening levels, VOC concentrations continue to be greatest at JW-13B (downgradient shallow bedrock well). The representative VOCs detected at JW-13B are the three VOCs detected at both JW-13D and JW-13B (cis-1,2-dichoroethene, total 1,2-dichloroethene, trichloroethene) and vinyl chloride. Therefore, it is recommended that the analytical program for VOCs for the next five-year sampling round be reduced to the following four VOCs:

- cis-1,2-dichloroethene.
- total 1,2-dichloroethene.
- Trichloroethene.
- Vinyl chloride.

Table D.1

Post-Remedial Groundwater Volatile Organic Compound Data for JW-13B and JW-13D at OU3

GROUNDWATER

LOCATION	**JW-13B**	**JW-13B**	**JW-13B**	**JW-13B**	**JW-13B**	**JW-13B**	**JW-13B**
SAMPLE ID	**OU3GWJW13B0706**	**OU3GWJW13B1206**	**OU3GWJW13B1206-D**	**OU3GWJW13B0407**	**OU3GWJW13B1007**	**OU3GWJW13B0408**	**OU3GWJW13B0411**
SAMPLE DATE	**7/11/2006**	**12/13/2006**	**12/13/2006**	**4/11/2007**	**10/4/2007**	**4/16/2008**	**4/18/2011**
VOLATILES (UG/L)							
1,1,1-TRICHLOROETHANE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
1,1,2-TRICHLOROETHANE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
1,1,2-TRICHLOROTRIFLUOROETHANE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
1,1-DICHLOROETHANE	**11**	14	**16**	**17**	**11**	**11**	**10**
1,1-DICHLOROETHENE	**3 J**	**2 J**	**2 J**	**2 J**	**1.6**	1 U	**1.6**
1,2,3-TRICHLOROBENZENE	--	--	--	--	--	--	0.5 U
1,2,4-TRICHLOROBENZENE	5 U	5 U	5 U	5 U	1 UJ	1 U	0.5 U
1,2-DIBROMO-3-CHLOROPROPANE	5 U	5 U	5 U	5 U	1 U	1 UJ	0.75 U
1,2-DIBROMOETHANE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
1,2-DICHLOROBENZENE	**3 J**	**3 J**	**2 J**	**3 J**	**2.1**	**2.6**	**2.8**
1,2-DICHLOROETHANE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
1,2-DICHLOROPROPANE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
1,3-DICHLOROBENZENE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
1,4-DICHLOROBENZENE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
2-BUTANONE	5 U	5 UJ	5 UJ	5 U	10 U	5 UR	2.5 U
2-HEXANONE	5 U	5 UJ	5 UJ	5 U	1 U	5 UJ	2.5 U
4-METHYL-2-PENTANONE	5 U	5 U	5 U	5 U	1 UJ	5 U	2.5 U
ACETONE	5 U	5 UJ	5 UJ	5 U	**9.1 J**	5 UR	2.5 U
BENZENE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
BROMOCHLOROMETHANE	--	--	--	--	--	--	0.5 U
BROMODICHLOROMETHANE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
BROMOFORM	5 U	5 U	5 U	5 U	1 UJ	1 U	0.5 U
BROMOMETHANE	5 U	5 U	5 U	5 U	1 UJ	1 U	1 U
CARBON DISULFIDE	5 U	5 U	5 U	5 U	1 U	1 UJ	0.5 U
CARBON TETRACHLORIDE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 UJ
CHLOROBENZENE	**0.6 J**	**0.6 J**	5 U	**0.5 J**	1 U	1 U	0.5 U
CHLORODIBROMOMETHANE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
CHLOROETHANE	5 U	5 U	5 U	5 U	1 U	1 UJ	1 U
CHLOROFORM	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
CHLOROMETHANE	5 U	5 U	5 U	5 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	**19**	**15**	**15**	**20**	**10**	**17**	**11**
CIS-1,3-DICHLOROPROPENE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
CYCLOHEXANE	5 U	5 U	5 U	5 U	1 U	1 UJ	0.5 U
DICHLORODIFLUOROMETHANE	5 U	5 U	5 U	5 U	**0.69 J**	**5.9**	**1.3 J**
ETHYLBENZENE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
ISOPROPYLBENZENE	5 U	5 U	5 U	5 U	1 UJ	1 U	0.5 U
M+P-XYLENES	10 U	10 U	10 U	10 U	--	--	--
METHYL ACETATE	5 U	5 U	5 U	5 U	1 U	1 UJ	0.75 UJ
METHYL CYCLOHEXANE	5 U	5 U	5 U	5 U	1 U	1 UJ	0.5 U
METHYL TERT-BUTYL ETHER	5 U	5 U	5 U	5 U	1 U	1 UJ	0.5 U
METHYLENE CHLORIDE	5 U	5 U	5 U	5 U	1 U	1 U	2.5 U
O-XYLENE	5 U	5 U	5 U	5 U	--	--	--
STYRENE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
TETRACHLOROETHENE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
TOLUENE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
TOTAL 1,2-DICHLOROETHENE	**19**	**15**	**15**	**20**	--	--	--
TOTAL XYLENES	15 U	15 U	15 U	15 U	1 U	1 U	1.5 U
TRANS-1,2-DICHLOROETHENE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 UJ
TRANS-1,3-DICHLOROPROPENE	5 U	5 U	5 U	5 U	1 U	1 U	0.5 U
TRICHLOROETHENE	**2 J**	5 U	**2 J**	**2 J**	1 U	**1.6**	0.5 U
TRICHLOROFLUOROMETHANE	5 U	5 UJ	5 UJ	5 U	1 U	1 U	1 UJ
VINYL CHLORIDE	5 U	**1 J**	**2 J**	**2 J**	**0.7 J**	1 U	**1.1 J**

GROUNDWATER Footnotes:

-- = The chemical was not analyzed or no value was available.

Data Qualifiers:

Blank (i.e., no qualifier) = the chemical was detected.

J = The chemical was detected but the concentration reported is an estimated value.

U = The chemical was not detected.

< = The chemical was not detected.

R = The chemical was rejected.

Dectected results are shown in BOLD. Yellow highlighted VOCs were detected in both JW-13D and JW-13B.
See Table 4-4 for VOC screening levels.

Table D.1
Post-Remedial Groundwater Volatile Organic Compound Data for JW-13B and JW-13D at OU3

GROUNDWATER

LOCATION	**JW-13D**	**JW-13D**	**JW-13D**	**JW-13D**	**JW-13D**	**JW-13D**
SAMPLE ID	**OU3GWJW13D0706**	**OU3GWJW13D1206**	**OU3GWJW13D0407**	**OU3GWJW13D1007**	**OU3GWJW13D0408**	**OU3GWJW13D0411**
SAMPLE DATE	**7/12/2006**	**12/12/2006**	**4/13/2007**	**10/2/2007**	**4/16/2008**	**4/19/2011**
VOLATILES (UG/L)						
1,1,1-TRICHLOROETHANE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,1,2,2-TETRACHLOROETHANE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,1,2-TRICHLOROETHANE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,1,2-TRICHLOROTRIFLUOROETHANE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,1-DICHLOROETHANE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,1-DICHLOROETHENE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,2,3-TRICHLOROBENZENE	--	--	--	--	--	0.5 U
1,2,4-TRICHLOROBENZENE	5 U	5 U	5 U	1 UJ	1 U	0.5 U
1,2-DIBROMO-3-CHLOROPROPANE	5 U	5 U	5 U	1 U	1 UJ	0.75 U
1,2-DIBROMOETHANE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,2-DICHLOROBENZENE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,2-DICHLOROETHANE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,2-DICHLOROPROPANE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,3-DICHLOROBENZENE	5 U	5 U	5 U	1 U	1 U	0.5 U
1,4-DICHLOROBENZENE	5 U	5 U	5 U	1 U	1 U	0.5 U
2-BUTANONE	5 U	5 UJ	5 U	10 U	5 UR	2.5 U
2-HEXANONE	5 U	5 UJ	5 U	1 U	5 U	2.5 U
4-METHYL-2-PENTANONE	5 U	5 U	5 U	1 UJ	5 U	2.5 U
ACETONE	5 U	5 UJ	5 U	10 U	5 UR	2.5 U
BENZENE	5 U	5 U	5 U	1 U	1 U	0.5 U
BROMOCHLOROMETHANE	--	--	--	--	--	0.5 U
BROMODICHLOROMETHANE	5 U	5 U	5 U	1 U	1 U	0.5 U
BROMOFORM	5 U	5 U	5 U	1 UJ	1 U	0.5 U
BROMOMETHANE	5 U	5 U	5 U	1 UJ	1 U	1 U
CARBON DISULFIDE	5 U	5 U	5 U	1 U	1 UJ	0.5 U
CARBON TETRACHLORIDE	5 U	5 U	5 U	1 U	1 U	0.5 UJ
CHLOROBENZENE	5 U	5 U	5 U	1 U	1 U	0.5 U
CHLORODIBROMOMETHANE	5 U	5 U	5 U	1 U	1 U	0.5 U
CHLOROETHANE	5 U	5 U	5 U	1 U	1 U	1 U
CHLOROFORM	5 U	5 U	5 U	1 U	1 U	0.5 U
CHLOROMETHANE	5 U	5 U	5 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	**0.5 J**	5 U	**1 J**	1 U	1 U	**0.63 J**
CIS-1,3-DICHLOROPROPENE	5 U	5 U	5 U	1 U	1 U	0.5 U
CYCLOHEXANE	5 U	5 U	5 U	1 U	1 U	0.5 U
DICHLORODIFLUOROMETHANE	5 U	5 U	5 U	1 U	1 U	1 UJ
ETHYLBENZENE	5 U	5 U	5 U	1 U	1 U	0.5 U
ISOPROPYLBENZENE	5 U	5 U	5 U	1 UJ	1 U	0.5 U
M+P-XYLENES	10 U	10 U	10 U	--	--	--
METHYL ACETATE	5 U	5 U	5 U	1 U	1 UJ	0.75 UJ
METHYL CYCLOHEXANE	5 U	5 U	5 U	1 U	1 UJ	0.5 U
METHYL TERT-BUTYL ETHER	5 U	5 U	5 U	1 U	1 U	0.5 U
METHYLENE CHLORIDE	5 U	5 U	5 U	1 U	1 U	2.5 U
O-XYLENE	5 U	5 U	5 U	--	--	--
STYRENE	5 U	5 U	5 U	1 U	1 U	0.5 U
TETRACHLOROETHENE	5 U	5 U	5 U	1 U	1 U	0.5 U
TOLUENE	5 U	5 U	5 U	1 U	1 U	0.5 U
TOTAL 1,2-DICHLOROETHENE	10 U	10 U	**1 J**	--	--	--
TOTAL XYLENES	15 U	15 U	15 U	1 U	1 U	1.5 U
TRANS-1,2-DICHLOROETHENE	5 U	5 U	5 U	1 U	1 U	0.5 UJ
TRANS-1,3-DICHLOROPROPENE	5 U	5 U	5 U	1 U	1 U	0.5 U
TRICHLOROETHENE	**0.7 J**	5 U	**1 J**	1 U	1 U	0.5 U
TRICHLOROFLUOROMETHANE	5 U	5 UJ	5 U	1 U	1 U	1 UJ
VINYL CHLORIDE	5 U	5 U	5 U	1 U	1 U	1 U

GROUNDWATER Footnotes:

-- = The chemical was not analyzed or no value was available.

Data Qualifiers:

Blank (i.e., no qualifier) = the chemical was detected.

J = The chemical was detected but the concentration reported is an esti

U = The chemical was not detected.

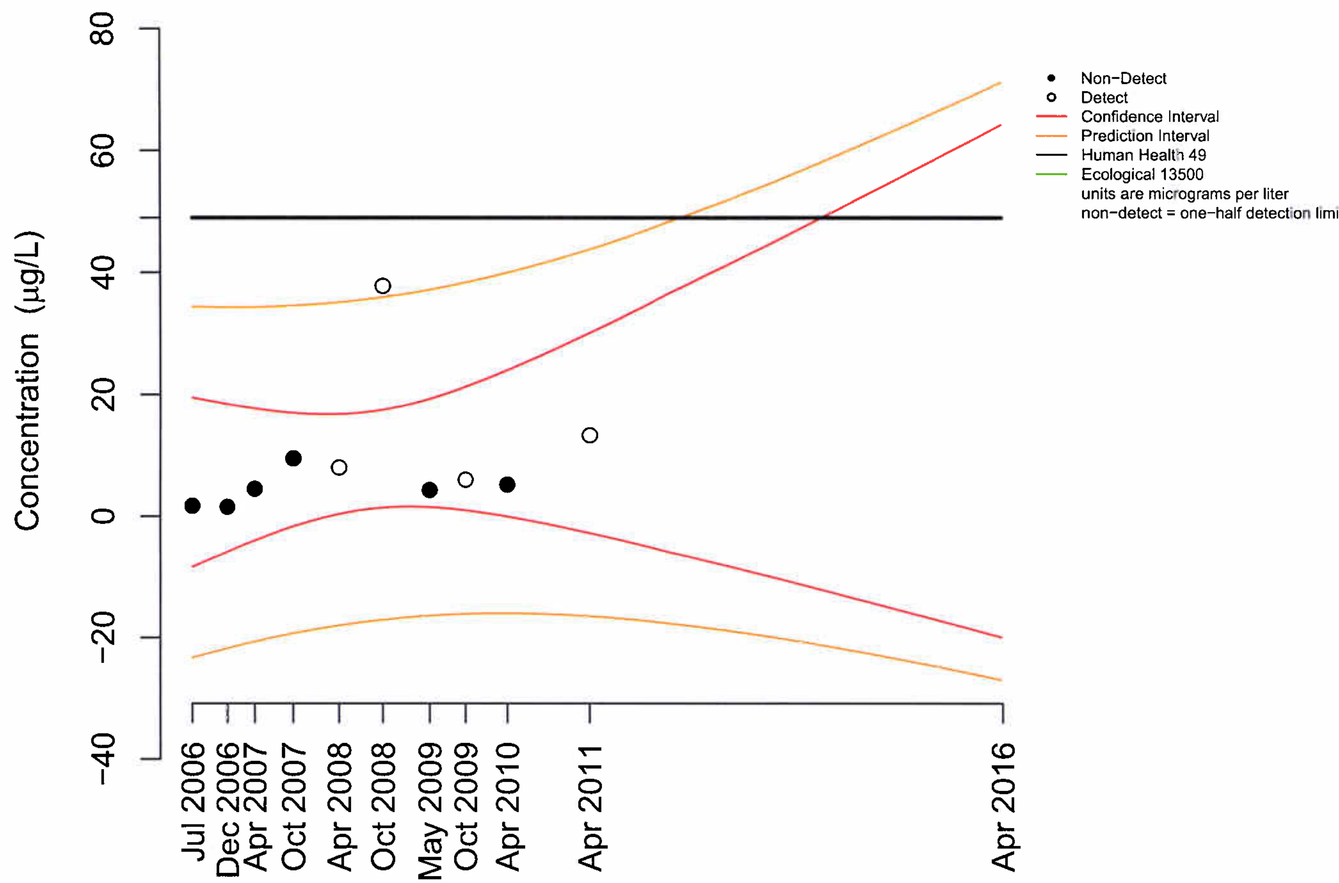
< = The chemical was not detected.

R = The chemical was rejected.

Dectected results are shown in BOLD. Yellow highlighted VOCs were detected in both JW-13D and JW-13B.
See Table 4-4 for VOC screening levels.

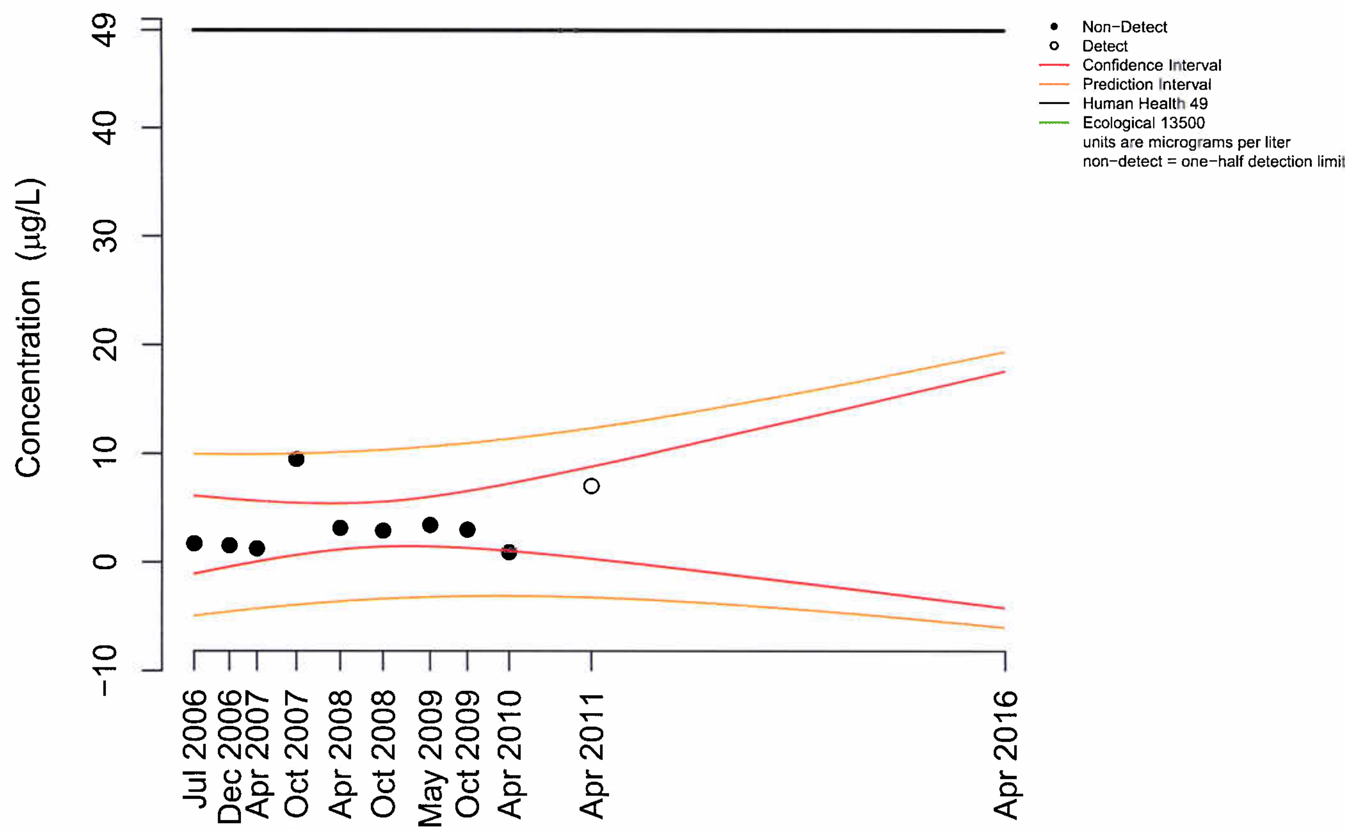
OU3 TREND PLOTS

FIGURE D.1. 1
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL ARSENIC AT JW−13D
SECOND−FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



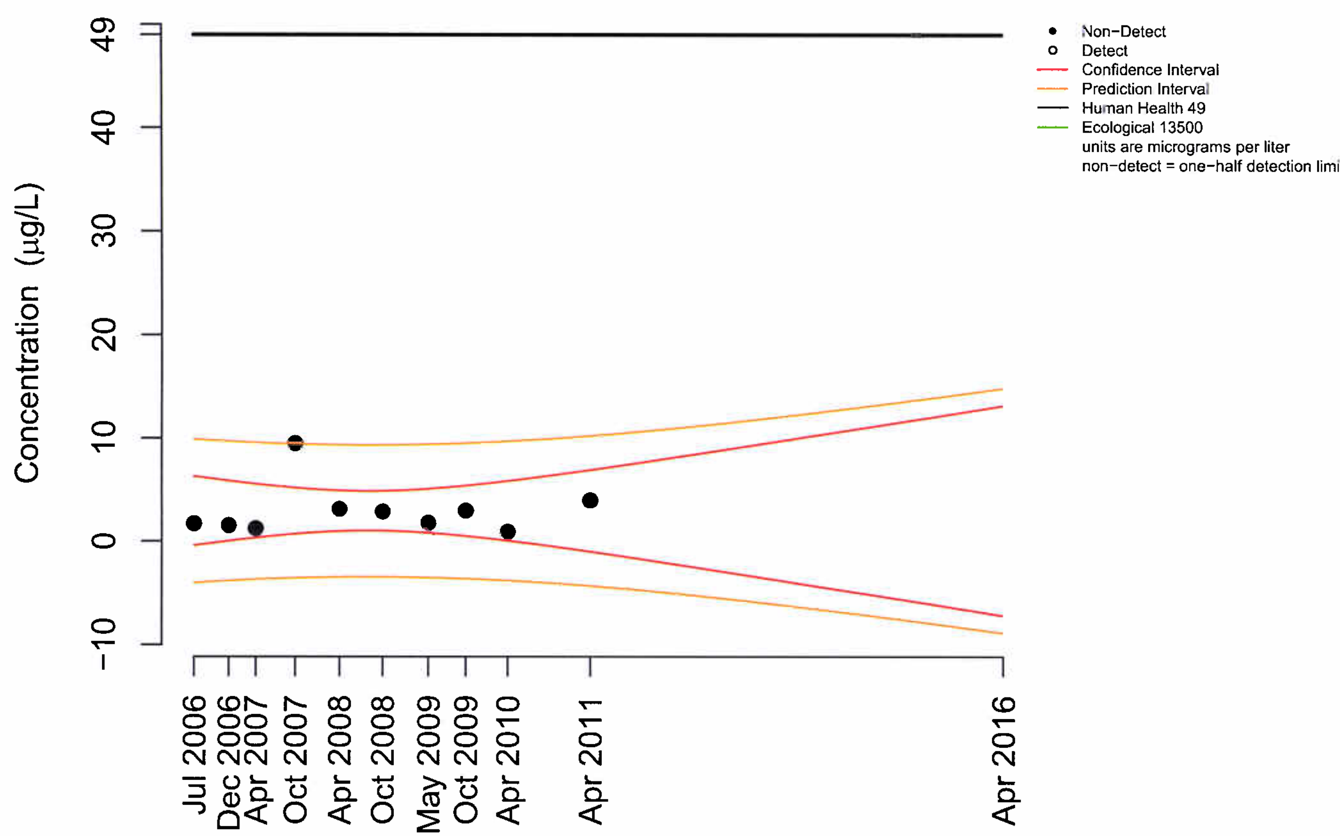
Downgradient well. Concentrations remain less than the action level; however, concentrations are predicted to exceed the action level in the next five years. Annual monitoring and evaluation of arsenic will be continued.

FIGURE D.1. 2
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL ARSENIC AT JW–20
SECOND–FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



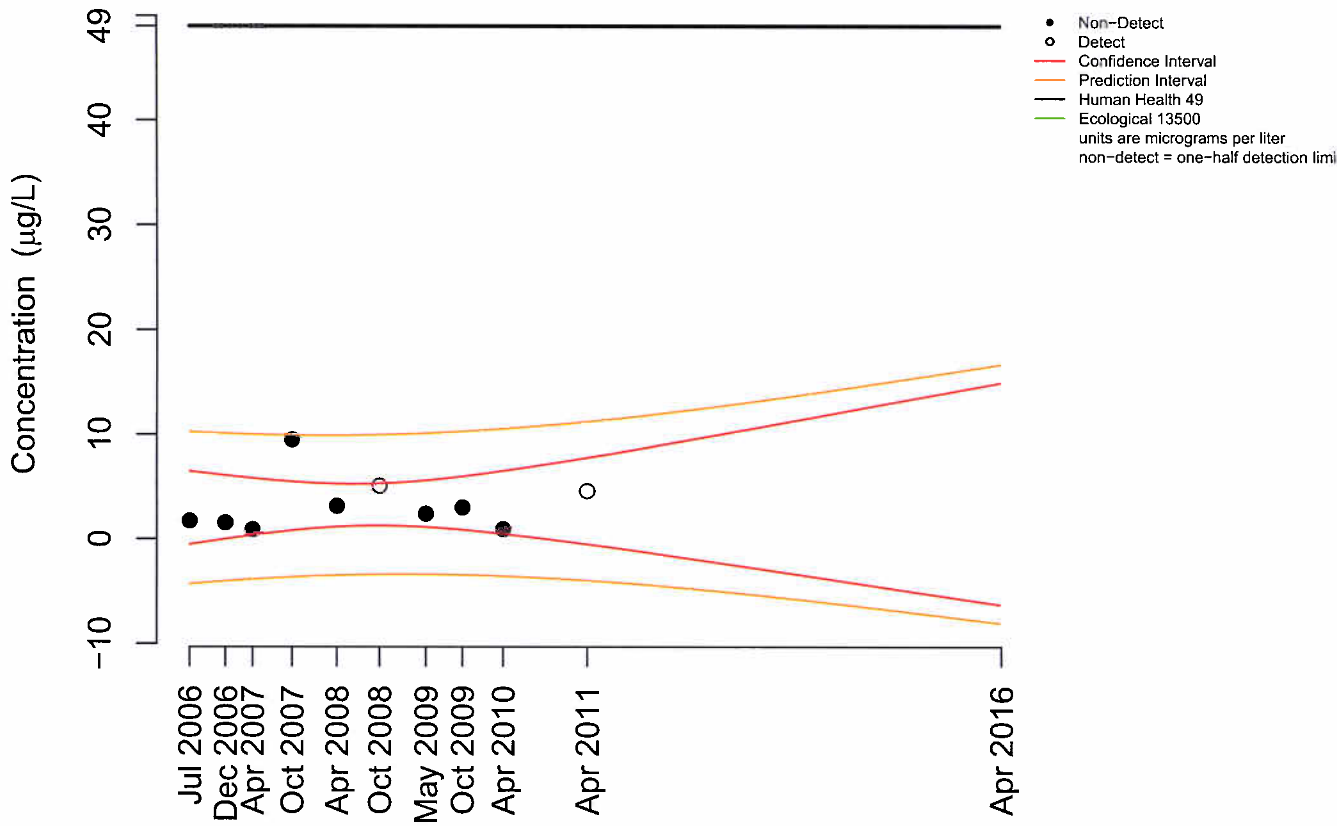
Downgradient well. No exceedances. Concentrations are at and predicted to remain at acceptable levels.

FIGURE D.1. 3
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL ARSENIC AT JW−21
SECOND−FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



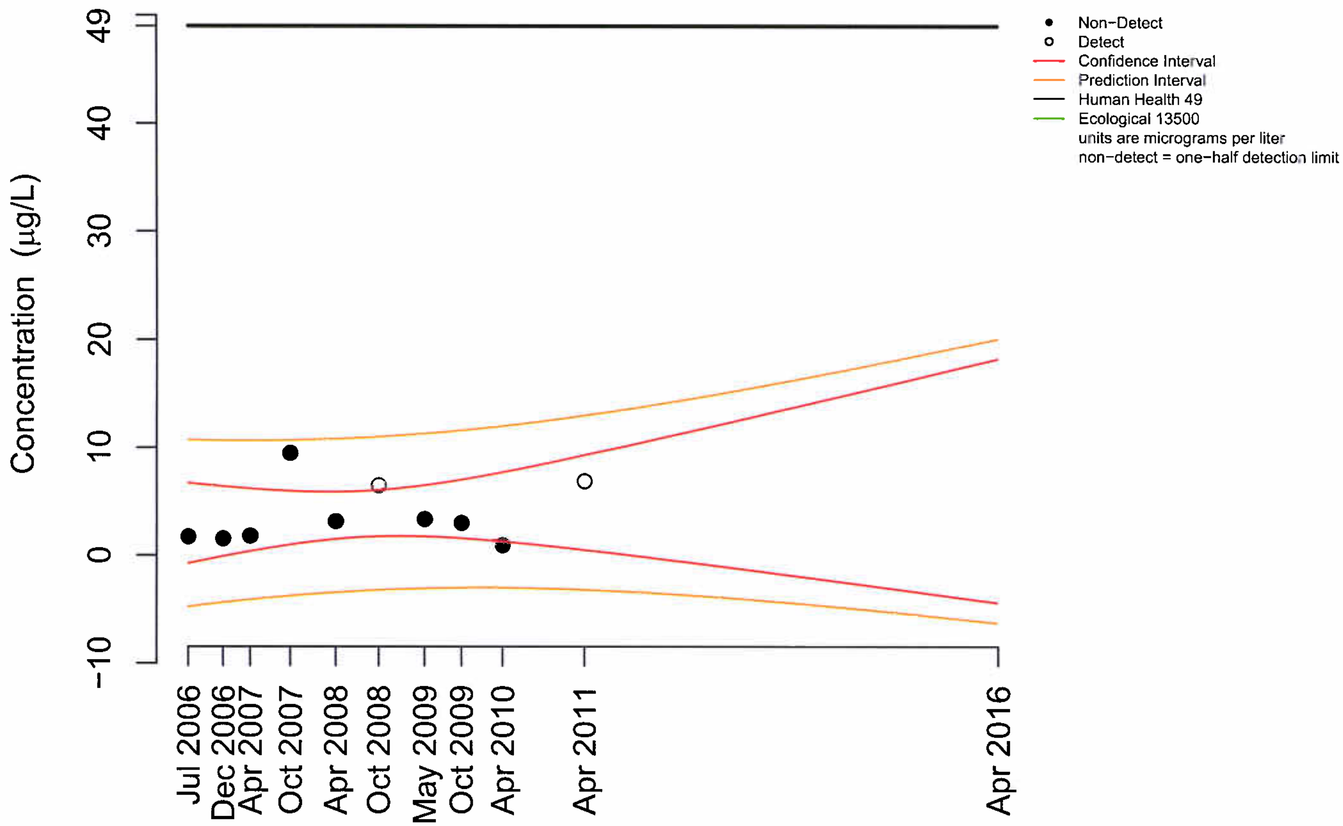
Downgradient well. No exceedances. Concentrations are at and predicted to remain at acceptable levels.

FIGURE D.1. 4
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL ARSENIC AT JW−22
SECOND−FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



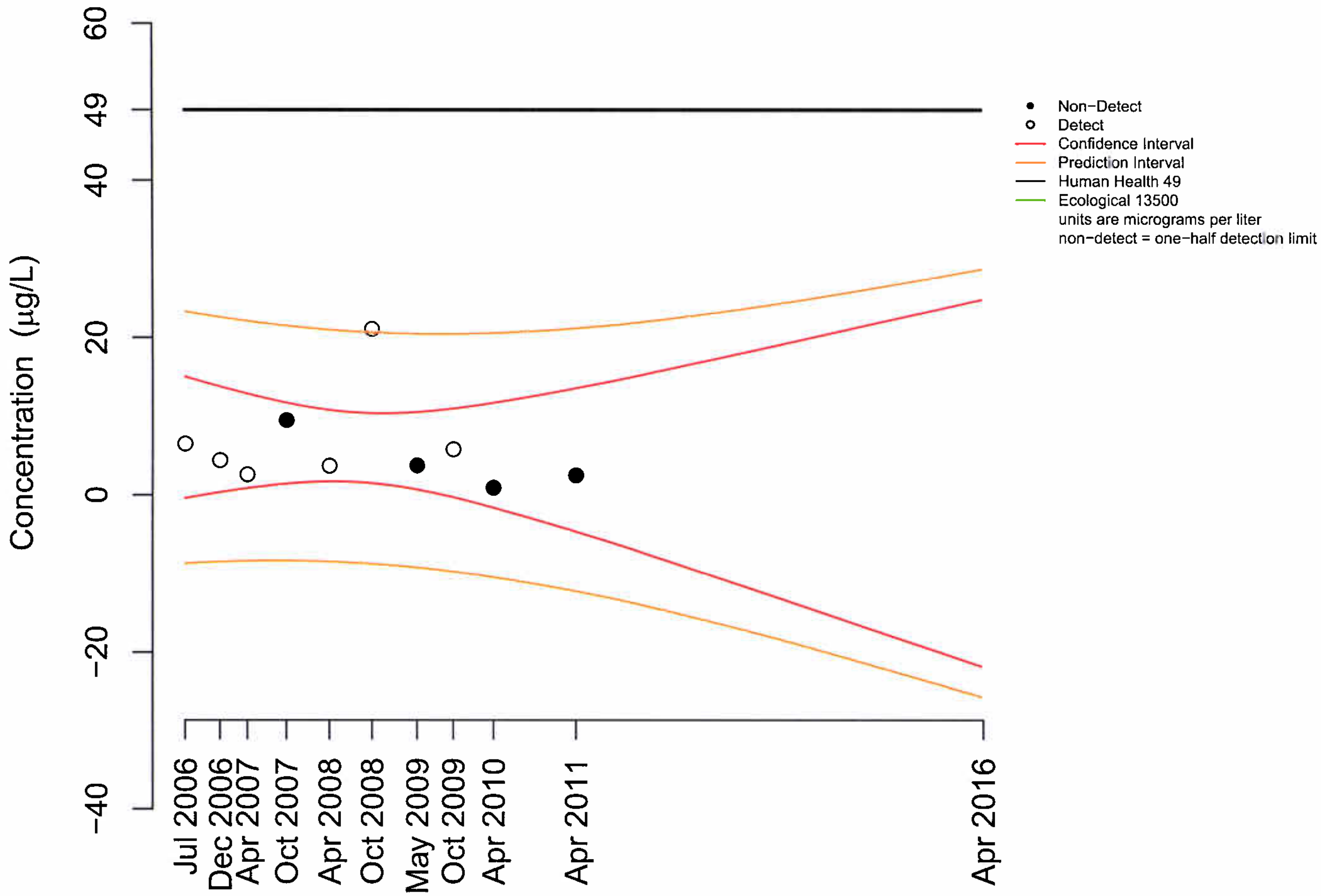
Downgradient well. No exceedances. Concentrations are at and predicted to remain at acceptable levels.

FIGURE D.1. 5
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL ARSENIC AT JW–23
SECOND–FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



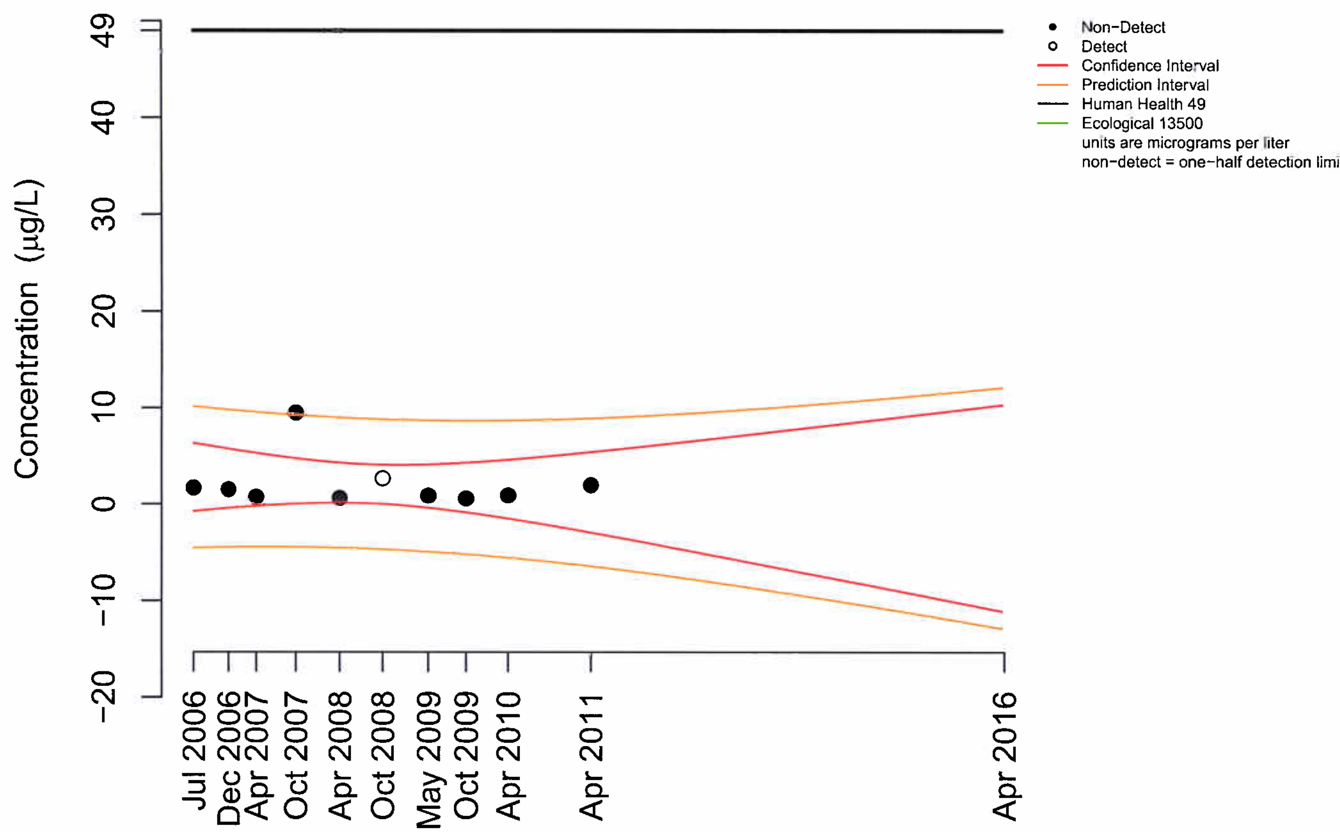
Downgradient well. No exceedances. Concentrations are at and predicted to remain at acceptable levels.

FIGURE D.1. 6
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL ARSENIC AT HW−2
SECOND−FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



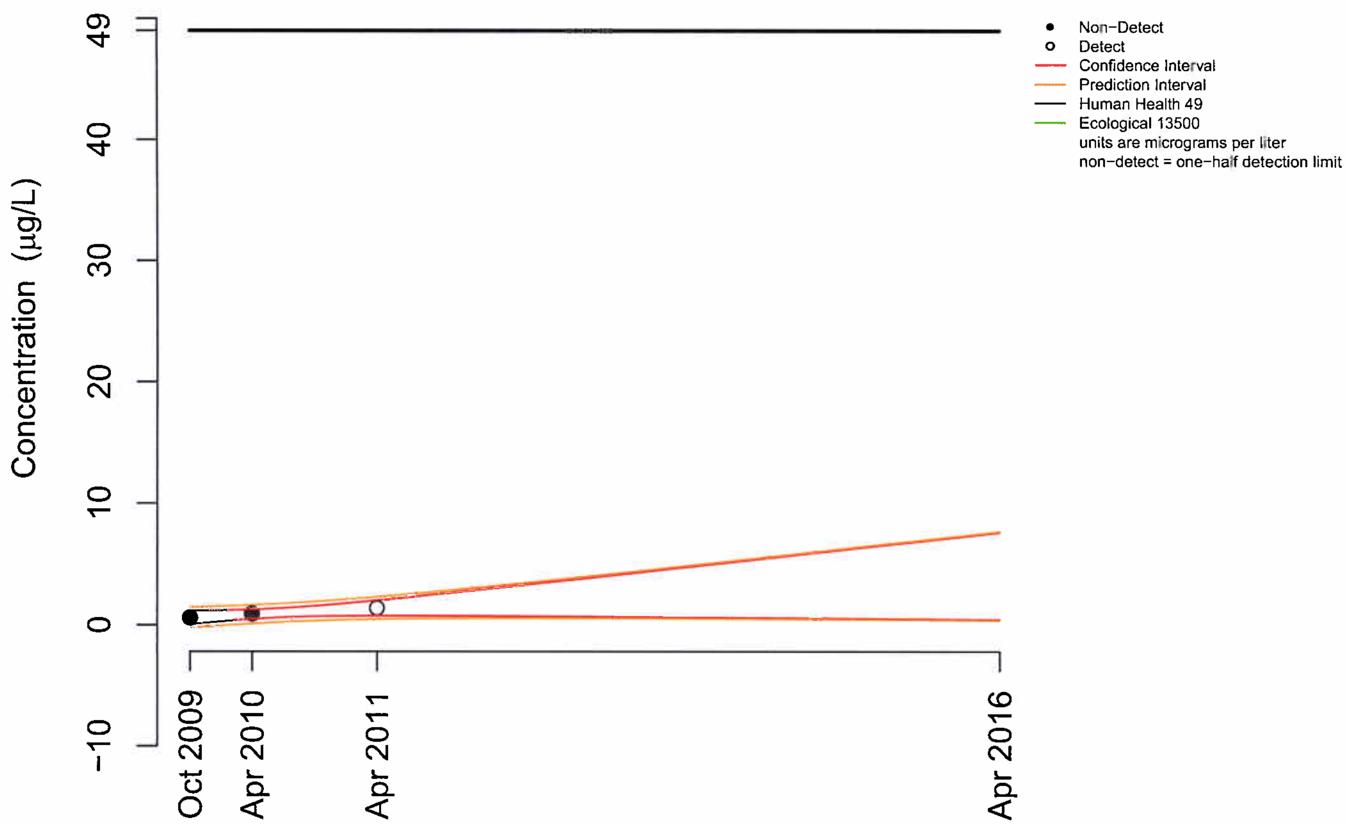
Upgradient well. No exceedances. Concentrations are at and predicted to remain at acceptable levels.

FIGURE D.1. 7
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL ARSENIC AT HW−3
SECOND−FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



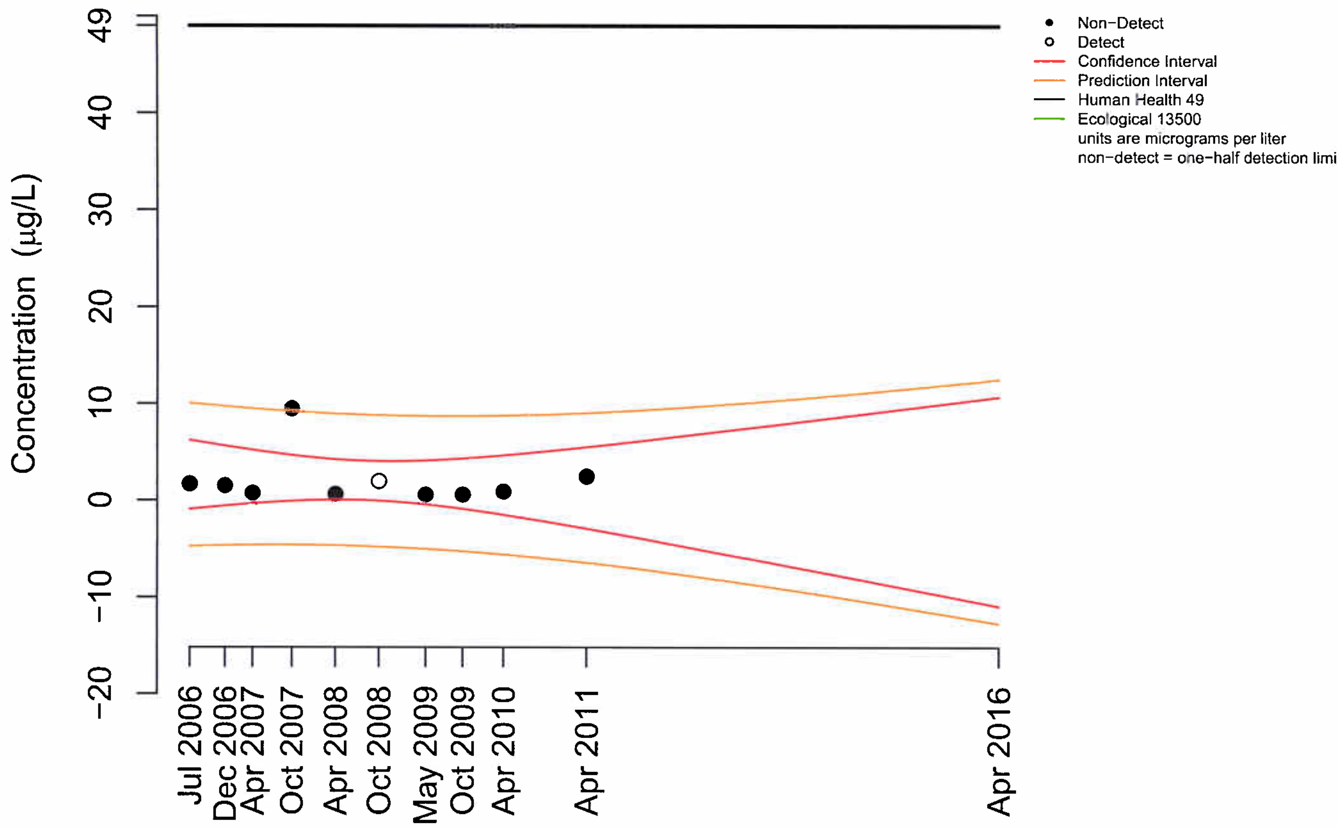
Upgradient well. No exceedances. Concentrations are at and predicted to remain at acceptable levels.

FIGURE D.1. 8
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL ARSENIC AT JW-7A
SECOND-FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



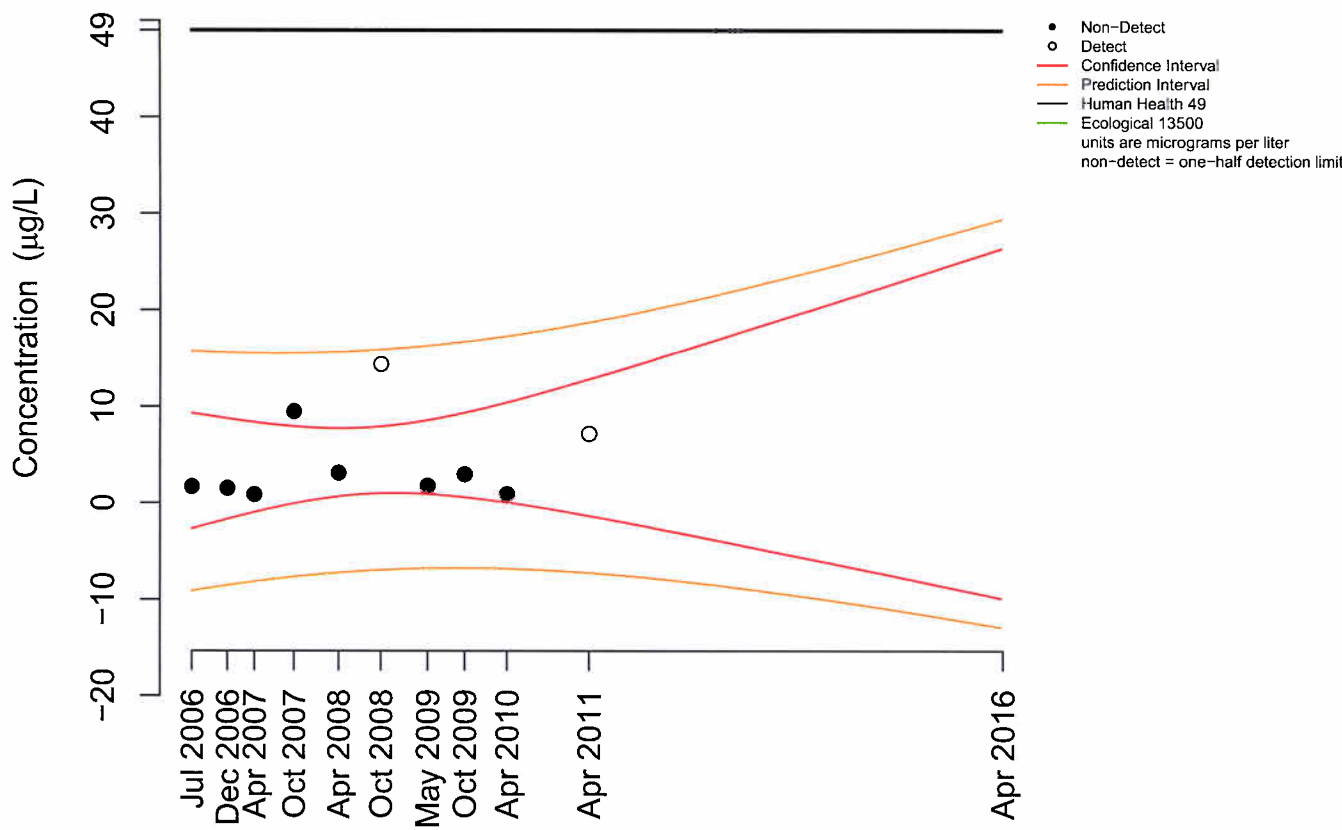
Upgradient well. No exceedances. Concentrations are at and predicted to remain at acceptable levels.

FIGURE D.1. 9
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL ARSENIC AT JW-8
SECOND-FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



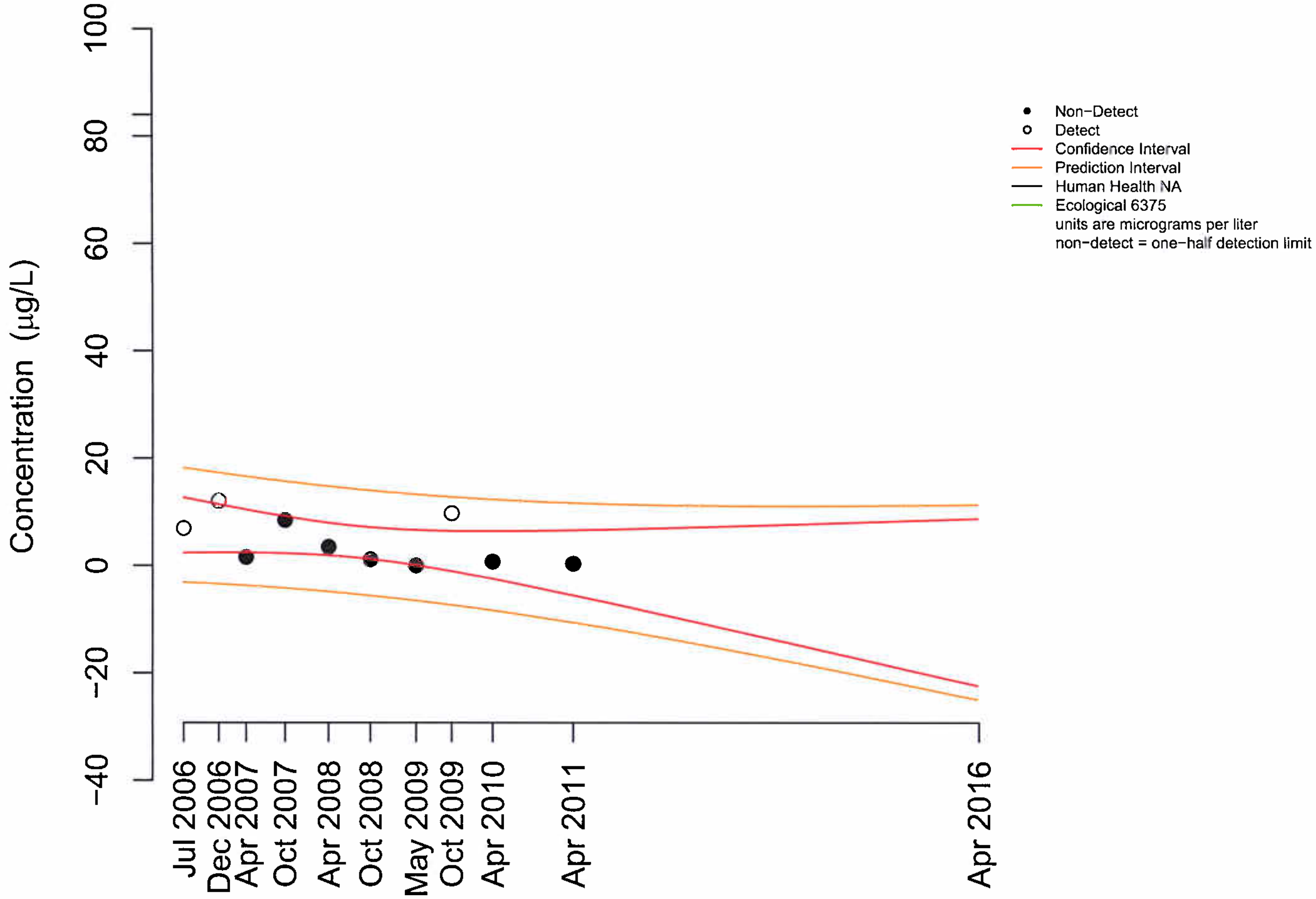
Upgradient well. No exceedances. Concentrations are at and predicted to remain at acceptable levels.

FIGURE D.1. 10
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL ARSENIC AT JW-9
SECOND-FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



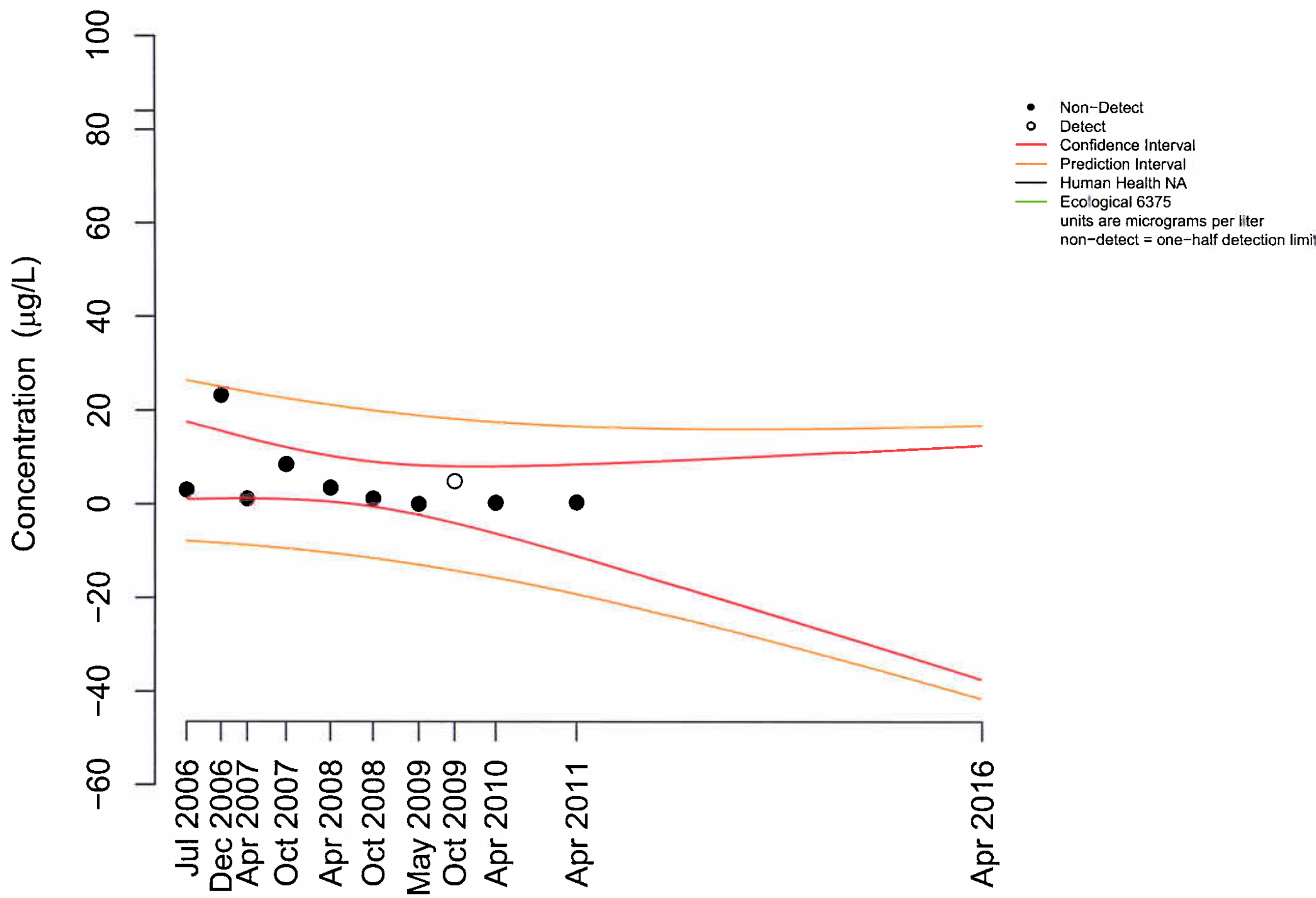
Upgradient well. No exceedances. Concentrations are at and predicted to remain at acceptable levels.

FIGURE D.1. 11
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL THALLIUM AT JW-13D
SECOND-FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



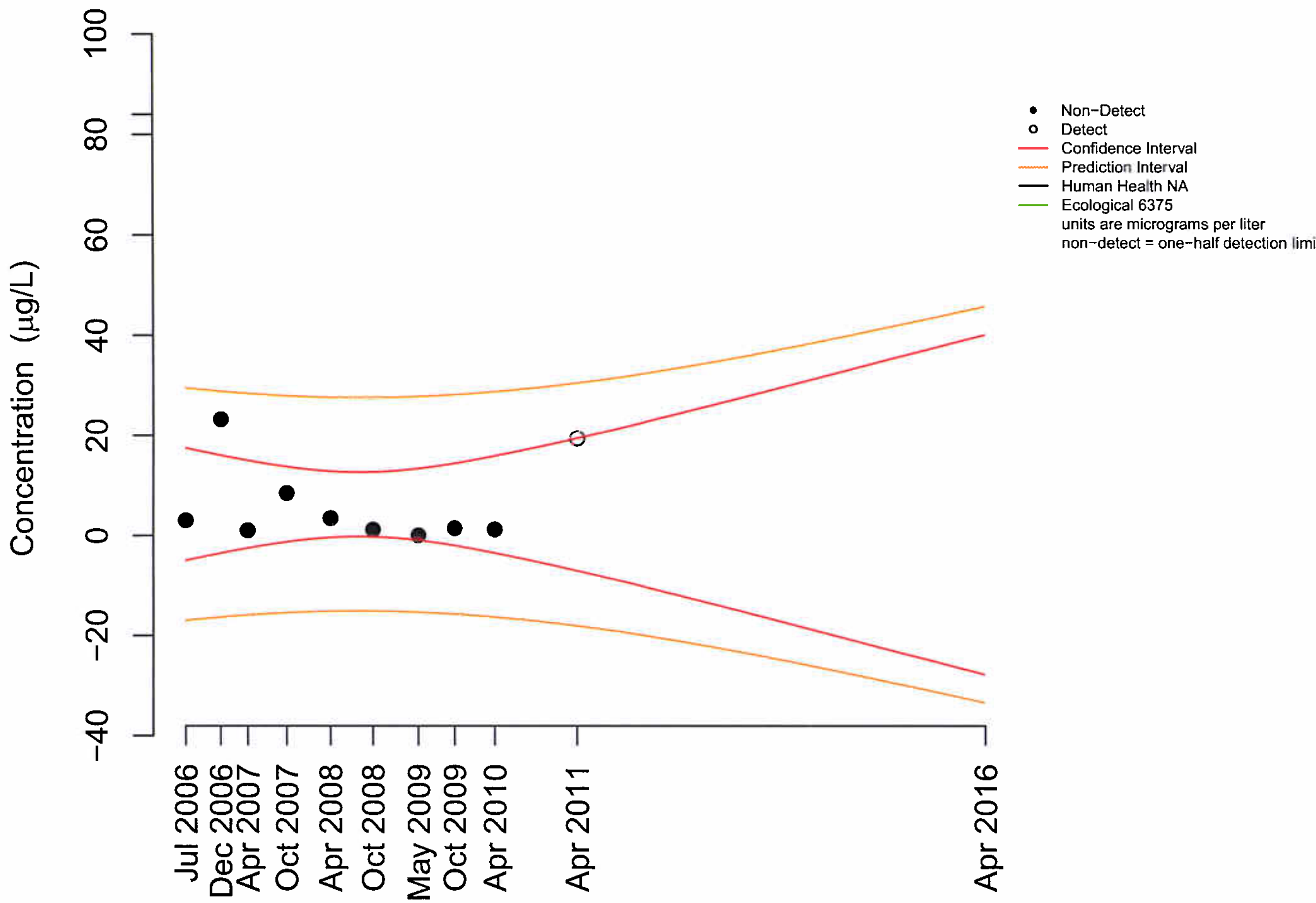
Downgradient well. Detections are low and do not indicate concentration trend increase. Round 10 result is similar to previous rounds.

FIGURE D.1. 12
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL THALLIUM AT JW−20
SECOND−FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



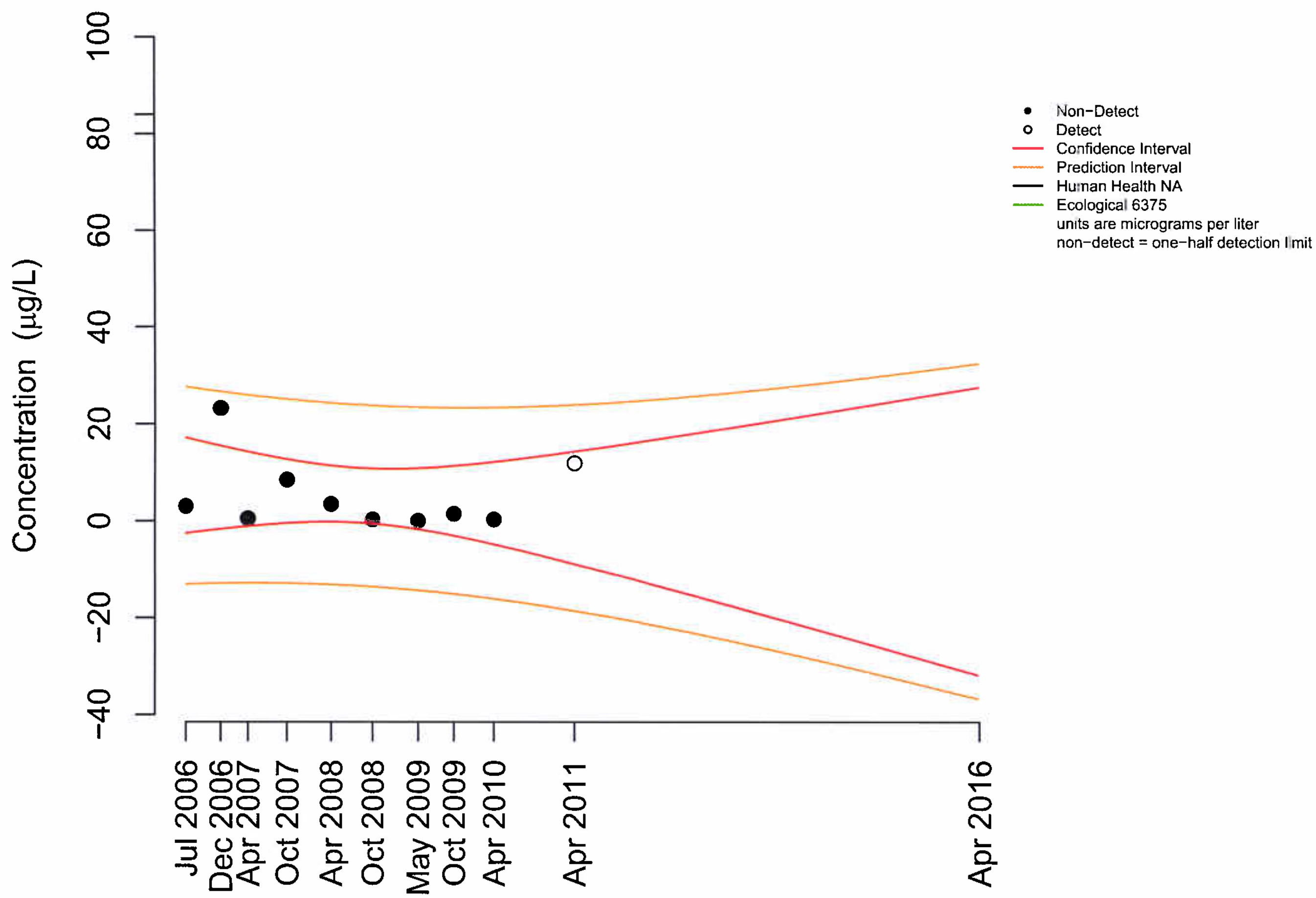
Downgradient well. Detection is low and results do not indicate concentration trend increase. Round 10 result is similar to previous rounds.

FIGURE D.1. 13
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL THALLIUM AT JW–21
SECOND–FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



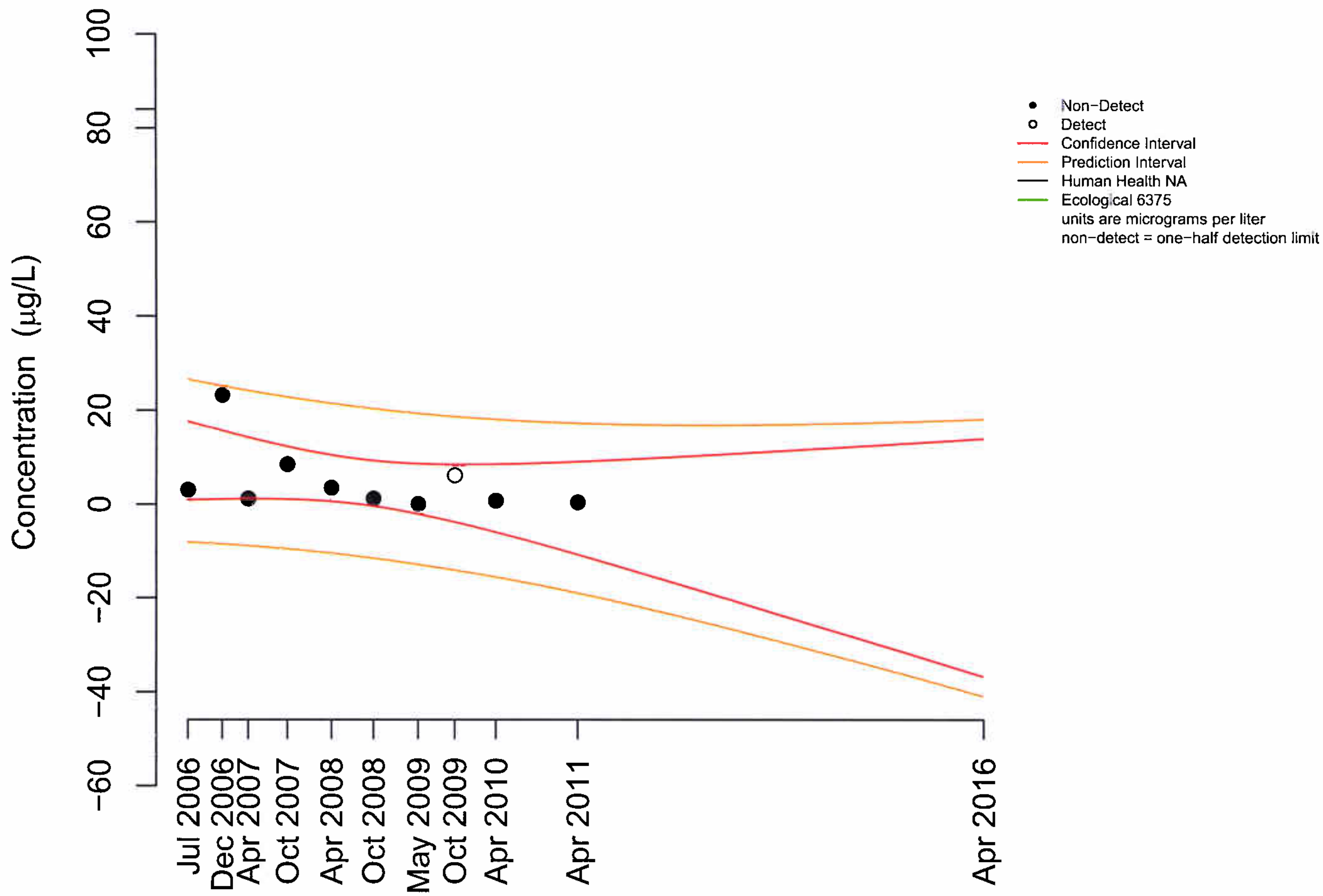
Downgradient well. Detected in Round 10 only, but concentration does not indicate a trend increase based on previous non-detected results.

FIGURE D.1. 14
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL THALLIUM AT JW−22
SECOND−FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



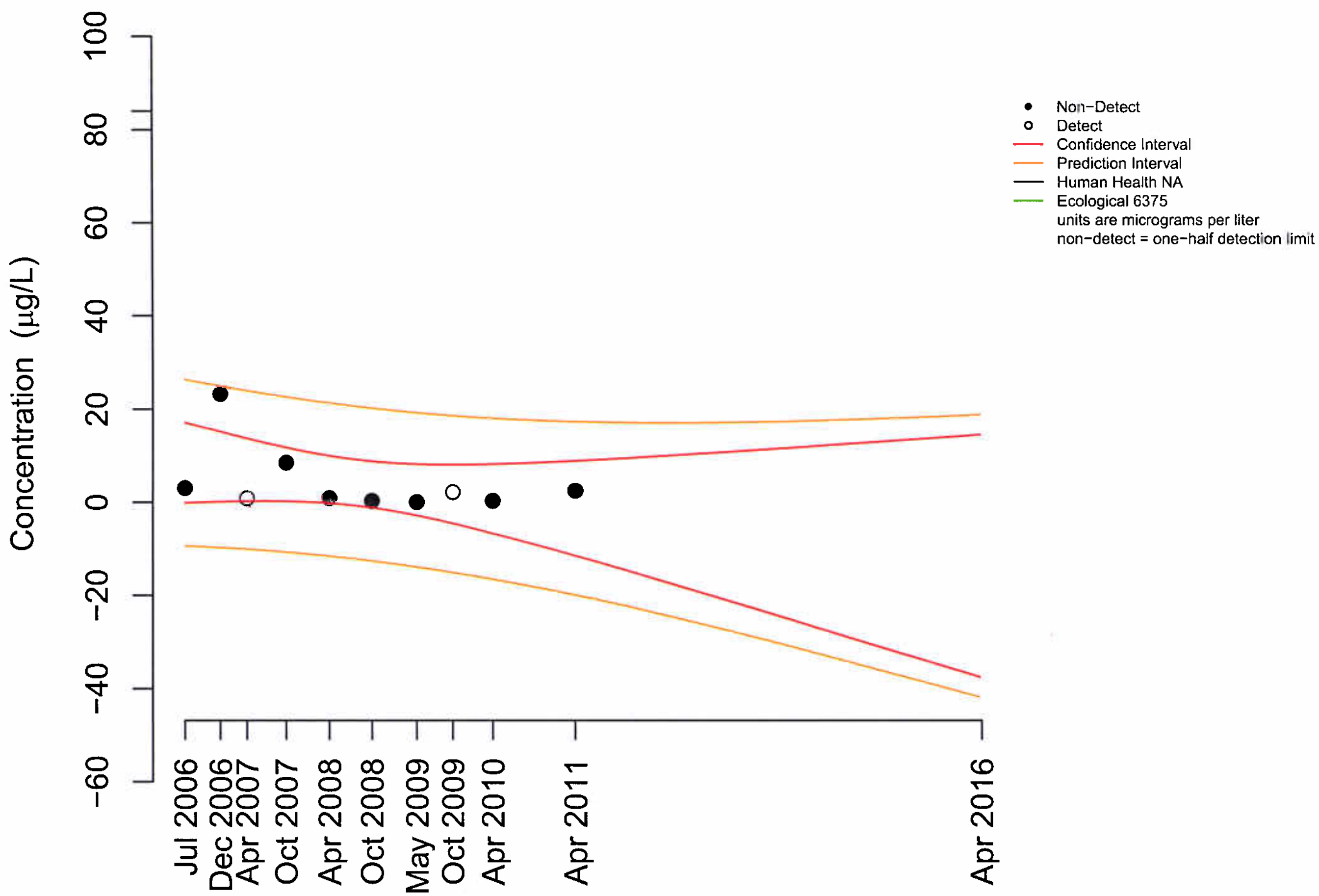
Downgradient well. Detected in Round 10 only, but concentration does not indicate a trend increase based on previous non-detected results.

FIGURE D.1. 15
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL THALLIUM AT JW-23
SECOND-FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



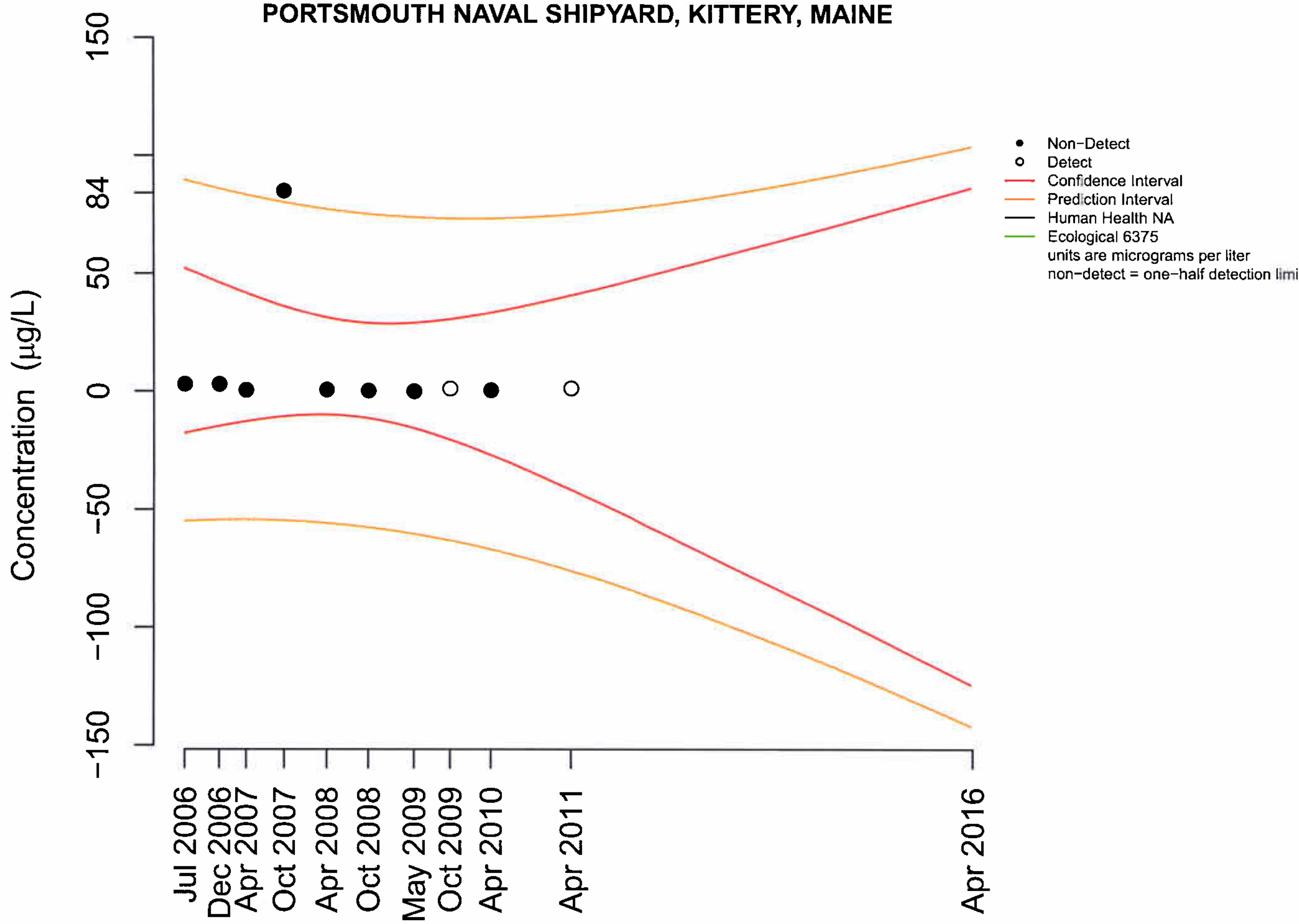
Downgradient well. Detection is low and results do not indicate concentration trend increase. Round 10 result is similar to previous rounds.

FIGURE D.1. 16
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL THALLIUM AT HW-2
SECOND-FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



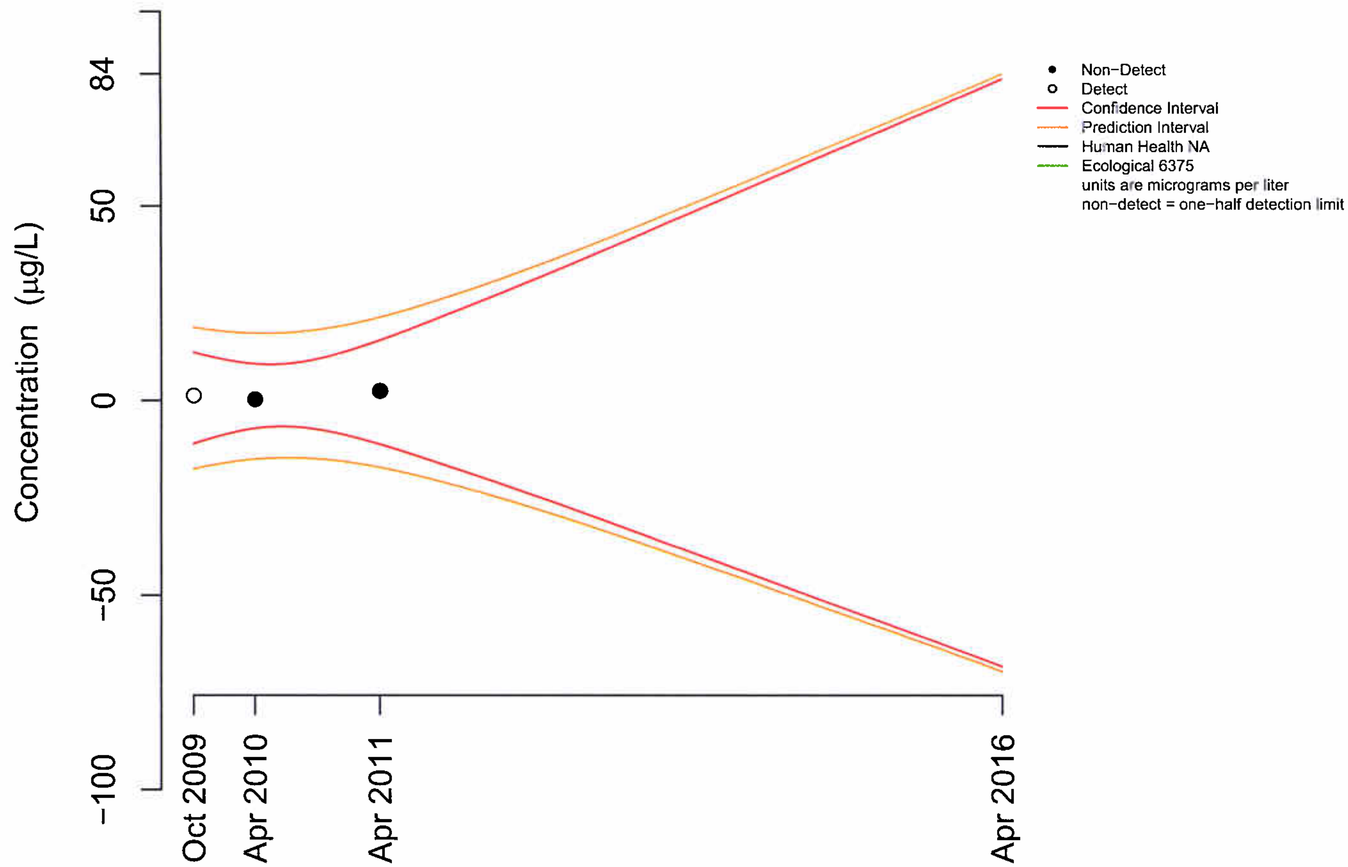
Upgradient well. Detections are low and do not indicate an increasing trend. Round 10 result is similar to previous rounds.

FIGURE D.1. 17
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL THALLIUM AT HW–3
SECOND–FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



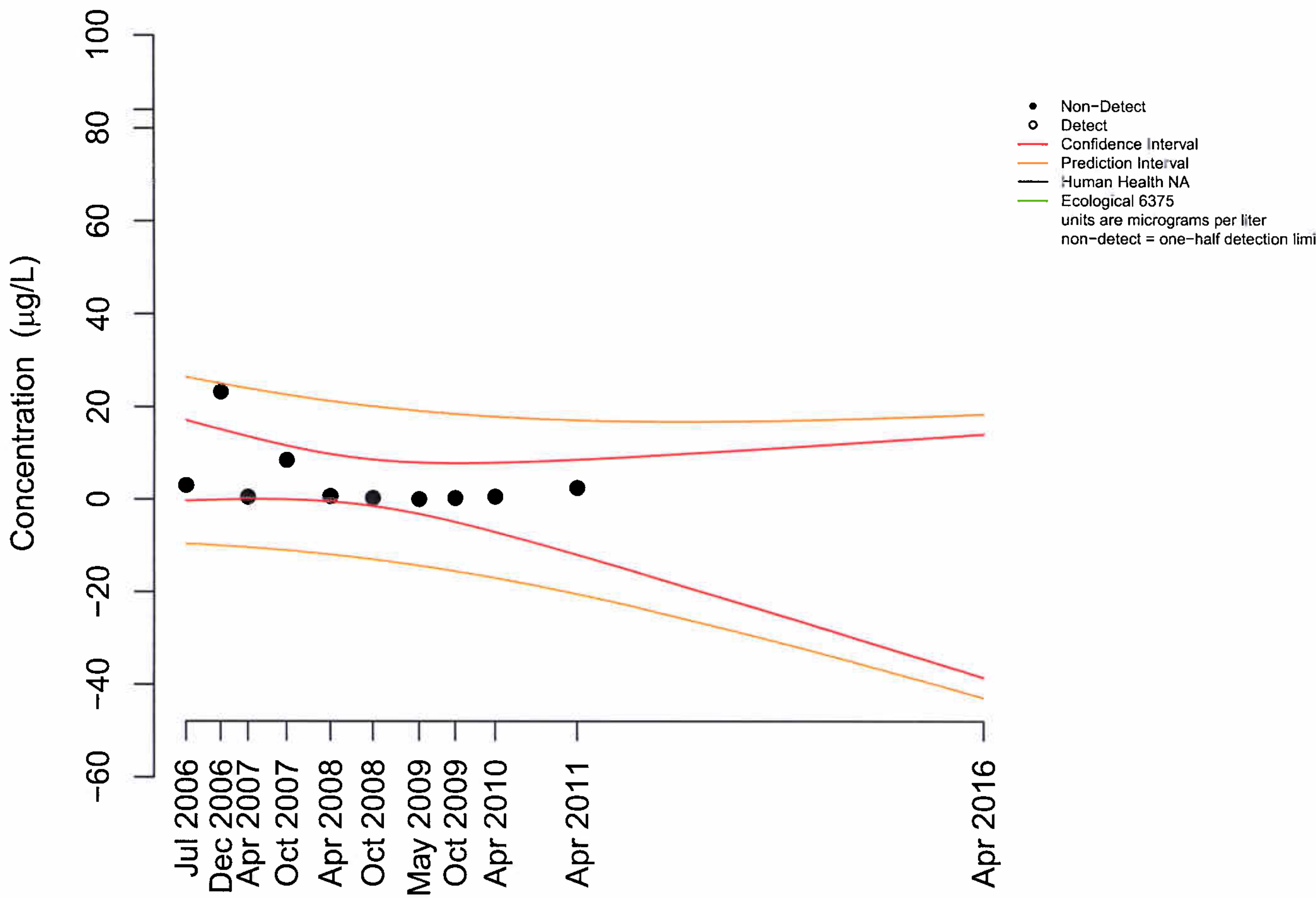
Upgradient well. Detections are low and do not indicate an increasing trend. Round 10 result is similar to previous rounds.

FIGURE D.1. 18
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL THALLIUM AT JW−7A
SECOND−FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



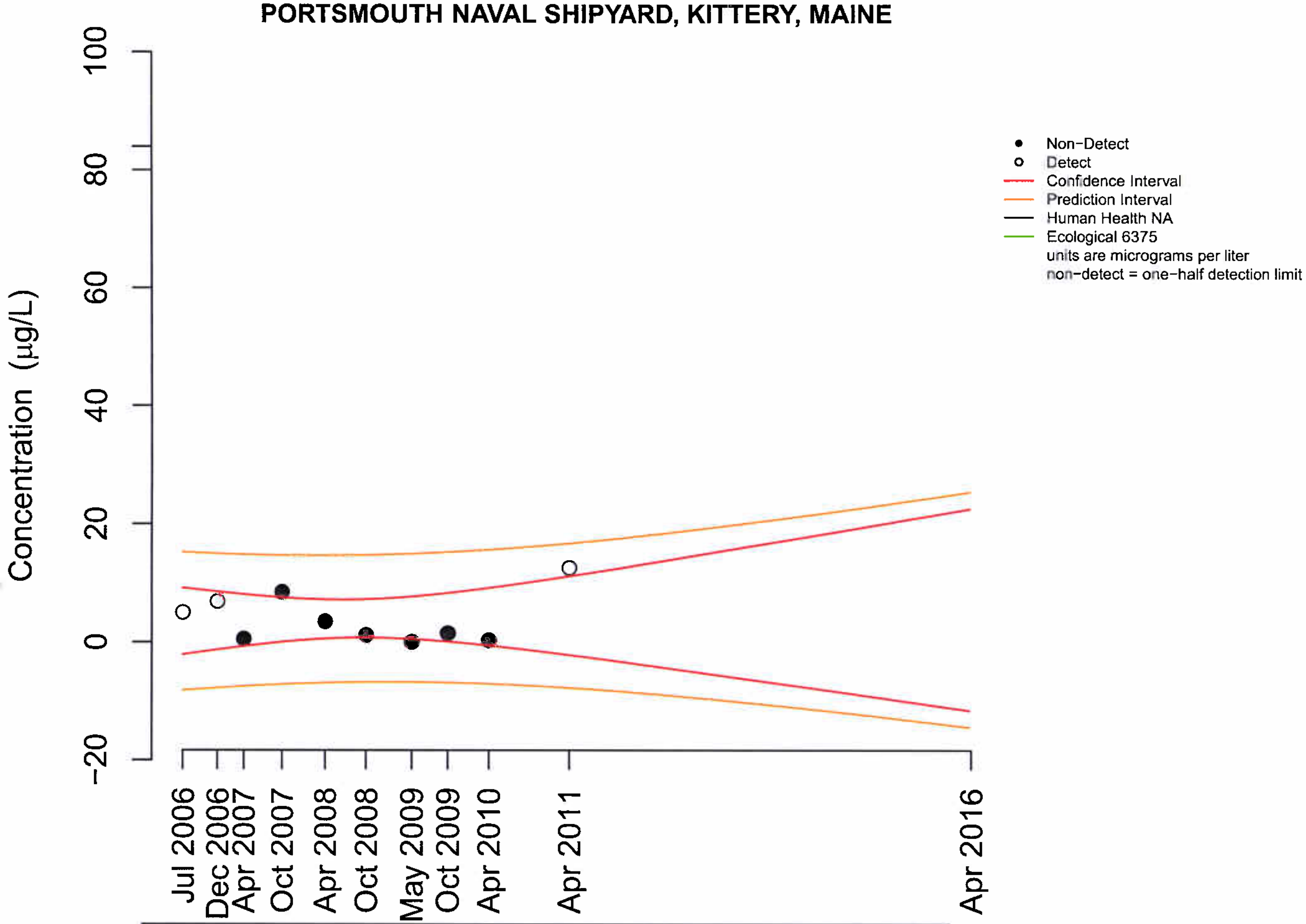
Upgradient well installed after Round 7. Small data set affects confidence and prediction bands; however, concentrations are similar to or less than the upgradient well.

FIGURE D.1. 19
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL THALLIUM AT JW−8
SECOND−FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



Upgradient well. Data do not indicate an increasing trend. Round 10 result is similar to previous rounds.

FIGURE D.1. 20
OU3 GROUNDWATER CONCENTRATION TREND PLOT
FOR TOTAL THALLIUM AT JW−9
SECOND−FIVE YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



Upgradient well. Detections are low and do not indicate an increasing trend. Round 10 detections slightly greater than previous detections.

APPENDIX D.2

OU4 DATA EVALUATION AND TREND PLOTS

OU4 DATA EVALUATION AND TREND PLOTS
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Operable Unit 4 (OU4) Interim Offshore Monitoring data were evaluated as part of the Rounds 1 through 10 Interim Offshore Monitoring Report (Tetra Tech, February 2010) and conclusions and recommendations regarding modifications to the interim offshore monitoring were made in that report. The Interim Offshore Monitoring Plan was updated (Revision 1, Tetra Tech, November 2010a) based on the recommendations, and Round 11 monitoring was conducted in April 2011 in accordance with the November 2010 Plan. In addition, the results of the Rounds 1 through 10 data evaluation have been used to develop remedial alternatives for monitoring stations with exceedances of Interim Remediation Goals (IRGs) (see discussion of IRGs in Section 5.0 of the Second Five-Year Review Report) as part of a feasibility study (FS) for OU4. The data evaluation herein compares the results of Round 11 to the previous rounds to determine whether concentrations in Round 11 are similar, lower, or greater than previous rounds and may change any conclusions regarding the monitoring program or affect the remedial alternative evaluation in the FS.

IRGs have been developed for copper, lead, nickel, acenaphythlyene, anthracene, fluorene, and high molecular weight (HMW) polycyclic aromatic hydrocarbons (PAHs), and as identified in the 2010 Interim Offshore Monitoring Plan, the appropriate chemicals for each monitoring station retained in the Interim Offshore Monitoring were analyzed during Round 11 for comparison to the IRGs. In addition, 4,4'-DDT, dioxins/furans, and polychlorinated biphenyls (PCBs) were identified in the Interim Offshore Monitoring program as potential chemicals of concern for select monitoring stations and were analyzed in Round 11 at these monitoring stations (MS-07, MS-08, and MS-09).

For the evaluation herein, calculation of toxicity equivalence (TEQ) values for dioxins/furans and dioxin-like polychlorinated biphenyls (PCBs), calculation of HMW PAHs, and preparation of trend plots were conducted in accordance with the method provided in the Rounds 1 through 10 Interim Offshore Monitoring Report. The appropriate plots for chemicals with IRGs at each monitoring station sampled during Round 11 were prepared as provided under the discussion of the individual monitoring stations. Round 11 metals data were analyzed using USEPA methods; however, previous rounds used a NOAA analytical method. To compare the Round 11 results for copper, lead, and nickel to previous rounds, metal-specific regression equations (from the Rounds 1 through 10 Report) were used to calculate NOAA estimated results for copper, lead, and nickel for Round 11. The plots use the estimated NOAA results for Round 11. Plots for 4,4'-DDT, dioxins/furans, and PCBs data were prepared for MS-07, MS-08, and MS-09 to compare to results of Round 11 to previous rounds to determine whether the results were consistent and whether these chemicals still do not present a potential unacceptable risk for the identified station. The concentration trend plots are attached to this discussion.

As provided in Table 5-3, interim offshore monitoring at monitoring station (MS)-02, MS-06, MS-10, MS-13, and MS-14 was discontinued after Round 10 because there are no exceedances of IRGs; therefore, no remedial alternatives are being evaluated for these monitoring stations. Although interim offshore monitoring is being continued to confirm the previous results for MS-05, MS-07, MS-08, and MS-09, there were also no recent IRG exceedances based on the Rounds 1 through 10 data evaluation and no remedial alternatives are being evaluated for these monitoring stations. Remedial alternatives are being evaluated for MS-01, MS-03, MS-04, MS-11, and MS-12, where there have been consistent or recent IRG exceedances. The following evaluation for each monitoring station identifies whether the Round 11 data support the remedy evaluation status for monitoring stations that remain in the interim offshore monitoring program.

Tables and concentration distribution figures with Rounds 1 through 10 data compared to IRGs were prepared for all monitoring stations to support the OU4 FS. These tables and figures are attached. Round 11 data are reported in the Round 11 Data Package (Tetra Tech, September 2011) and are included on the concentration trend plots that are attached. Figures 1-2, 5-1, and 5-3 of the Second Five-Year Review Report show the location of the offshore AOCs, monitoring stations, and onshore sites.

Evaluation of Monitoring Stations to Support the Five-Year Review

All monitoring stations are discussed below, even if the monitoring station was not sampled in Round 11, for complete understanding of the status of the monitoring stations.

MS-01 Evaluation

This monitoring station is located in the western portion of the Back Channel AOC, offshore of Site 34 (OU9). The onshore investigation indicated that Site 34 is not a current source, but was a historical source of PAHs to the offshore area. Source material at Site 34 was removed in 2007 as part of a non-time critical removal action. PAH concentrations in sediment were found to exceed IRGs based on the Rounds 1 through 7 interim offshore monitoring data. Sampling to delineate the extent of PAH contamination in sediment was conducted in 2009 as part of the Remedial Investigation (RI) for Site 34 and the results are being used to support delineation of the extent of contamination to support evaluation of remedial alternatives in the OU4 FS. Monitoring of sediment for PAHs was conducted at this station during Round 11. Interim offshore monitoring will be conducted every 5 years for PAHs at this monitoring station until a final remedy is implemented.

Trend plots with Rounds 1 through 11 PAH data compared to the IRGs for MS-01 were prepared (Figures D.2.1 through D.2.4). Round 11 concentrations were all less than IRGs and less than previous rounds (Rounds 1 through 7), indicating a decrease since the 2007 removal action. However, the 2009 sediment data, which provides PAH concentrations across the monitoring station, show there still may be exceedances of IRGs within the monitoring station (see the data table and concentration distribution figure for MS-01 attached). Based on the Round 11 results, natural recovery is occurring; however, the extent of the recovery across the station is not known. Monitored natural recovery and sediment removal are two remedial alternatives being evaluated for MS-01. The decrease in concentrations observed based on the results of Round 11 should be considered when selecting a remedial alternative for MS-01.

MS-02 and MS-10 Evaluation

These monitoring stations are located in the Back Channel and Sullivan Point AOCs, respectively, and are not located immediately offshore of any Installation Restoration Program (IRP) sites. Based on the Rounds 1 through 10 Report, no additional offshore monitoring or actions were needed for these stations because chemical concentrations in sediment are less than IRGs and the data do not indicate any impacts from known IRP sites (see the MS-02 and MS-10 data tables attached). PAH and metals concentrations detected in sediment at MS-02 were similar to or within the range of concentrations detected in the interim offshore monitoring reference stations. For MS-10, there were infrequent number of IRG exceedances over eight rounds of sampling, concentrations of COCs were relatively low in most samples, and the data did not indicate any impacts from IRP sites. Therefore, interim offshore monitoring was discontinued at these stations and no remedial alternatives need to be evaluated. No further action is required for these two monitoring stations.

MS-03 and MS-04 Evaluation

These monitoring stations are located in the eastern portion of the Back Channel AOC, offshore of Site 32 (OU7). Copper-contaminated foundry slag along the Site 32 shoreline was identified as the source of elevated copper concentrations at MS-03 and MS-04. One area of PAH-contaminated sediment was also found at MS-04. In June 2006, a time-critical removal action was conducted to provide shoreline erosion controls where significant erosion was occurring. As part of the removal action, surficial debris (including slag) was removed from the shoreline, and shoreline controls were placed along the entire Site 32 shoreline in the mid- to high tide area. Additional sampling was conducted in 2008 as part of the OU7 RI field work to determine the extent of copper and PAH contamination in exposed sediment in the intertidal area (in the mid- to low tide area). Monitoring of sediment for PAHs and copper was conducted at these stations during Round 11. Interim offshore monitoring will be conducted every 5 years for PAHs and copper until a final remedy is implemented.

Trend plots with Rounds 1 through 11 PAH and copper data compared to the IRGs for MS-03 and MS-04 were prepared (Figures D.2.5 through D.2.14). Round 11 concentrations were generally less than IRGs and less than previous rounds (Rounds 1 through 7), indicating a decrease since the 2008 removal action. Copper contamination around MS-03, Loc 2 and copper and PAH contamination around MS-04, Loc 1 was previously identified. For MS-03, there are still copper IRG exceedances at Loc 2 based on Round 11 data and 2008 RI sediment data (see the data table and concentration distribution figures for MS-03/MS-04 attached). Some natural recovery appears to have occurred, but copper contamination still remains in sediment at this location. For MS-04, copper and PAH concentrations in Round 11 and 2008 RI sediment data indicate there are no longer exceedances of IRGs at Loc 1 and that natural recovery is occurring. Monitored natural recovery and sediment removal are two remedial alternatives being evaluated for MS-03 and MS-04. The relatively stable copper concentration at MS-03, Loc 2 and decrease in copper and PAH concentrations at MS-04 Loc 1 should be considered when selecting a remedial alternative for MS-03 and MS-04.

MS-05 and MS-06 Evaluation

MS-05 and MS-06 are located in the Jamaica Cove AOC, offshore of the constructed wetlands adjacent to OU3. As part of the remedial action, contaminated landfill material was removed adjacent to Jamaica Cove and wetlands were constructed in the excavated area. Prior to the OU3 remedial action, metals and PAH concentrations in sediment at MS-05 and MS-06 were less than the IRGs. After the remedial action, an increase in copper, lead, and nickel concentrations in sediment in MS-05 was observed, such that copper and lead concentrations exceeded IRGs. MS-06 concentrations continued to remain less than IRGs. Additional sampling was conducted at MS-05 to determine the extent of concentrations exceeding IRGs. Monitoring of sediment for PAHs and metals was conducted at MS-05 during Round 11.

Trend plots with MS-05 Rounds 1 through 11 PAH, copper, lead, and nickel data compared to the IRGs were prepared (Figures D.2.15 through D.2.21). Although an increase in concentrations was observed at some locations after implementation of the OU3 remedial action, the increase was temporary. Lead and copper concentrations were less than IRGs in Rounds 10 and 11. Because there are no recent IRG exceedances, no remedial alternatives were evaluated for MS-05 and no further action is required for this monitoring station. However, interim offshore monitoring will be conducted at MS-05 until a final remedy is implemented and the frequency and analytes are every 5 years for PAHs and metals and every 2 years in between the five-year sampling rounds for copper, lead, and nickel. The additional sampling as part of the interim offshore monitoring program will provide confidence that concentrations continue to be at acceptable levels before implementation of a final remedy for OU4.

Based on the evaluation in the Rounds 1 through 10 Report, MS-06 has not had any exceedances of IRGs (see the attached data table for MS-06) indicating that sediment in the offshore area adjacent to

OU3 has not been impacted by OU3. Therefore, interim offshore monitoring was discontinued at this station and no remedial alternatives need to be evaluated. No further action is required for this monitoring station.

MS-07, MS-08, and MS-09 Evaluation

MS-07, MS-08, and MS-09 are located in the Clark Cove AOC. MS-08 and MS-09 are immediately offshore of OU3, and MS-07 is in the offshore area adjacent to OU3. Remedial action conducted at OU3 included excavation of wastes from the offshore area within MS-08, and placement of shoreline controls along the entire OU3 shoreline. Because of the placement of shoreline controls, there is no longer sediment in the intertidal area of MS-09, and monitoring station locations were moved as needed to the subtidal area where sediment is present. Because an increase in chemical concentrations was identified within MS-09 after OU3 remedial action construction, additional scrutiny was conducted to delineate the area of elevated chemical concentrations.

Based on the Rounds 1 through 10 data evaluation, continued interim offshore monitoring was recommended for MS-08 and MS-09. Interim offshore monitoring will be conducted until a final remedy is implemented and the frequency and analytes are every 5 years for PAHs, metals, 4,4'-DDT, PCBs, and dioxins/furans and every 2 years in between the five-year sampling rounds for PAHs, copper, lead, nickel, 4,4'-DDT, and dioxins/furans. MS-07 was identified as a reference station for MS-08 and MS-09 because it is not immediately adjacent to OU3 and concentrations in sediment at MS-07 indicate it has not been impacted by OU3 (no IRG exceedances and consistent and low concentrations detected). Interim offshore monitoring at MS-07 will be conducted every 5 years for the same analytes as MS-08 and MS-09 (PAHs, metals, 4,4'-DDT, PCBs, and dioxins/furans) until a final remedy is selected. Monitoring of sediment at MS-07, MS-08, and MS-09 was conducted in Round 11.

Trend plots with MS-07, MS-08, and MS-09 Rounds 1 through 11 PAH, copper, lead, and nickel data compared to the IRGs were prepared. In addition, trend plots were made for 4,4'-DDT, and toxicity equivalent values (TEQs) for PCBs (TEQ PCBs) and dioxins/furans (TEQ dioxins/furans). The calculation of TEQs were made based on potential human health exposure to intertidal sediment (TEQ PCB and TEQ dioxins/furans values), on potential bird exposure to sediment (TEQ PCBs bird and TEQ dioxins/furans bird values), and on potential fish exposure to sediment (TEQ PCB fish and TEQ dioxins/furans fish values). For MS-09, there is no intertidal sediment; therefore, TEQ PCB and TEQ dioxins/furans values were not calculated. Figures D.2.22 through D.2.35 provide the trend plots for MS-07, D.2.36 through D.2.49 provide the trend plots for MS-08, and D.2.50 through D.2.61 provide the trend plots MS-09.

Although an increase in concentrations after the OU3 remedial action was observed at some locations, the increase was temporary. Copper, lead, and nickel concentrations have not exceeded IRGs after Round 7 at MS-08 and after Round 8 at MS-09. PAH concentrations have not exceeded IRGs at MS-08 or MS-09 except for one exceedance of fluorene IRG in Round 7 and three exceedances of HMW PAH IRG in Rounds 7 and 8 at MS-09. The other organic compounds (4,4'-DDT, PCBs, and dioxins/furans) were analyzed to confirm that these chemicals remain low and are not potential chemicals of concern for MS-08 and MS-09. The results of Round 11 indicate concentrations are low and consistent with previous rounds.

Because there are no recent IRG exceedances, no remedial alternatives were evaluated for MS-07, MS-08, and MS-09 and no further action is required for these monitoring stations. The additional sampling as part of the interim offshore monitoring program will provide confidence that concentrations continue to be at acceptable levels before implementation of a final remedy for OU4.

MS-11 Evaluation

This monitoring station is located in the DRMO Storage Yard AOC offshore of OU2. Before shoreline erosion controls were in place along the entire OU2 shoreline, erosion of metals-contaminated soil along a portion of the OU2 shoreline (by Site 6) was identified in 1999 and along the eastern portion of OU2 shoreline (eastern portion of Site 29) in 2005. Time-critical removal actions were conducted to prevent further erosion of contaminants by placing shoreline erosion controls along the portions of the OU2 shoreline where erosion controls were needed. The Piscataqua River offshore of OU2 has a fast current and there is only a small area of potential sediment accumulation adjacent to the OU2 shoreline within MS-11. There is a small amount of sediment present at the one sampling location in this area. Sediment is not present in other portions of MS-11. Previously, sediment concentrations at the other two sampling locations were estimated from mussel data using mussel-sediment concentration correlation data. Additional scrutiny was conducted to confirm that elevated concentrations of metals (copper, lead, and nickel) in MS-11 sediment on the eastern side of the monitoring station were likely from erosion from OU2. Rounds 8, 9, and 10 sampling were not required for MS-11. Because the area where sediment is present is too small to present significant risks, sampling to determine extent of contamination was also not required. Monitoring of sediment for copper, lead, and nickel was conducted at this station during Round 11.

Trend plots with Rounds 1 through 11 copper, lead, and nickel data compared to the IRGs for MS-11 are attached (Figures D.2.62 through D.2.64). Round 11 concentrations were less than IRGs and much less than previous rounds (Rounds 1 through 7), indicating a decrease since the 2005 removal action. Because the Round 11 data were not available to show a decrease in metals concentrations, remedial alternatives were developed for this monitoring station in the FS report. There is not sufficient sediment to cause an unacceptable risk, therefore, the only alternative identified was monitored natural recovery (in addition to no action). The results of Round 11 support that no further action is needed for MS-11.

MS-12 Evaluation

This station is located in the Dry Dock AOC, offshore of Site 10 (OU1). One industrial waste outfall (part of Site 5) discharged in the offshore area of Site 10, apparently from past Site 10 operations and other operations nearby. Site 5 and Site 10 are no longer sources of contamination to the offshore area. Therefore, there are no current IRP sources to MS-12. Maintenance dredging, conducted by the Shipyard in 2009 by the dry dock east of MS-12 (Dry Dock 2 which is east of Site 10), was not in the vicinity of the Round 11 sample locations. Elevated lead and PAH concentrations were detected in sediment at MS-12, which may be caused by a combination of sources that may or may not be related to PNS, including potential migration or transport from IRP sites, discharges from barges/boats, discharges from storm water outfalls located in the vicinity of the shipyard, and dock-side activities. Additional scrutiny was required for MS-12 to determine the extent and potential sources of contamination. Rounds 8, 9, and 10 sampling were not required for MS-12. Monitoring of sediment for PAHs and lead was conducted at this station during Round 11. Additional sediment samples near one location with elevated lead concentrations (AS12-SD12) were also collected and analyzed for lead. Interim offshore monitoring will be conducted every 5 years for PAHs and lead until a final remedy is implemented. In addition, during the five-year sampling round and every 2 years in between five-year sampling rounds, additional sediment sampling near AS12-SD12 for lead analysis will be conducted until a final remedy is implemented.

Trend plots of MS-12 PAH and lead data compared with IRGs are attached (Figures D.2.65 through D.2.69). PAH concentrations were lower in Round 11 than previously; however, concentrations still exceed IRGs. Some natural recovery may be occurring for PAH in sediment. Although lead concentrations at the interim offshore monitoring locations do not exceed IRGs, concentrations of lead at the locations by AS12-SD12 (not included on the trend plots) exceed IRGs. In addition, other locations on the boat ramp going into Building 178 (see the figure of MS-12 attached), have lead concentrations greater than IRGs. Monitored natural recovery and sediment removal are two remedial alternatives being evaluated for MS-12. An area of contamination by Building 178 (PAH and lead) and an area of contamination by AS12-SD12 (lead) has been delineated for the remedial alternative evaluation. The additional samples for lead around AS12-SD12 should be considered when determining the actual remediation areas for MS-12.

MS-13 and MS-14 Evaluation

These stations are located in the Dry Dock AOC to monitoring sediment potentially impacted by Site 31 (OU8). Industrial waste outfalls (part of Site 5) had discharge points in this area, but these discharges were discontinued by 1975. The area by MS-13 was dredged between January and April 2002 (between Rounds 5 and 6). Maintenance dredging was conducted by the Shipyard in 2009 in the southeastern portion of MS-13 (by Dry Dock 1) and south of MS-14 (along Berth 13). Potential sources of PAHs detected in sediment at these stations that may or may not be related to PNS include potential migration or transport from IRP sites, discharges from barges/boats, discharges from storm water outfalls located in the vicinity of the shipyard, and dock-side activities. Round 8 sampling was required for these monitoring stations; additional scrutiny was not required. PAH concentrations in most samples were less than IRGs. No additional monitoring or action are needed at these stations because of infrequent number of exceedances of IRGs over the eight rounds of sampling and because the data do not indicate any impacts from IRP sites. Therefore, interim offshore monitoring was discontinued at these stations and no remedial alternatives need to be evaluated. No further action is required for these two monitoring stations.

Conclusions and Recommendations

Based on the evaluation of the Round 11 data in comparison with the results of the evaluation of the Rounds 1 through 10 data, the following conclusions and recommendations are made:

- Consistent and recent exceedances of IRGs were identified at MS-01, MS-03, MS-04, and MS-12 and remedial alternative evaluation is warranted. Round 11 concentrations were lower at the interim offshore monitoring locations at MS-01, MS-03, and MS-04 than previously and suggest that natural recovery is occurring. The results of Round 11 should be considered in the selection of remedial alternatives for MS-01, MS-03, MS-04, and MS-12.

- MS-11 concentrations have reduced to less than IRGs. Because there is little sediment for ecological exposure and concentrations are low, it is recommended that no further action be considered for MS-11 during the selection of remedial action.

- MS-05, MS-08, and MS-09, offshore of OU3, do not have exceedances of IRGs in recent rounds and therefore no further action is necessary at these monitoring stations. In addition, the data for 4,4'-DDT, PCBs, and dioxins/furans are low and similar to previous concentrations and these chemicals are not at levels of concern at these monitoring stations. These stations are still included in the interim offshore monitoring program; however, the Round 11 data supports that further monitoring of these stations is not warranted. Because 4,4'-DDT, PCBs, and dioxins/furans concentrations remain low, action levels (e.g., IRGs or PRGs) are not required and therefore, it is recommended that analyses of these chemicals be discontinued as part of the interim offshore monitoring program or any future monitoring program that includes the offshore area of OU3. MS-07 is only included in the interim offshore monitoring program as a reference location for MS-08 and MS-09; therefore, any changes in monitoring at MS-08 and MS-09 should also be made for MS-07 (e.g., reduction of analyte list or discontinuation of monitoring). Consistent with the results of Rounds 10 and 11, no further action should be considered for these monitoring stations.

- No sampling at MS-02, MS-06, MS-10, MS-13, and MS-14 was conducted in Round 11 because there have been no exceedances or no recent exceedances of IRGs indicating sediment at these monitoring stations has not been adversely impacted by onshore IRP sites. These stations were removed from the interim offshore monitoring program and no further action should be considered as the final remedy for these monitoring stations.

References

Tetra Tech, February 2010. Rounds 1 through 10 Interim Offshore Monitoring Program Report for Operable Unit 4, Portsmouth Naval Shipyard, Kittery, Maine. Tetra Tech, Inc., King of Prussia, Pennsylvania.

Tetra Tech, November 2010a. Final Interim Offshore Monitoring Plan (Revision 1) for Operable Unit 4, Revision 1 for Portsmouth Naval Shipyard, Kittery, Maine. Tetra Tech, Inc., King of Prussia, Pennsylvania.

Tetra Tech, September 2011. Round 11 Data Package for Operable Unit 4 at Portsmouth Naval Shipyard, Kittery, Maine. Tetra Tech, Inc., King of Prussia, Pennsylvania.

OU4 TREND PLOTS

FIGURE D.2. 1
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ACENAPHTHYLENE AT MS−01
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

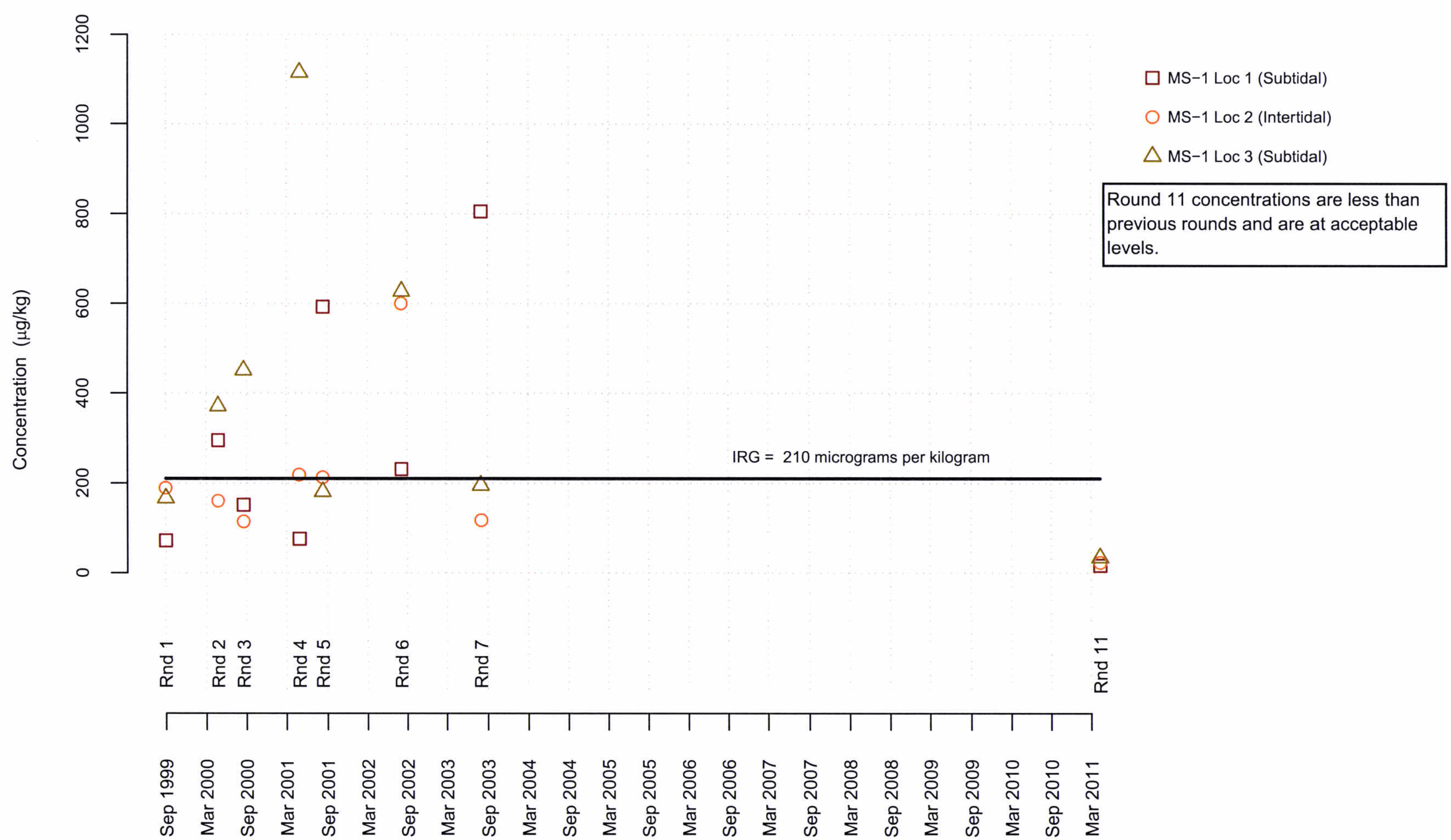


FIGURE D.2. 2
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ANTHRACENE AT MS−01
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

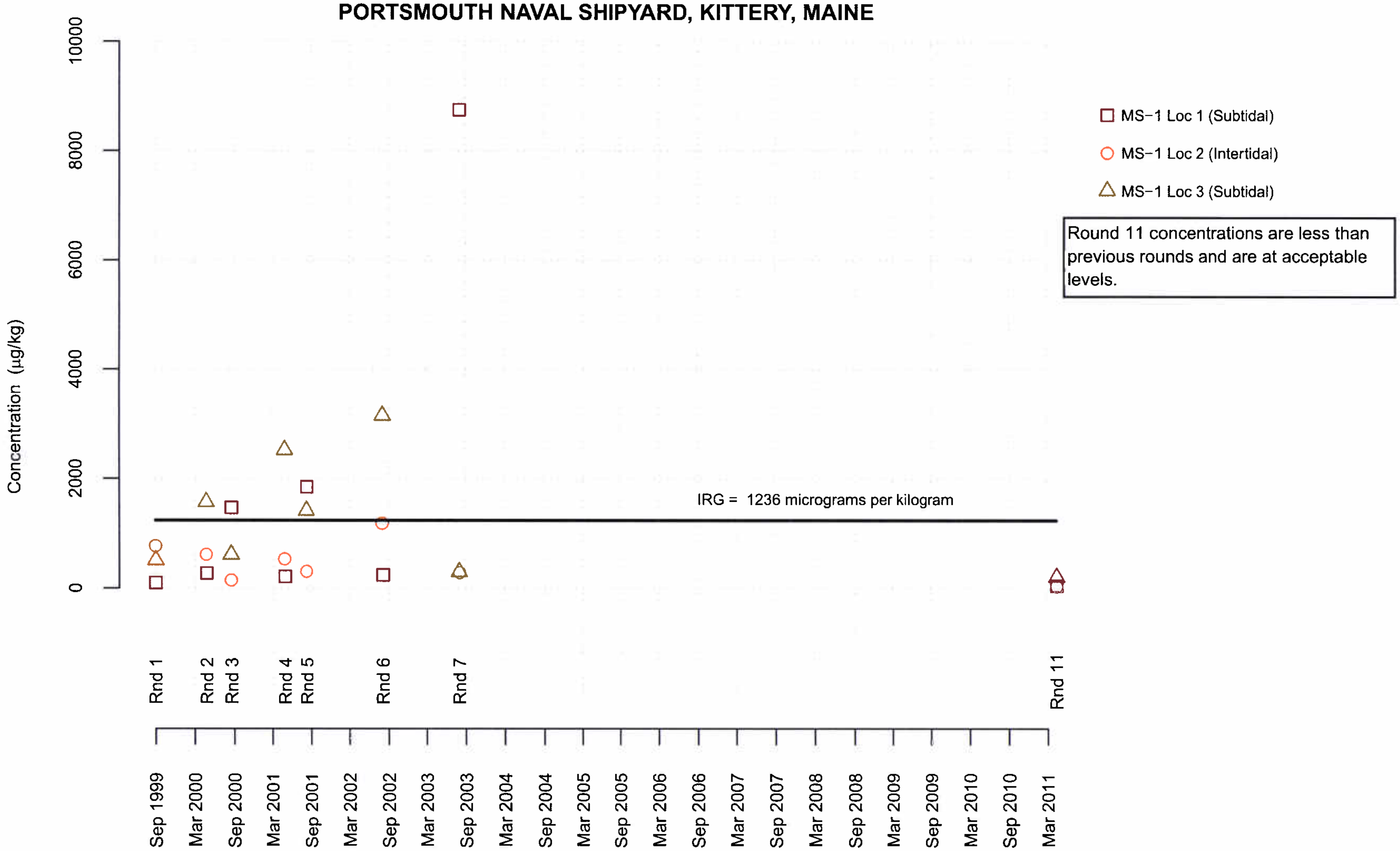


FIGURE D.2. 3
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR FLUORENE AT MS-01
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

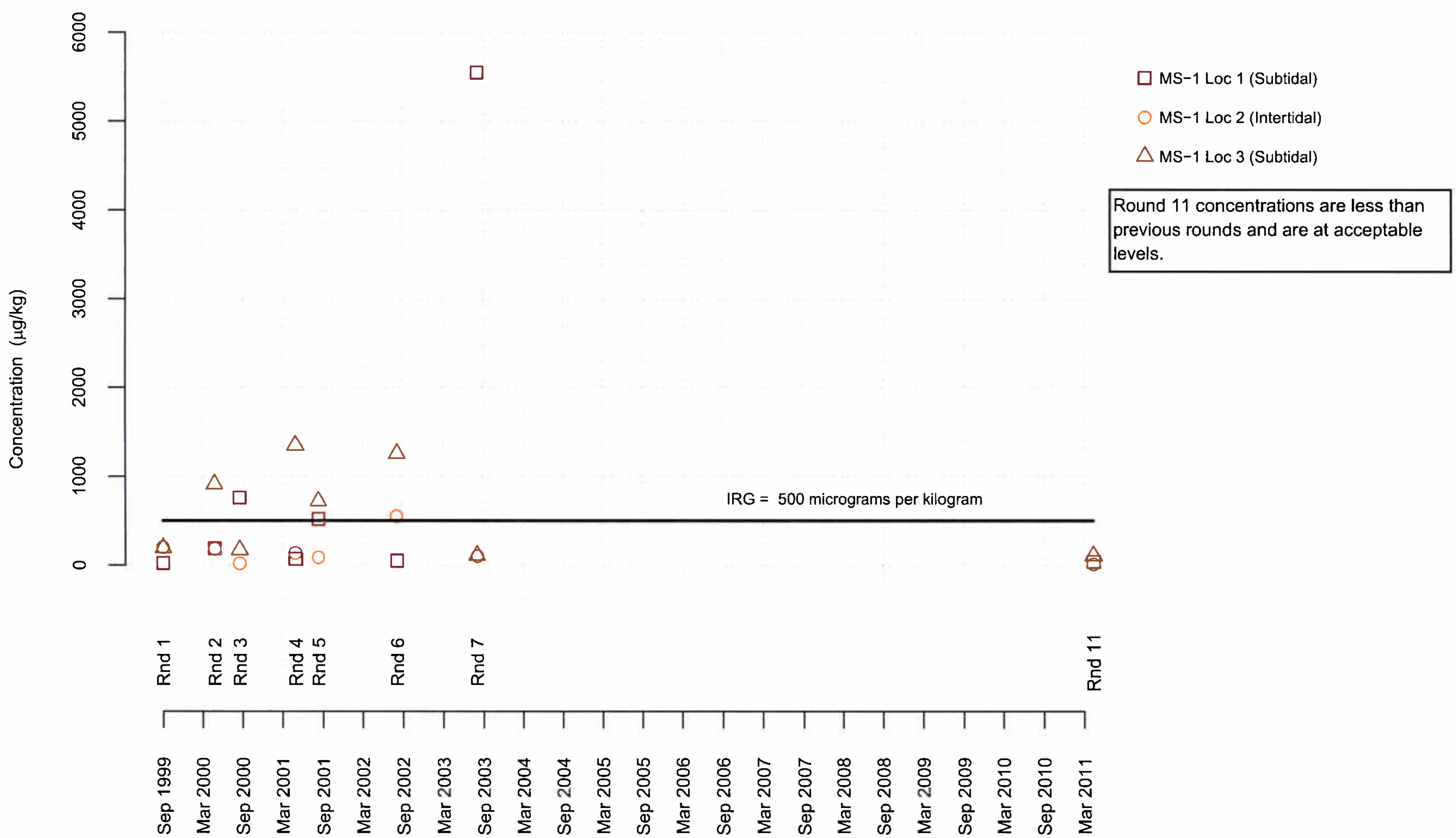


FIGURE D.2. 4
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS−01
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

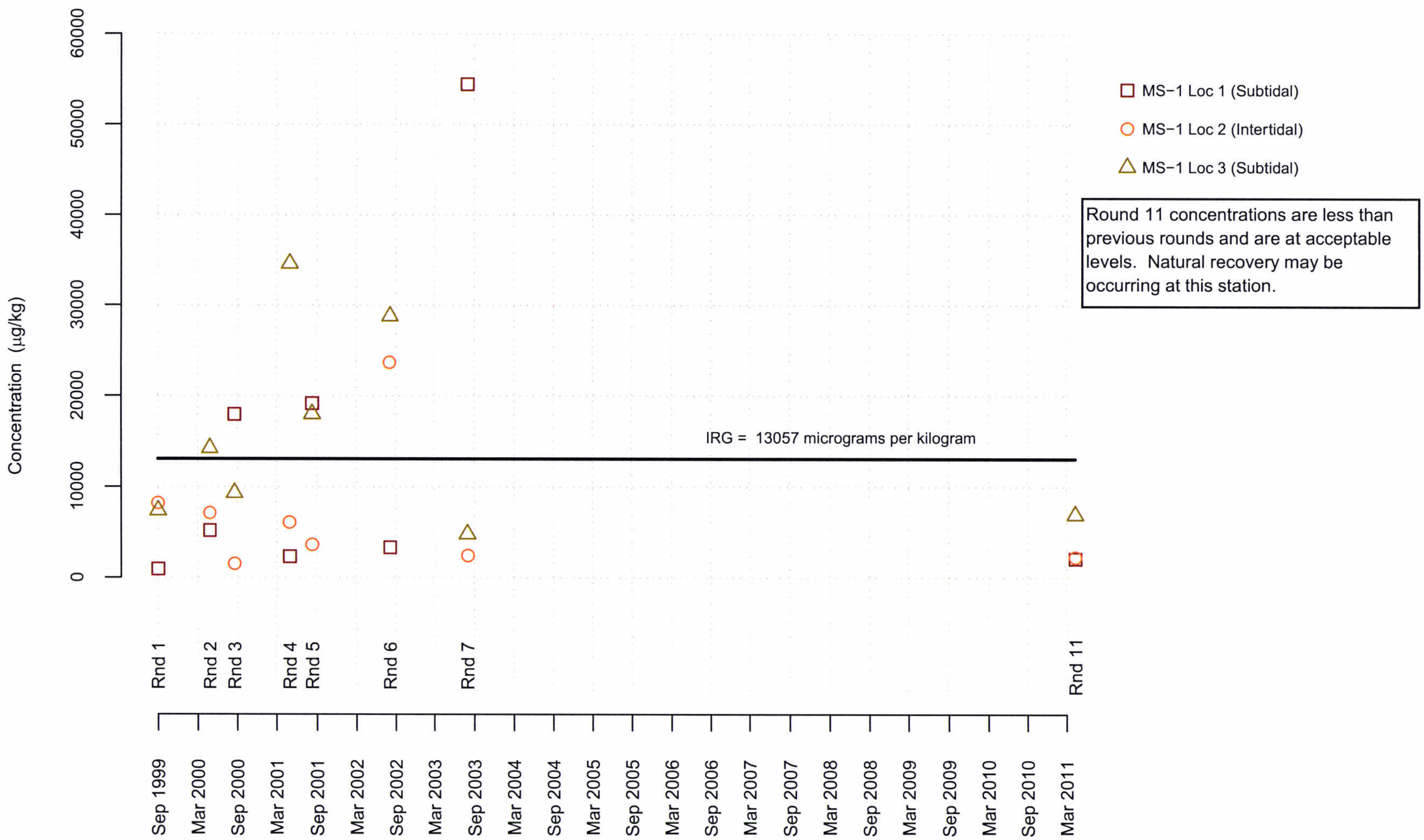


FIGURE D.2. 5
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS−03
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

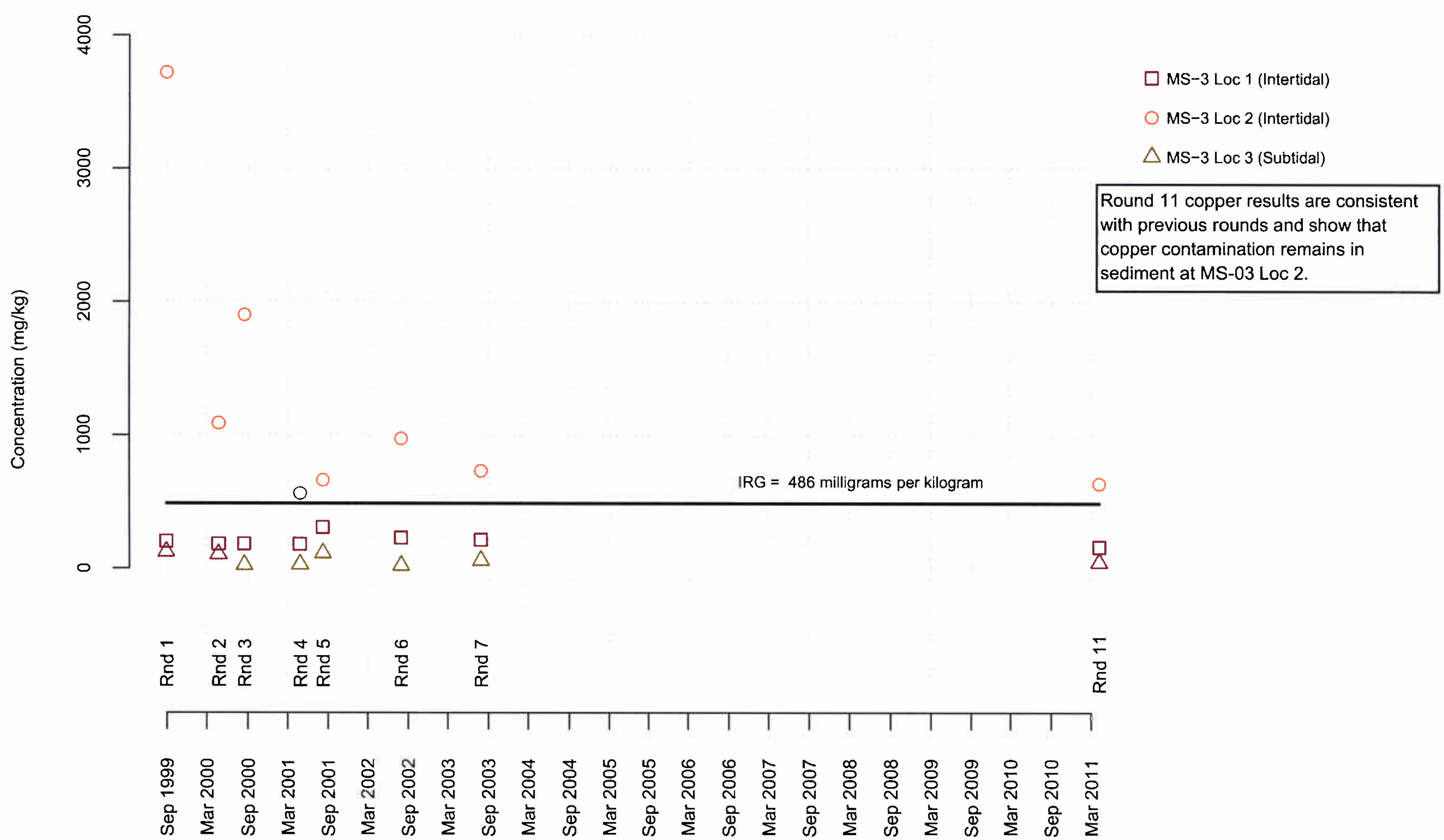


FIGURE D.2. 6
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ACENAPHTHYLENE AT MS-03
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

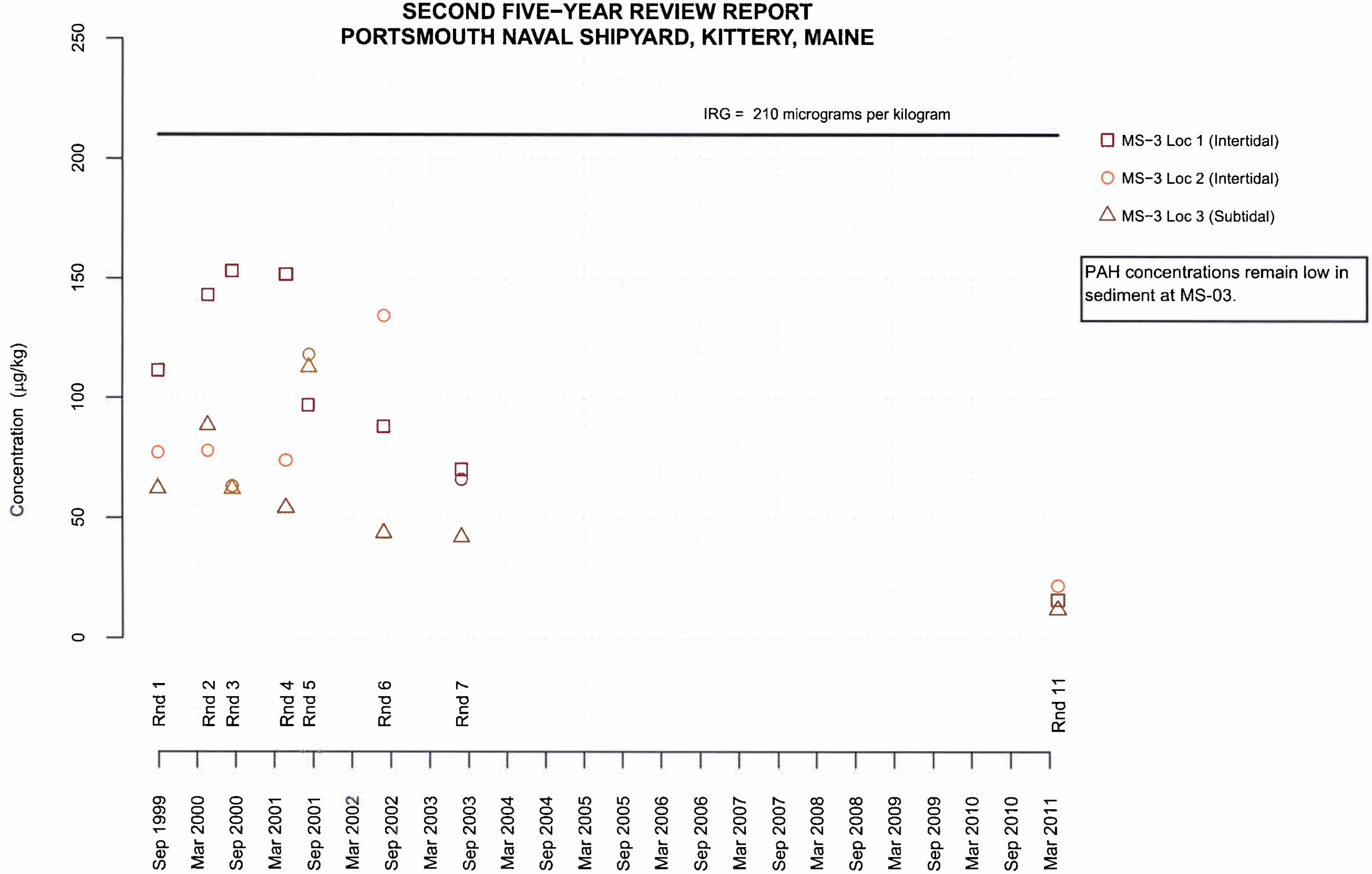


FIGURE D.2. 7
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ANTHRACENE AT MS-03
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

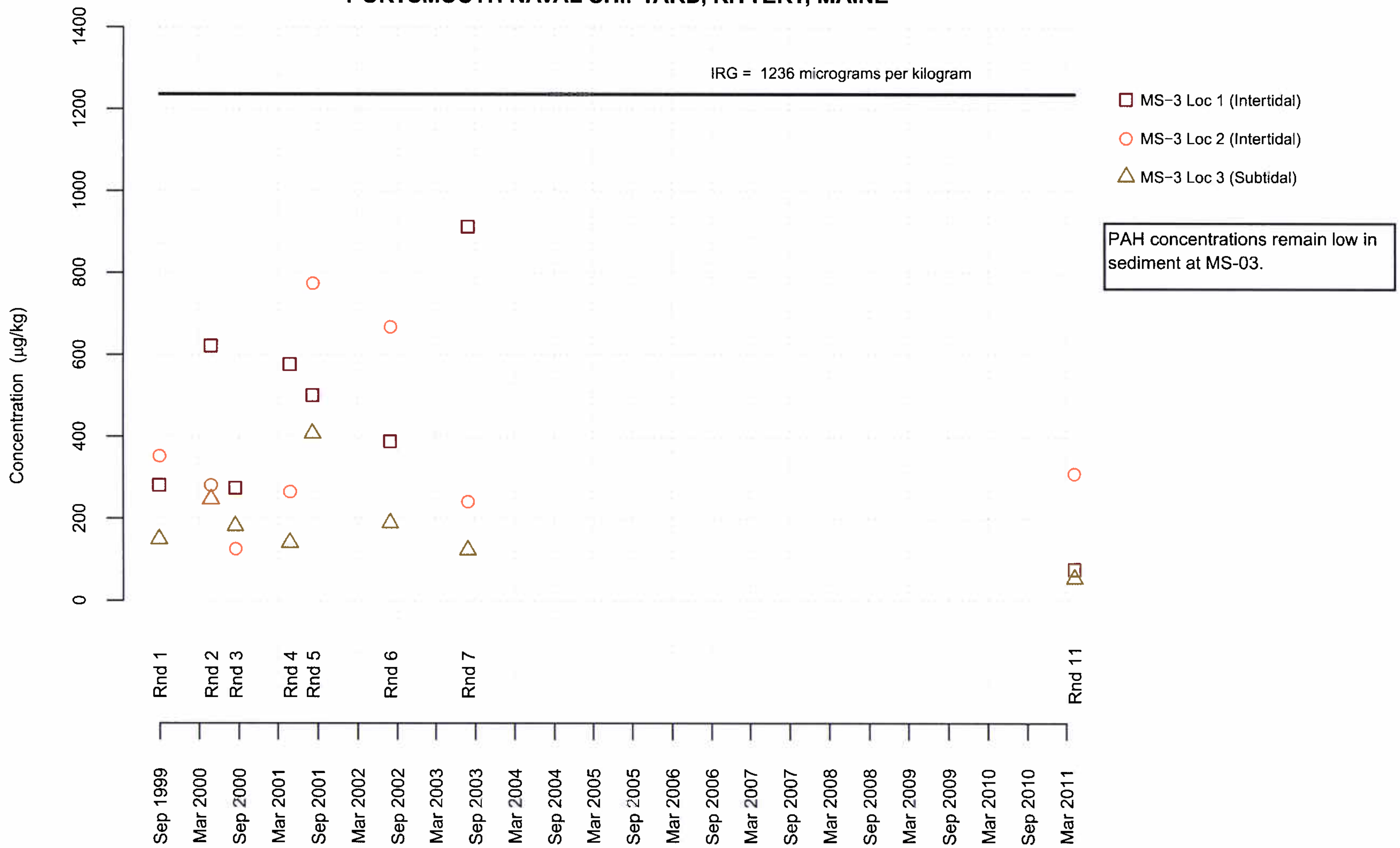


FIGURE D.2. 8
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR FLUORENE AT MS−03
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

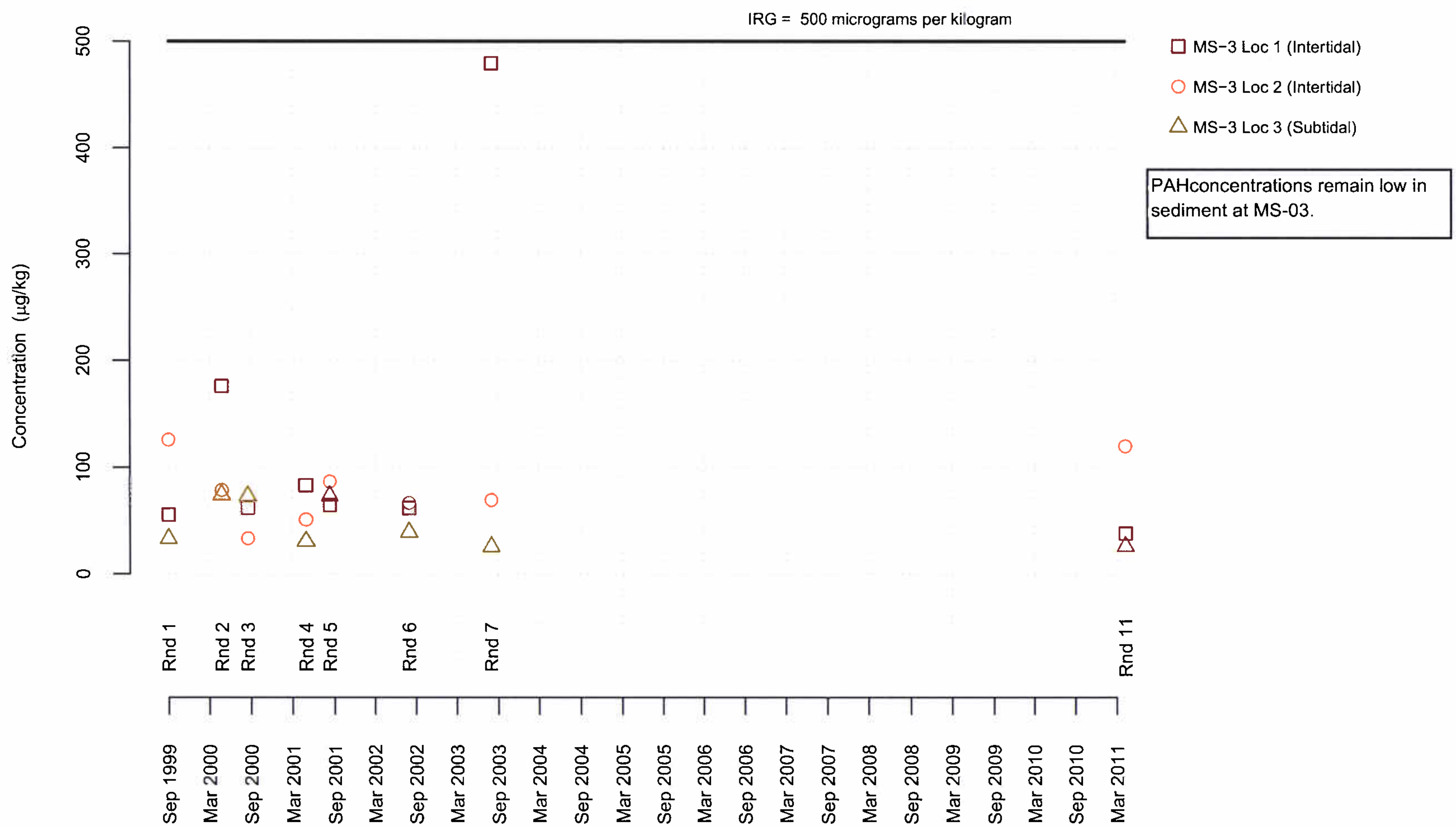
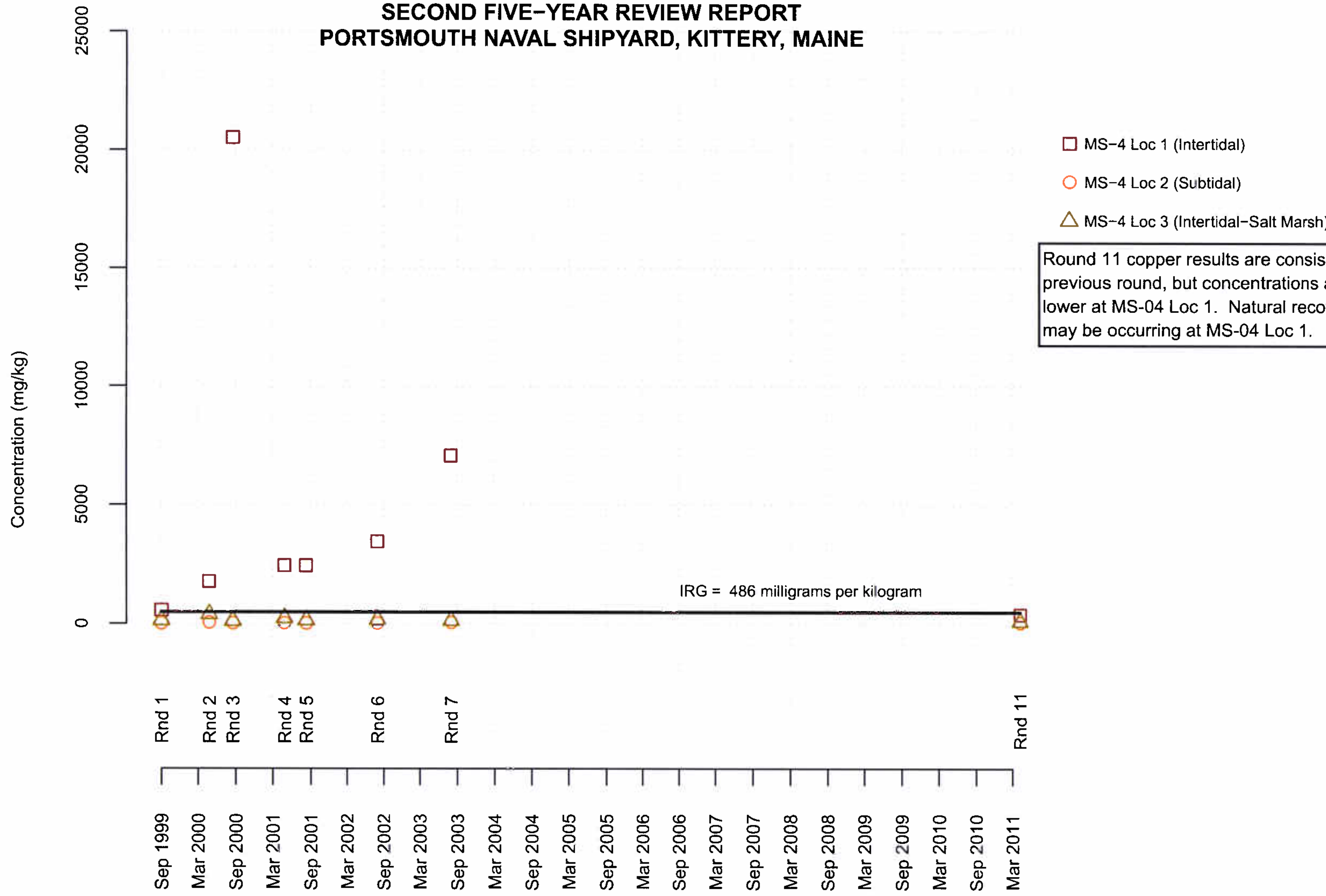


FIGURE D.2. 9
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS−03
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

FIGURE D.2. 10
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS−04
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



Round 11 copper results are consistent with previous round, but concentrations are lower at MS-04 Loc 1. Natural recovery may be occurring at MS-04 Loc 1.

FIGURE D.2. 11
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ACENAPHTHYLENE AT MS−04
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

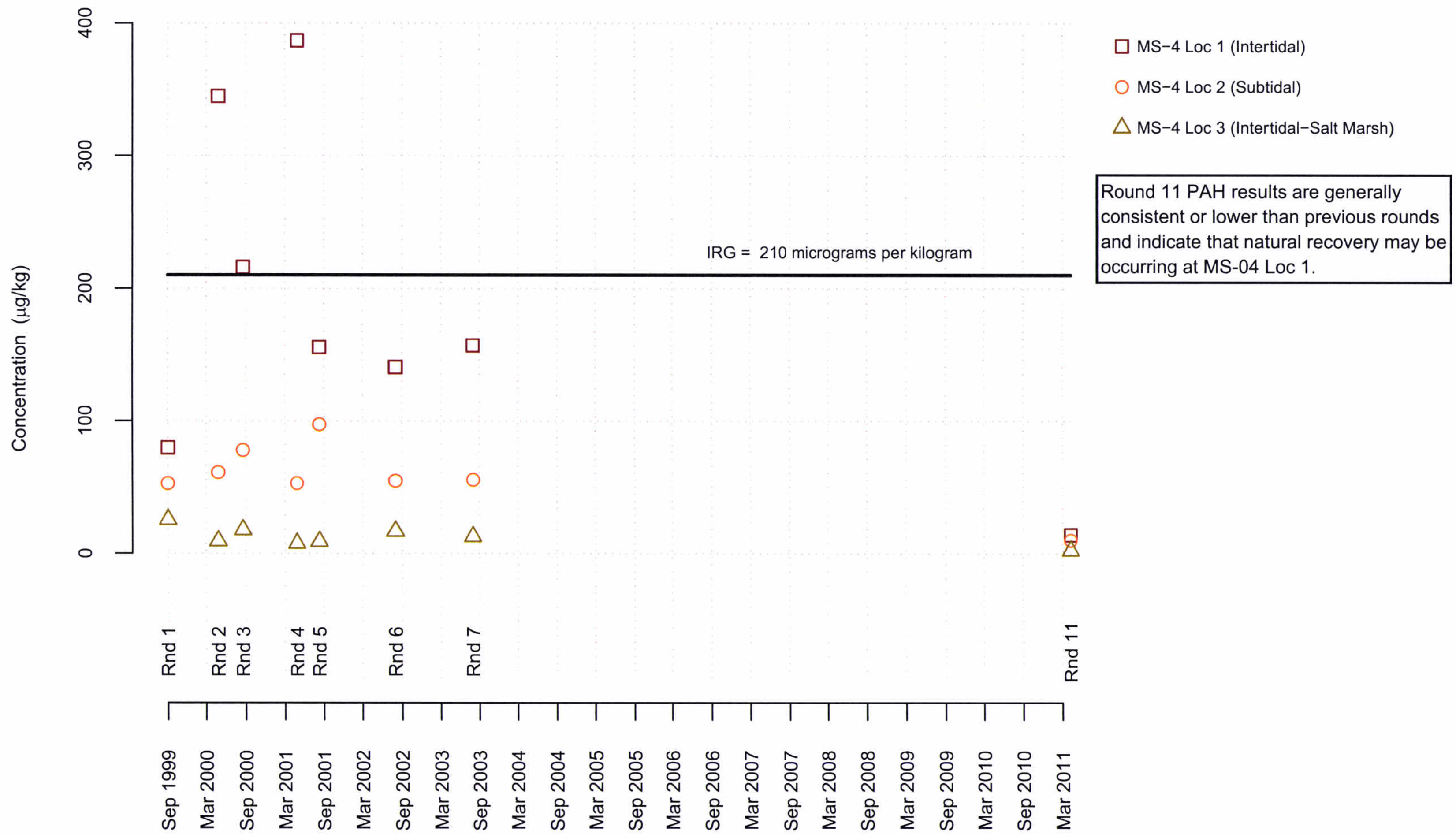


FIGURE D.2. 12
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ANTHRACENE AT MS−04
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

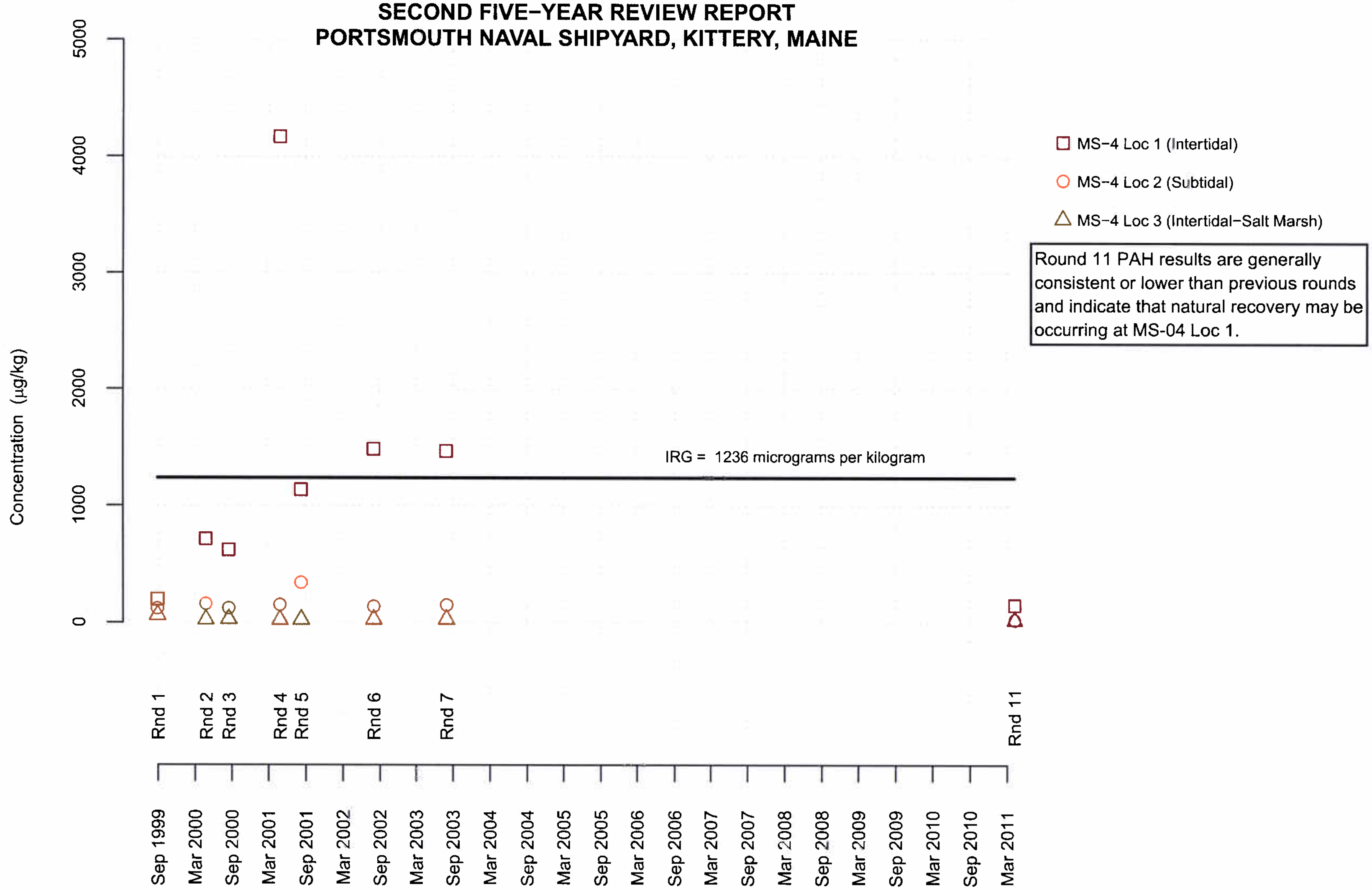


FIGURE D.2. 13
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR FLUORENE AT MS−04
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

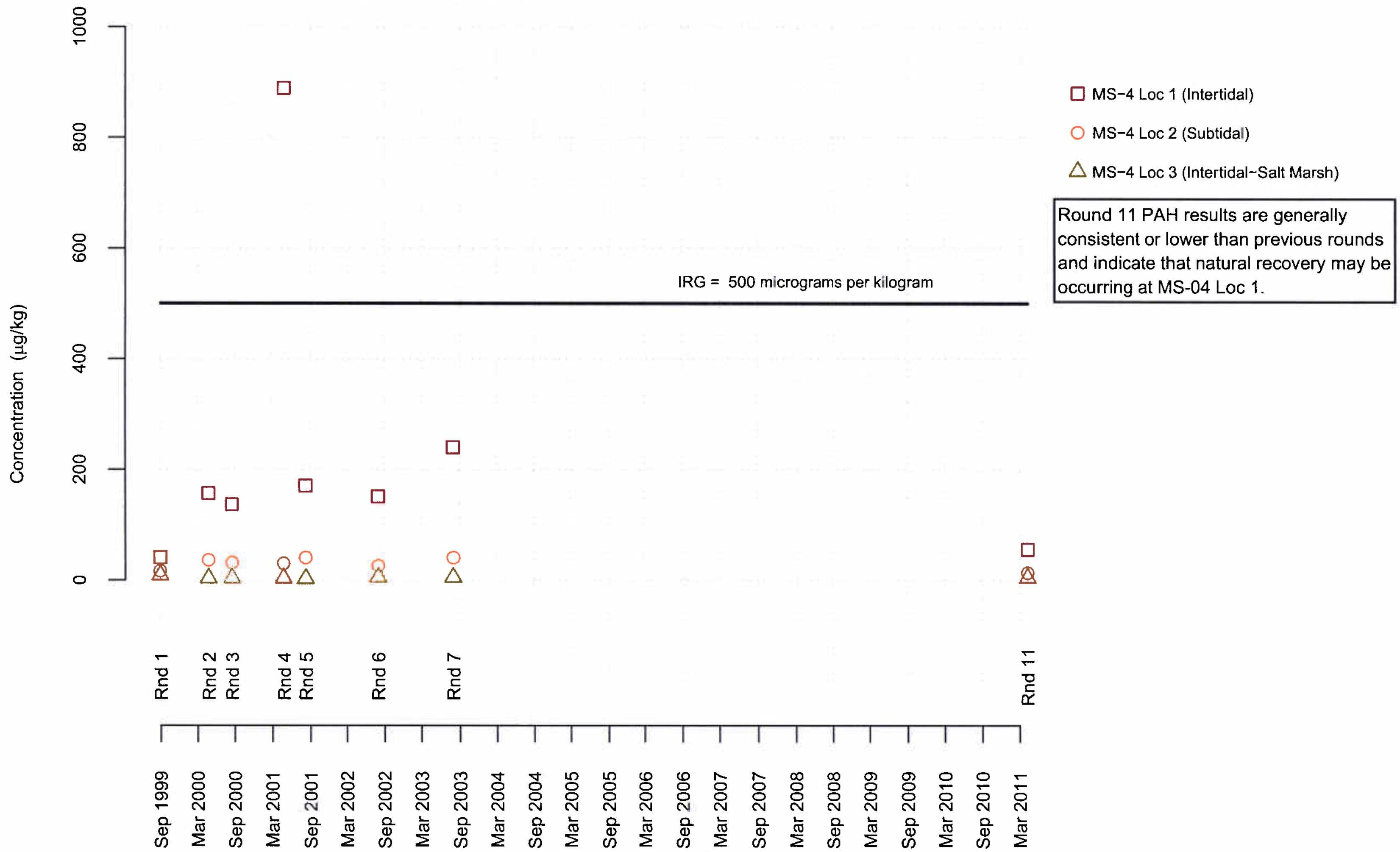


FIGURE D.2. 14
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS−04
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

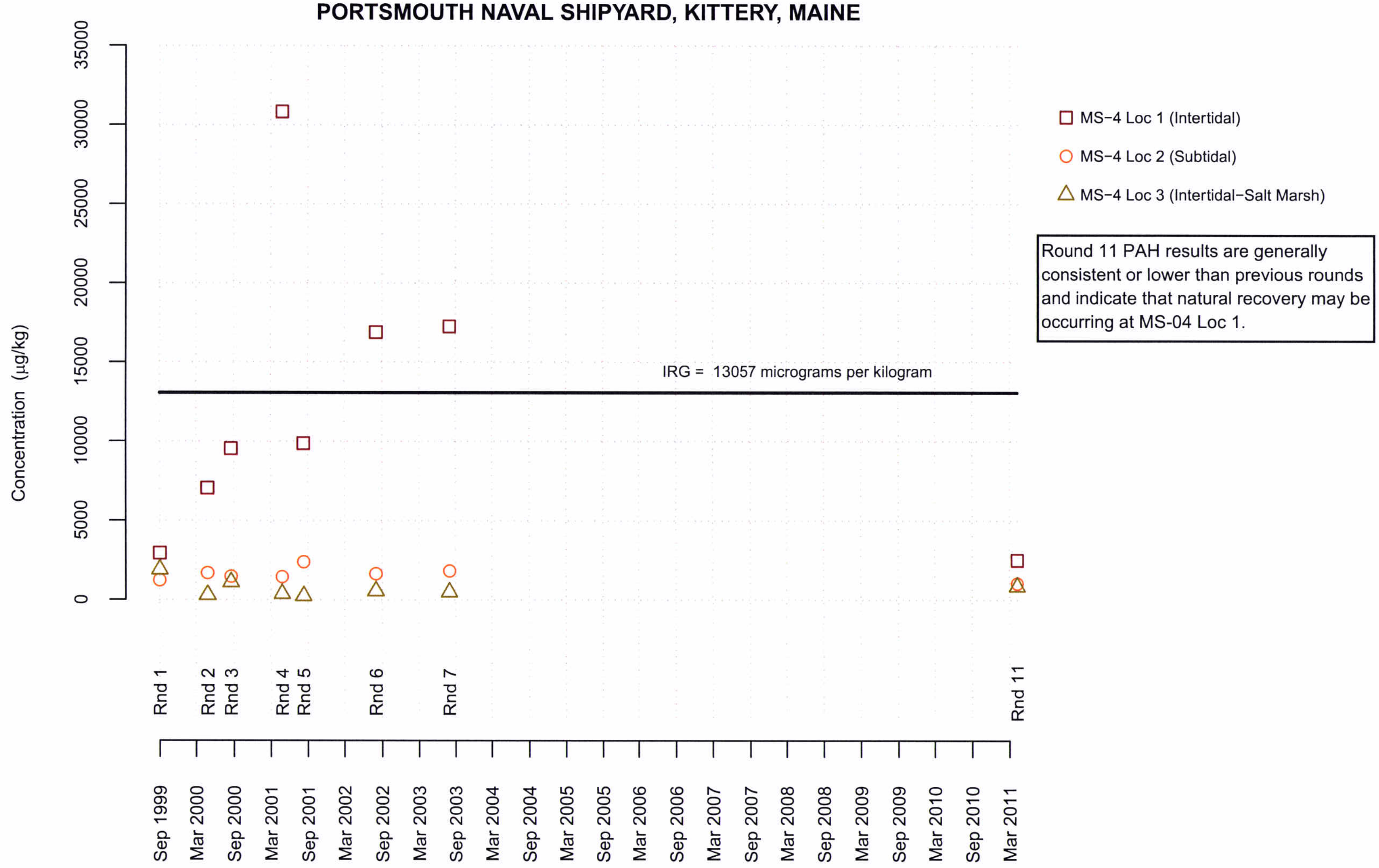


FIGURE D.2. 15
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS-05
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

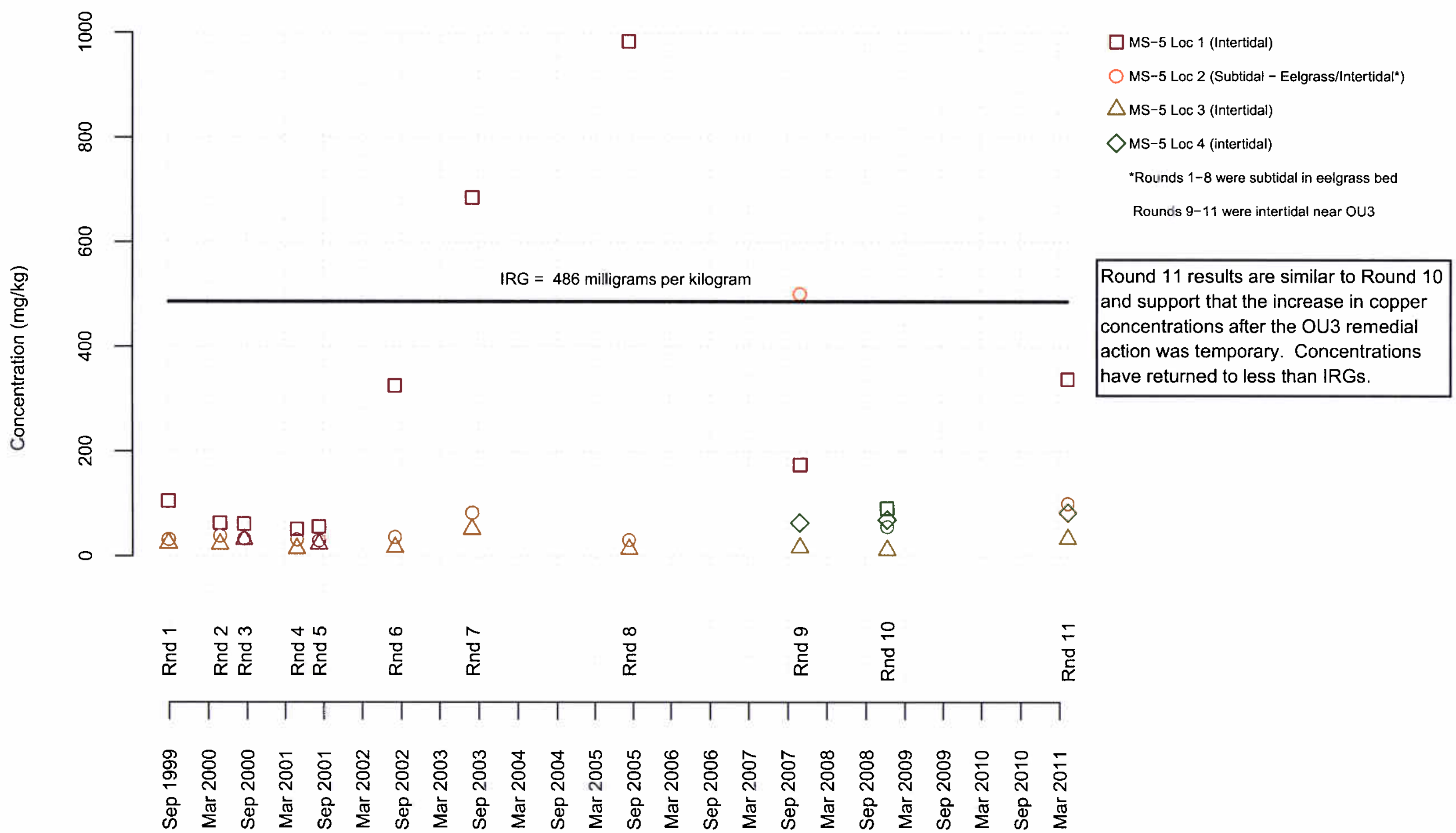


FIGURE D.2. 16
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR LEAD AT MS−05
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

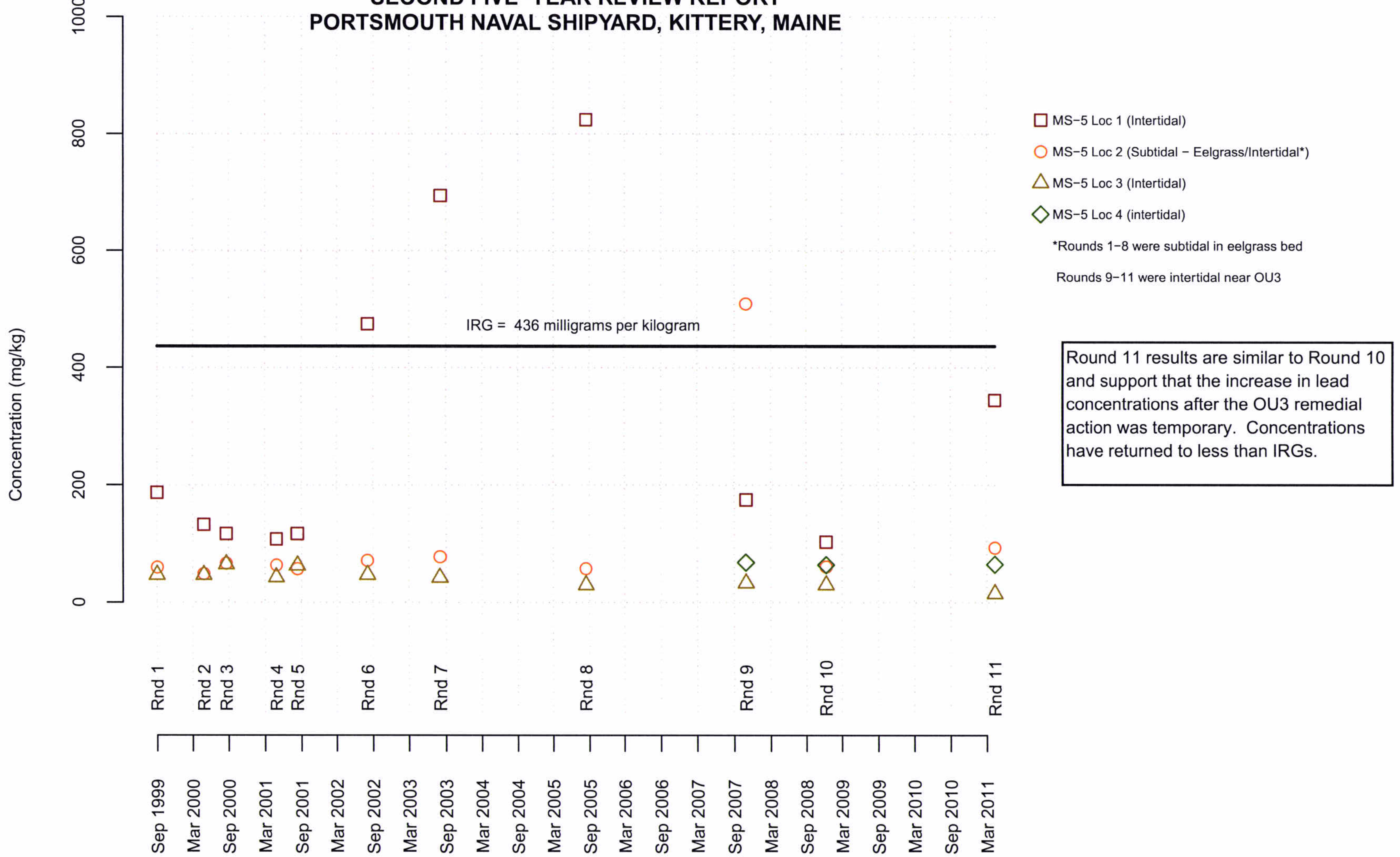


FIGURE D.2. 17
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR NICKEL AT MS-05
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

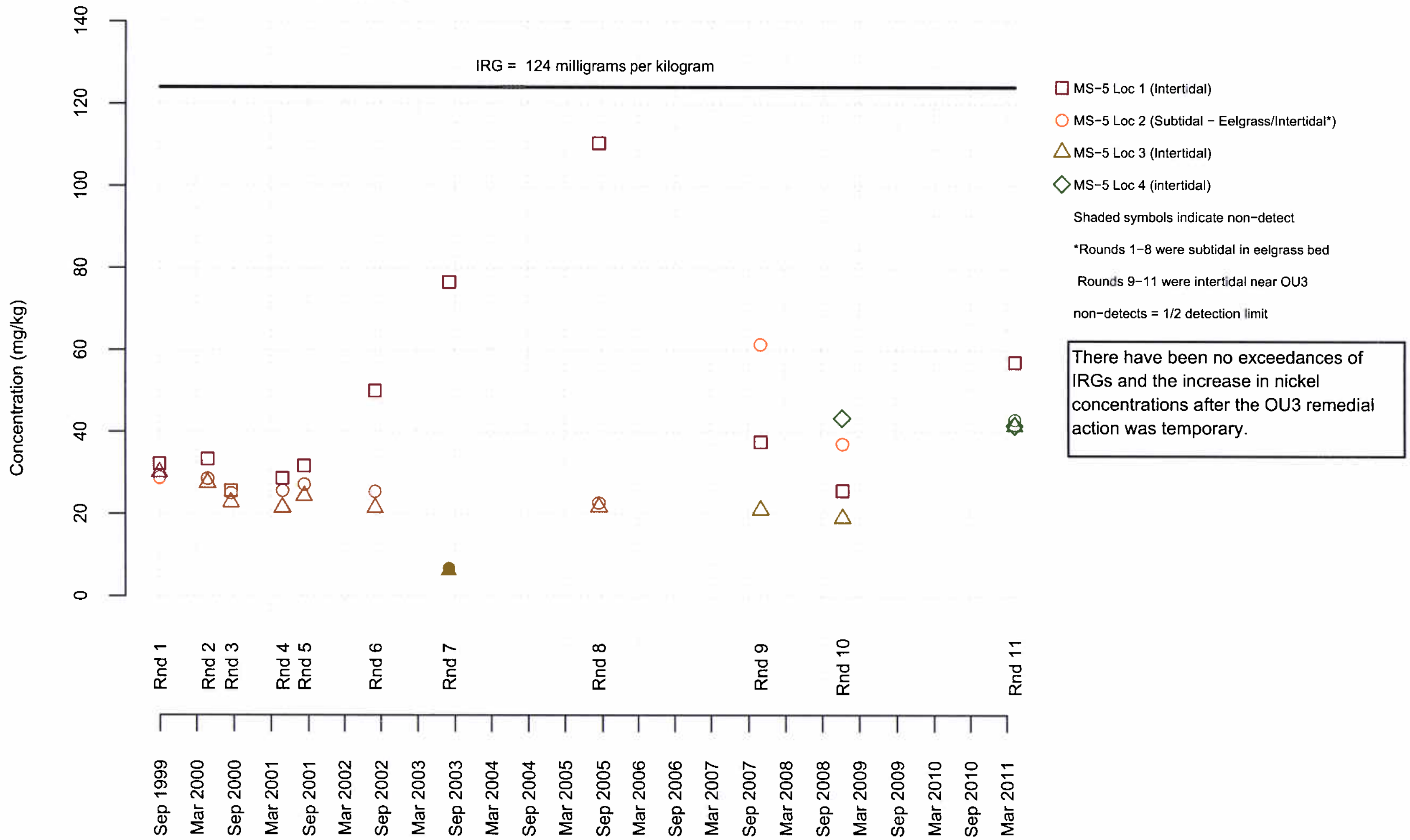


FIGURE D.2. 18
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ACENAPHTHYLENE AT MS−05
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

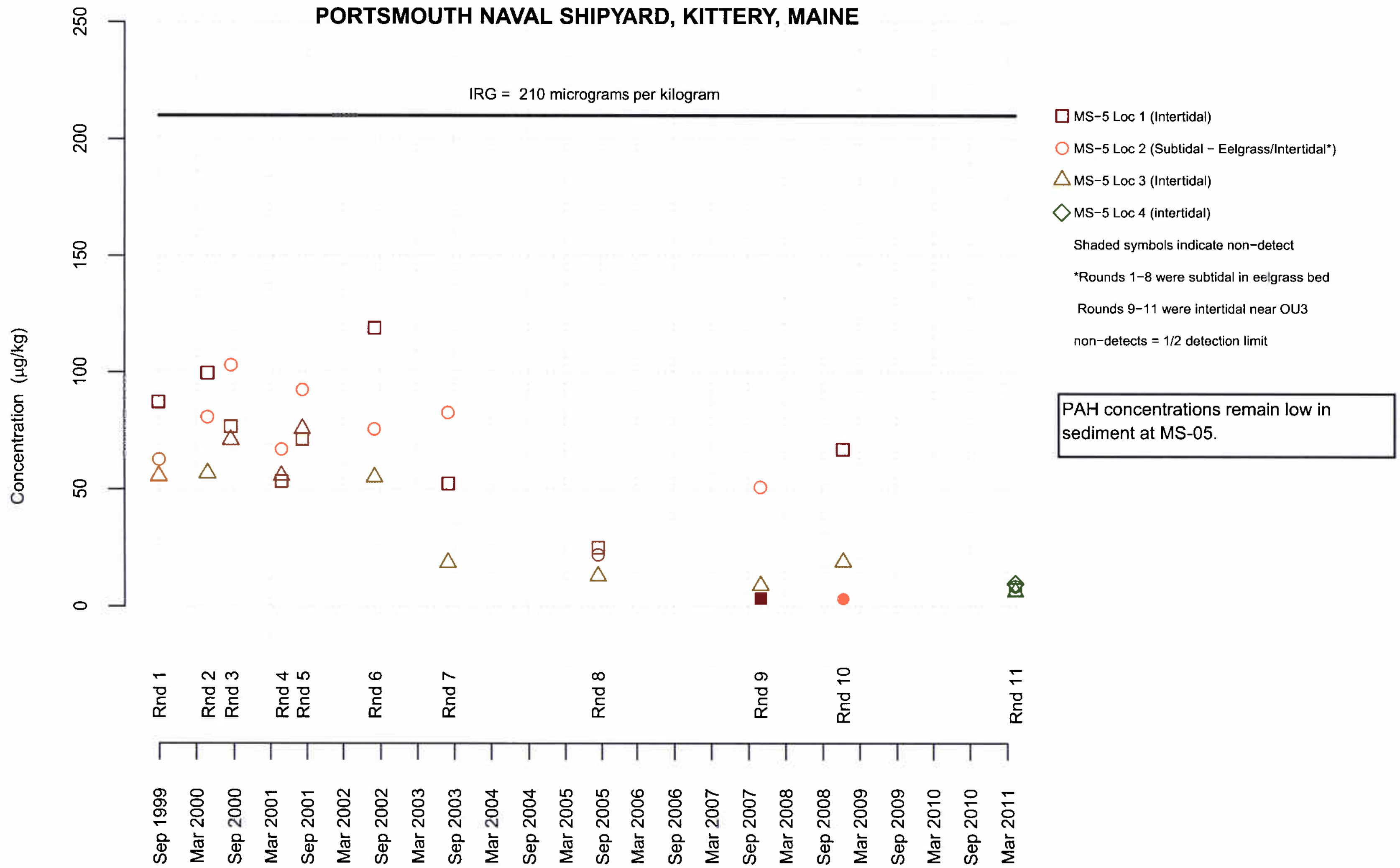


FIGURE D.2. 19
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ANTHRACENE AT MS-05
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

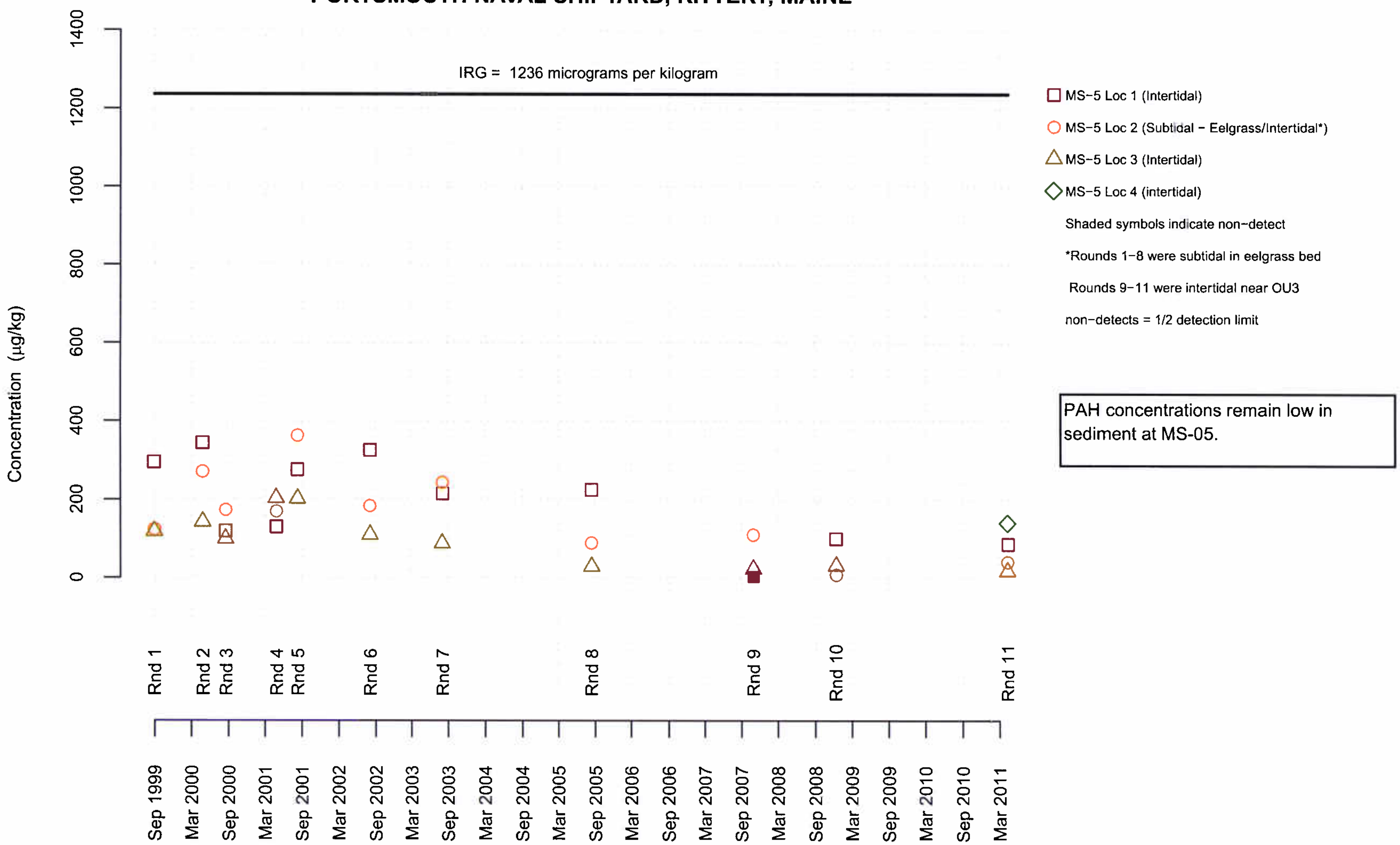


FIGURE D.2. 20
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR FLUORENE AT MS-05
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

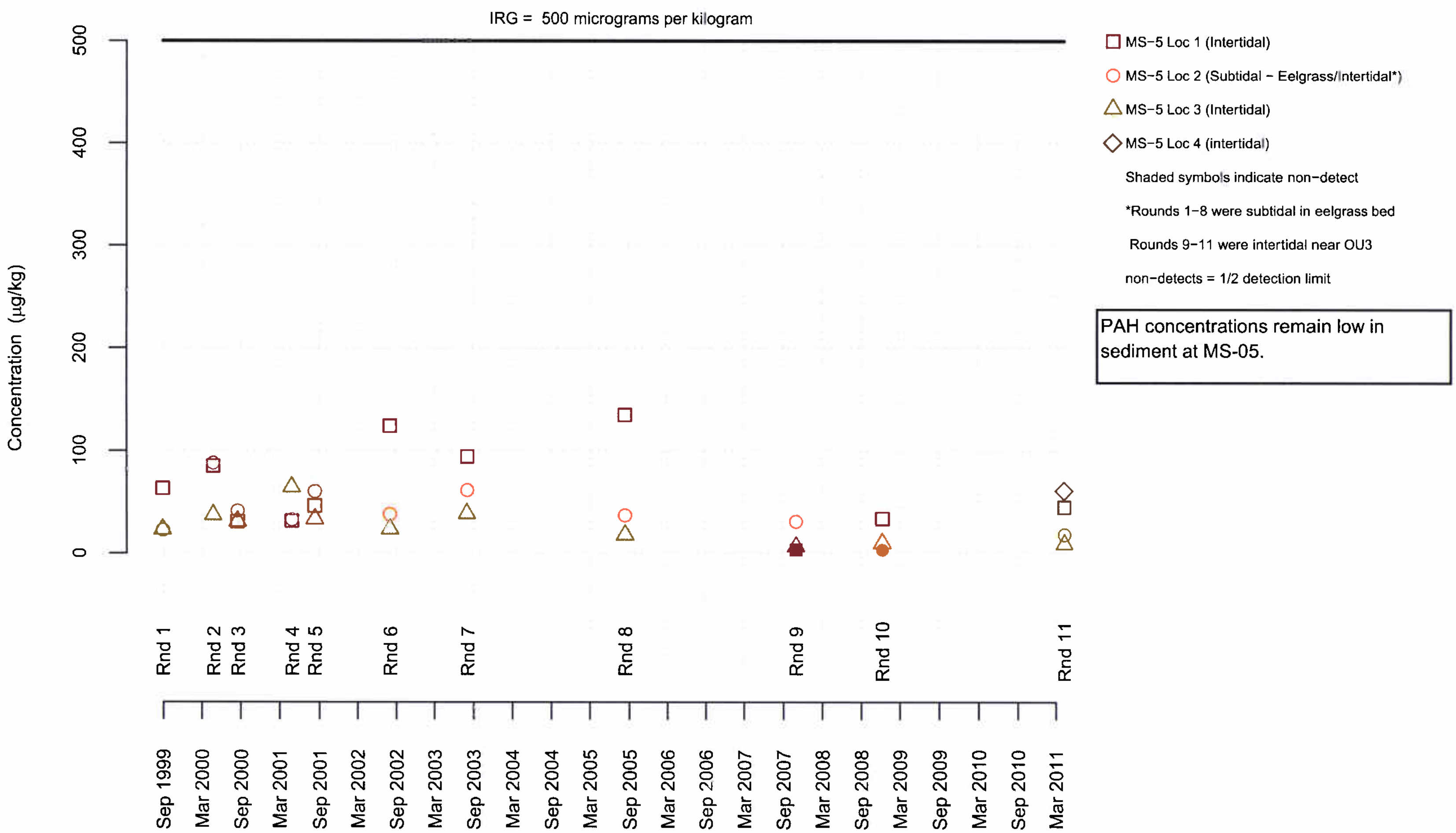


FIGURE D.2. 21
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS−05
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

FIGURE D.2. 22
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS−07
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

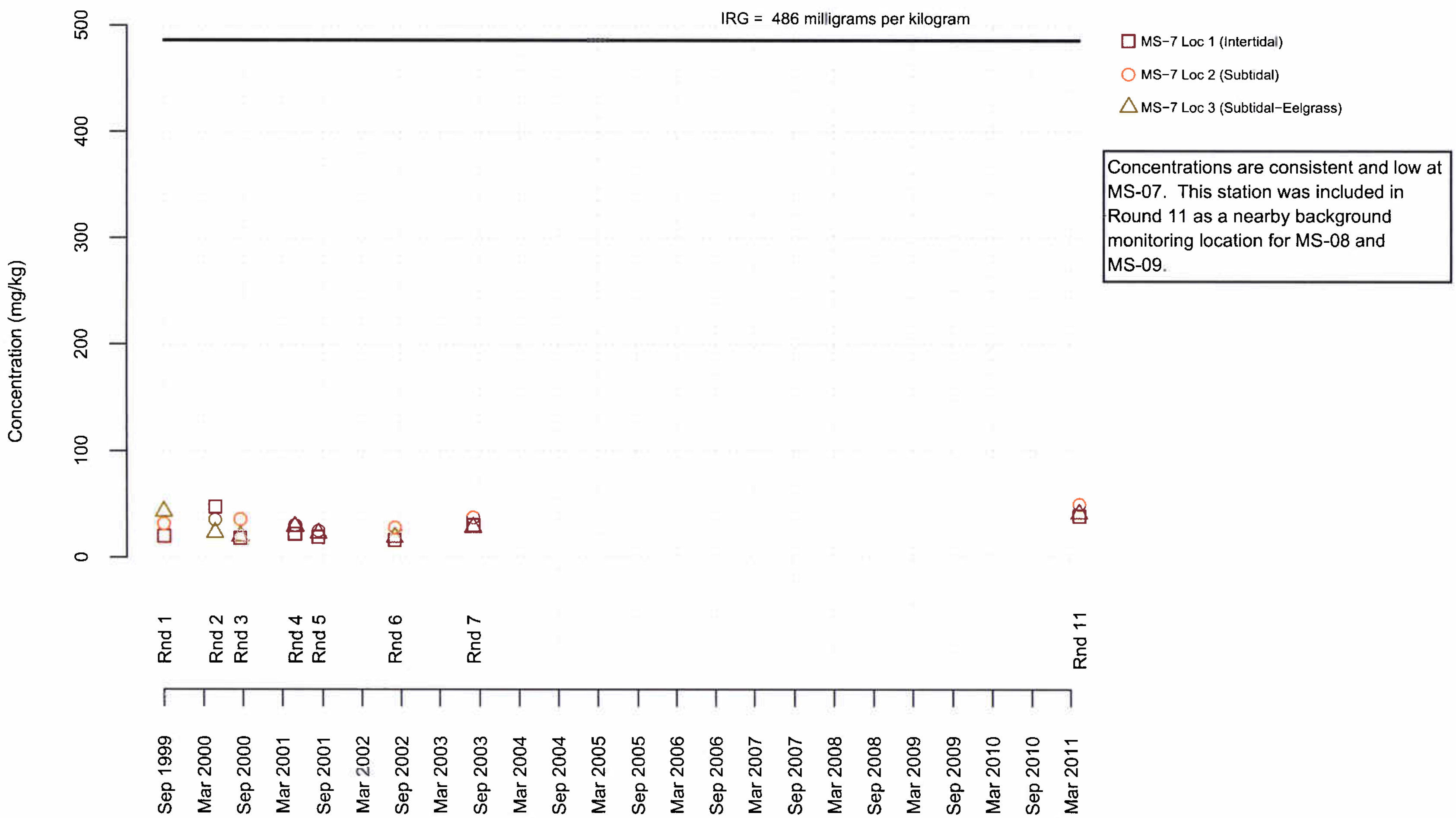


FIGURE D.2. 23
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR LEAD AT MS−07
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

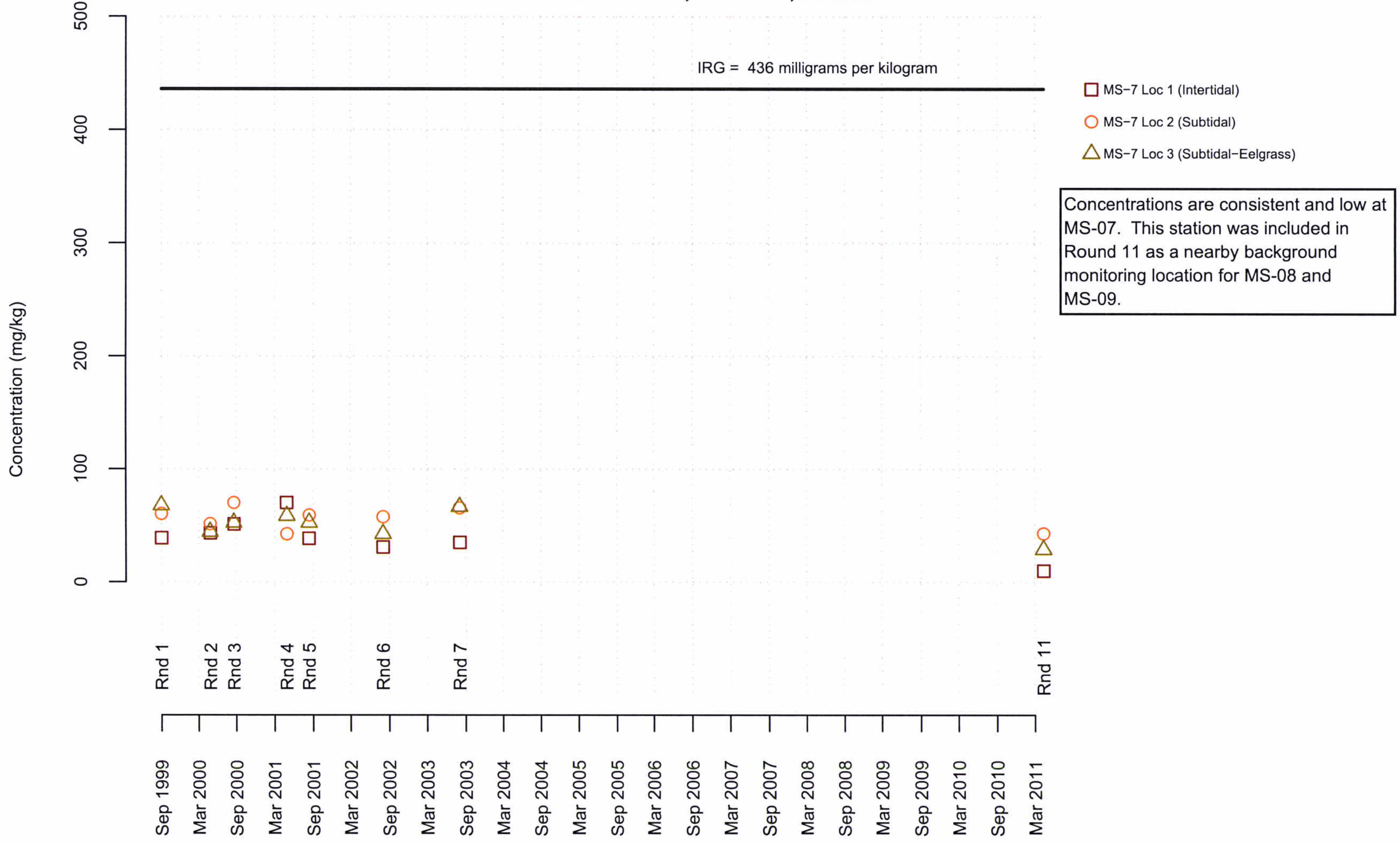


FIGURE D.2. 24
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR NICKEL AT MS-07
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

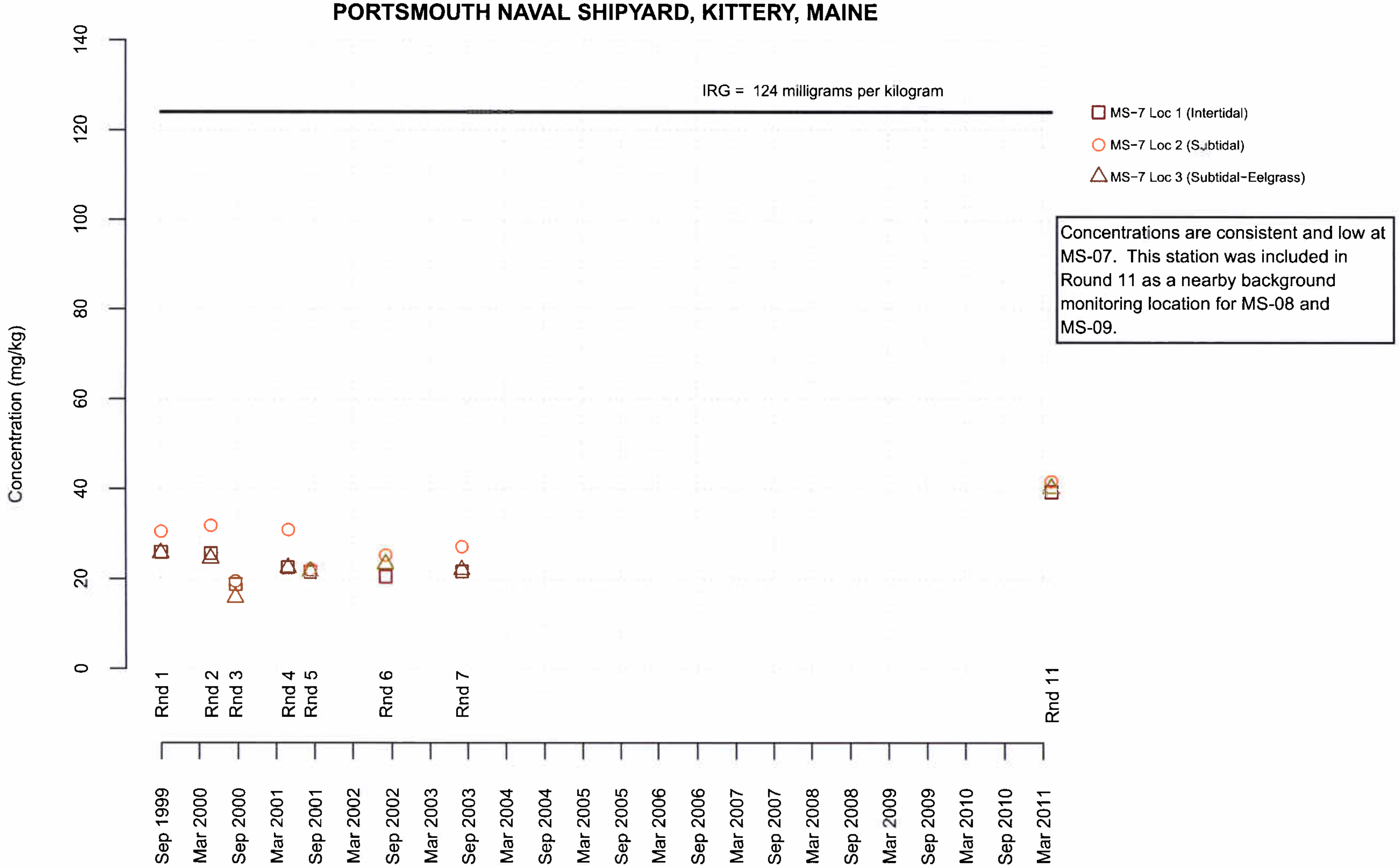


FIGURE D.2. 25
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ACENAPHTHYLENE AT MS-07
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

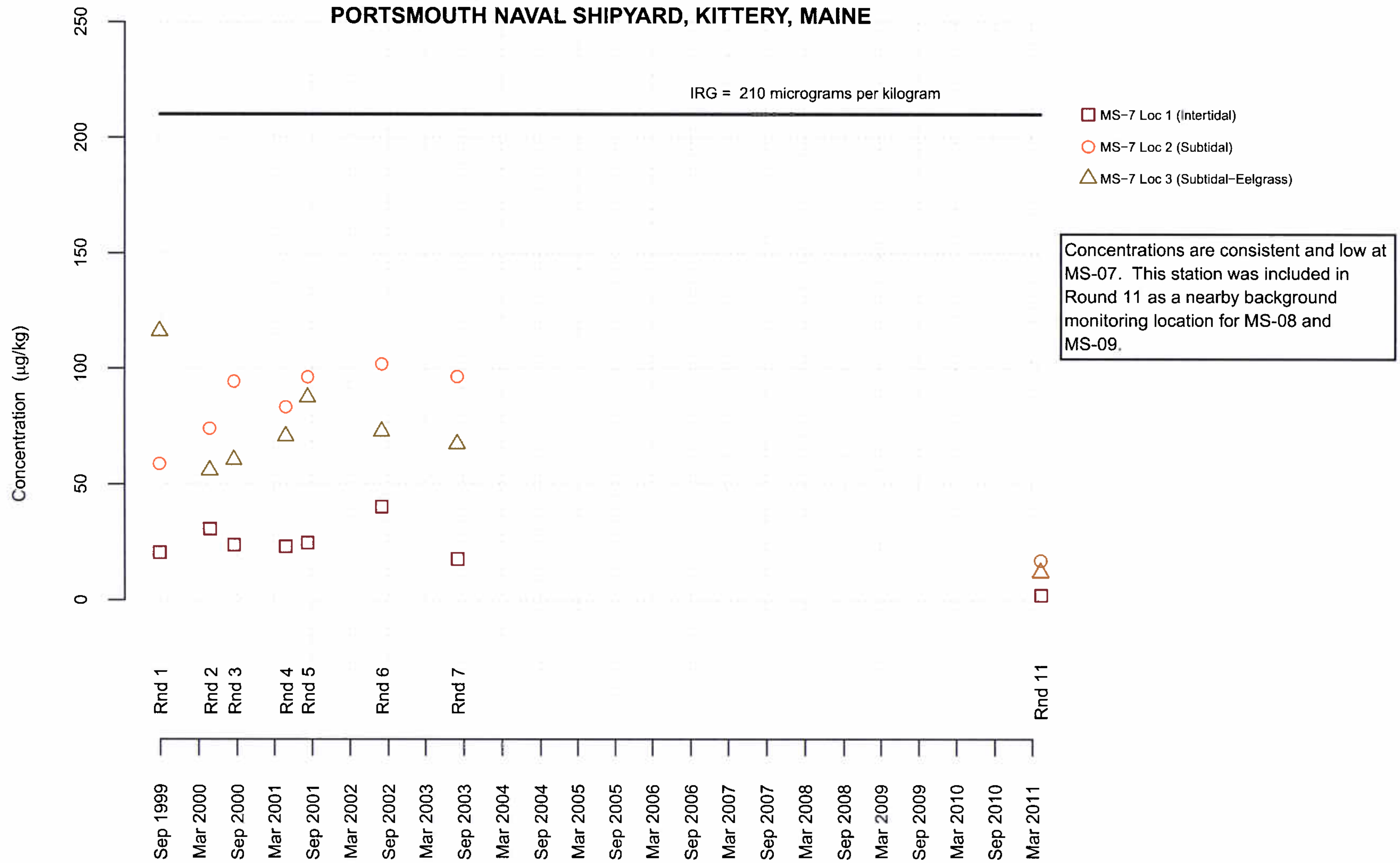


FIGURE D.2. 26
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ANTHRACENE AT MS−07
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

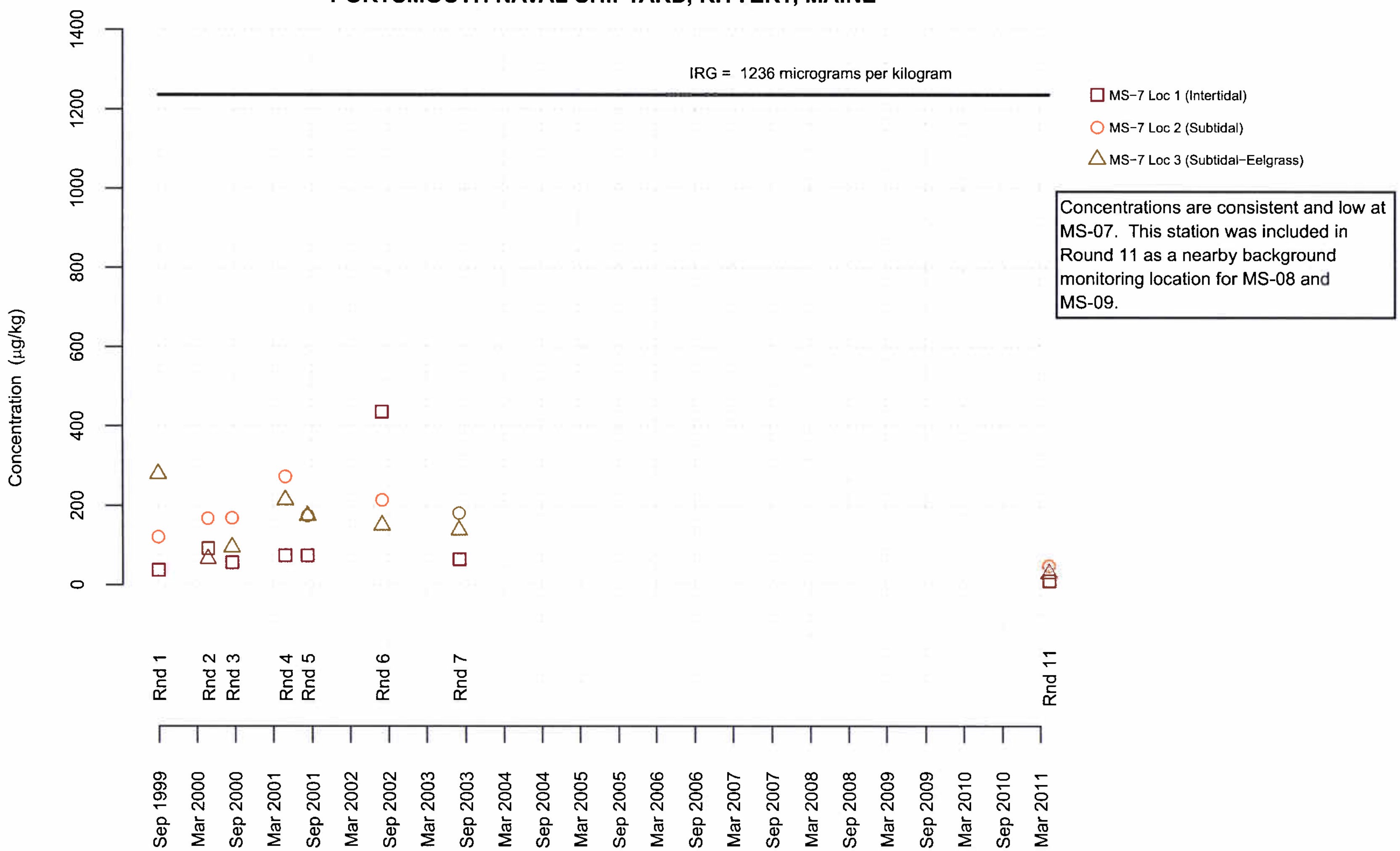
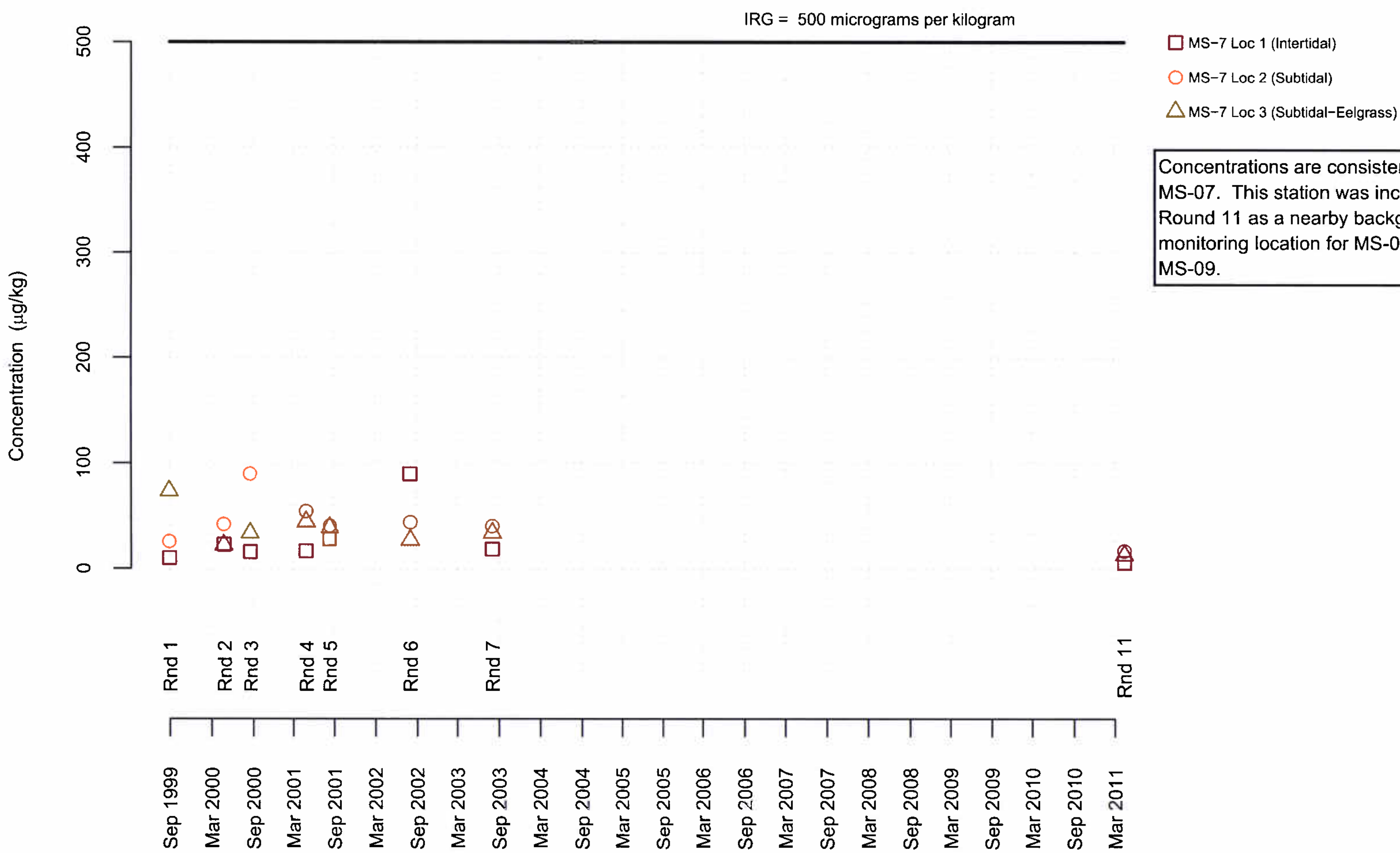
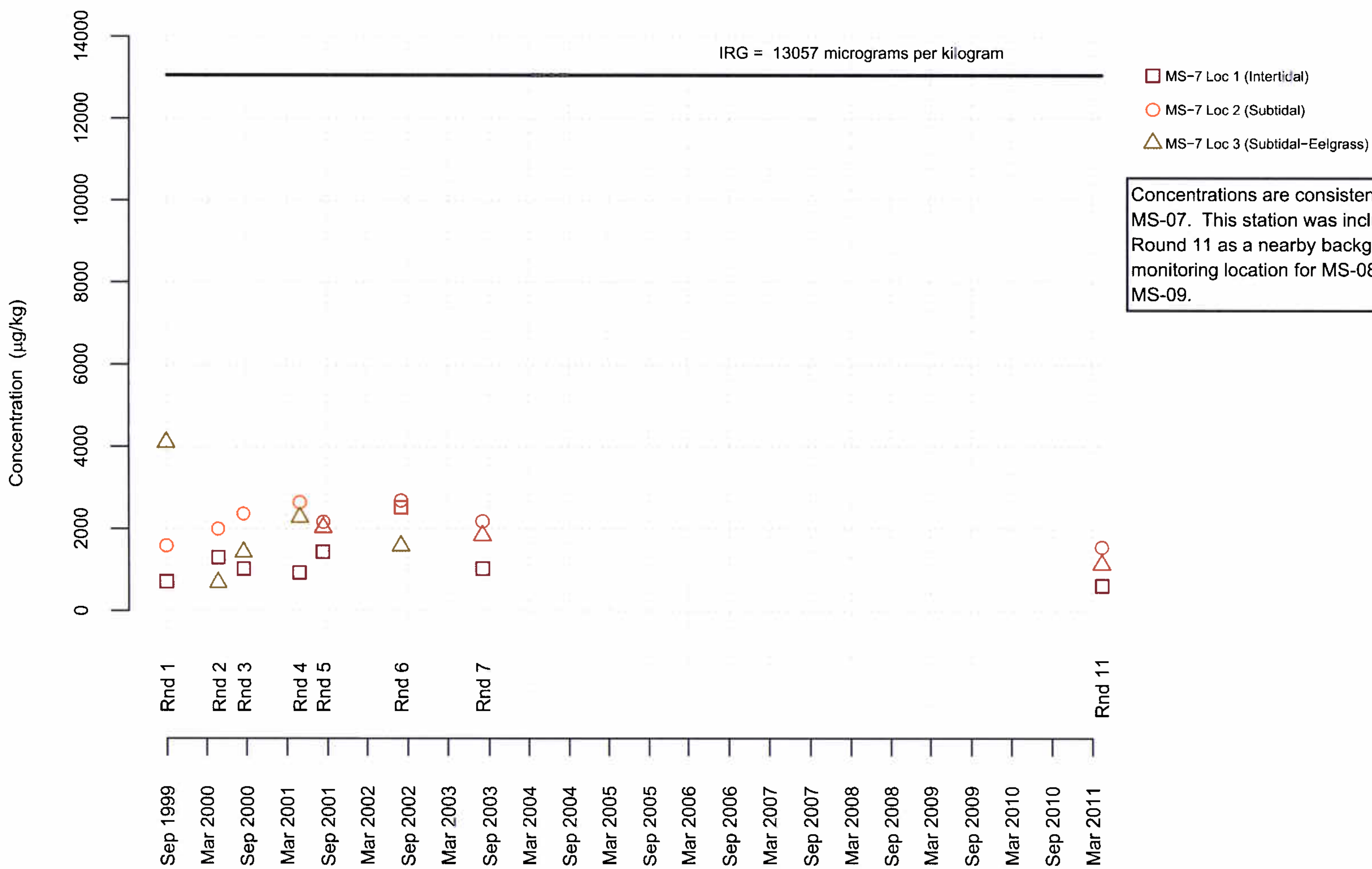


FIGURE D.2. 27
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR FLUORENE AT MS–07
SECOND FIVE–YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



Concentrations are consistent and low at MS-07. This station was included in Round 11 as a nearby background monitoring location for MS-08 and MS-09.

FIGURE D.2. 28
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS-07
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



Concentrations are consistent and low at MS-07. This station was included in Round 11 as a nearby background monitoring location for MS-08 and MS-09.

FIGURE D.2. 29
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR 4,4'–DDT AT MS–07
SECOND FIVE–YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

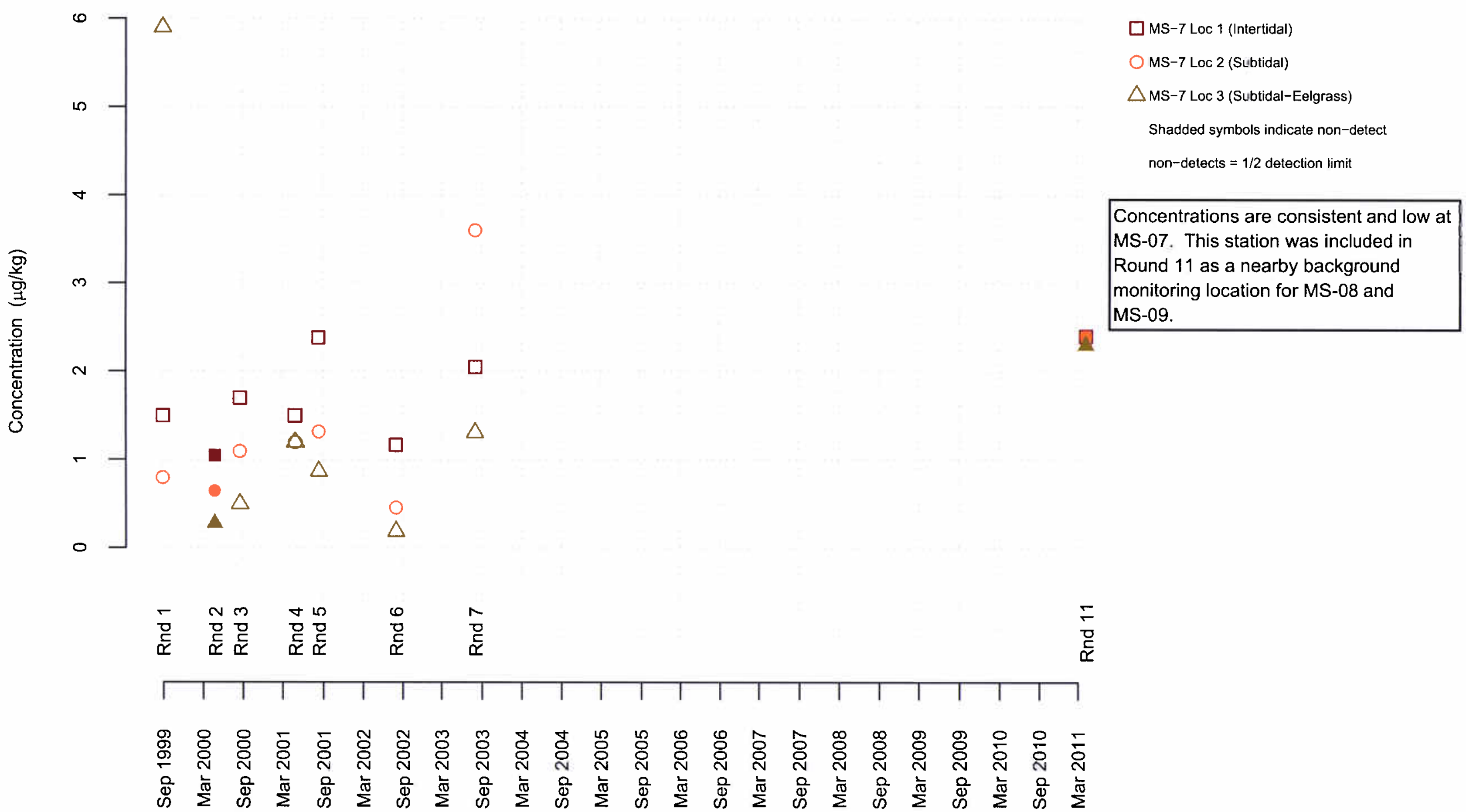


FIGURE D.2. 30
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ PCB AT MS-07
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

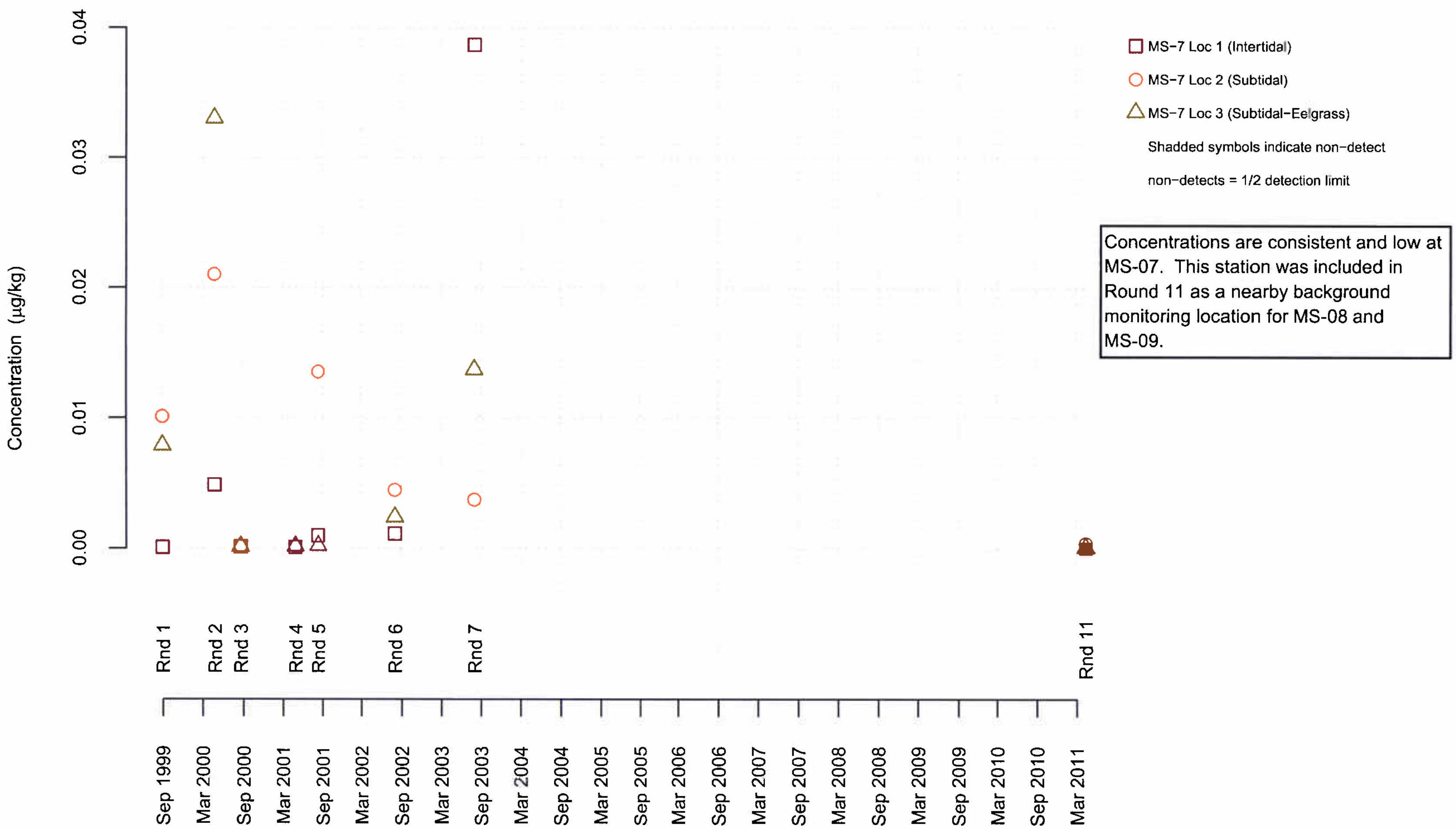


FIGURE D.2. 31
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ PCB BIRD AT MS−07
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

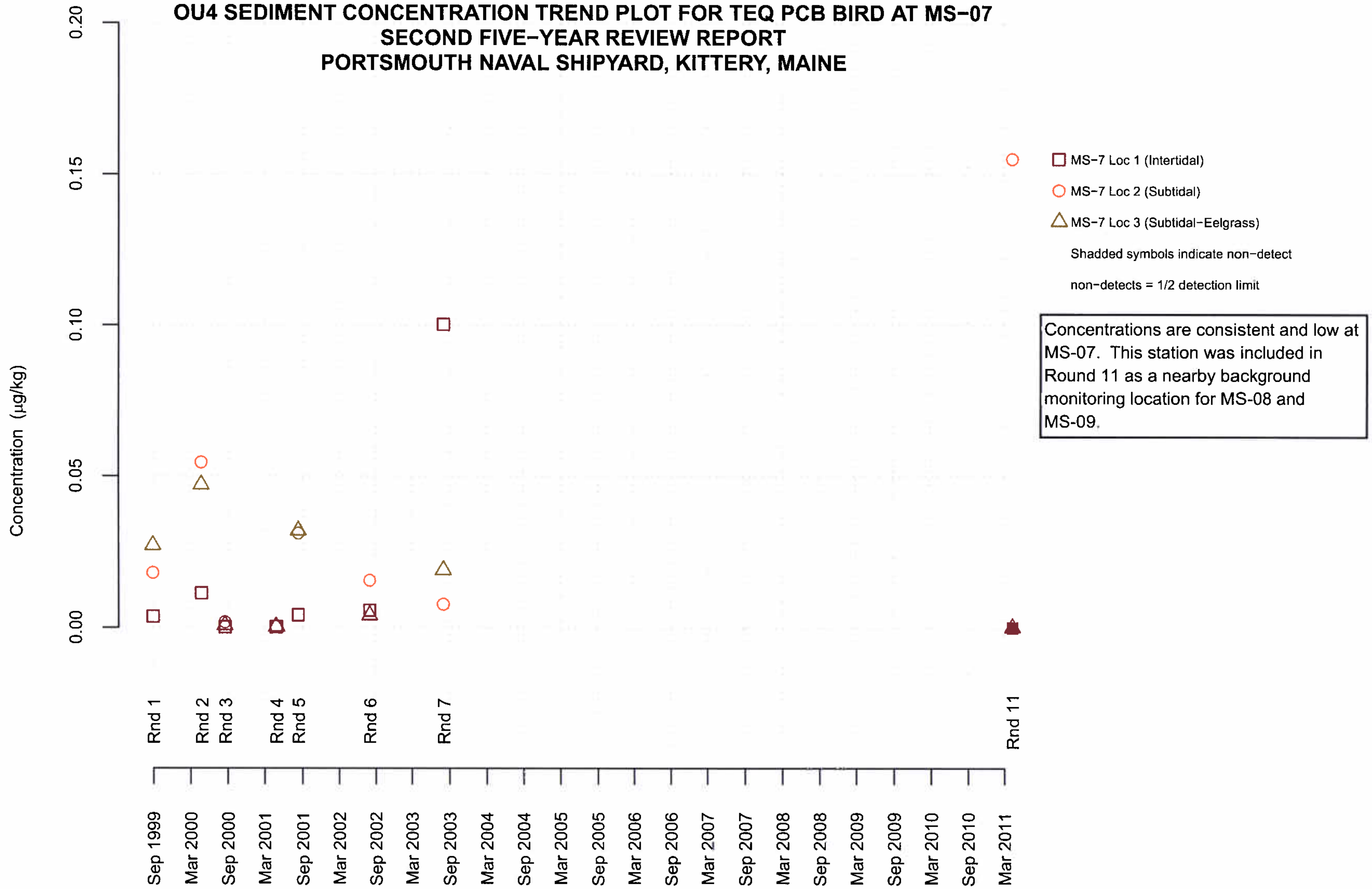


FIGURE D.2. 32
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ PCB FISH AT MS-07
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

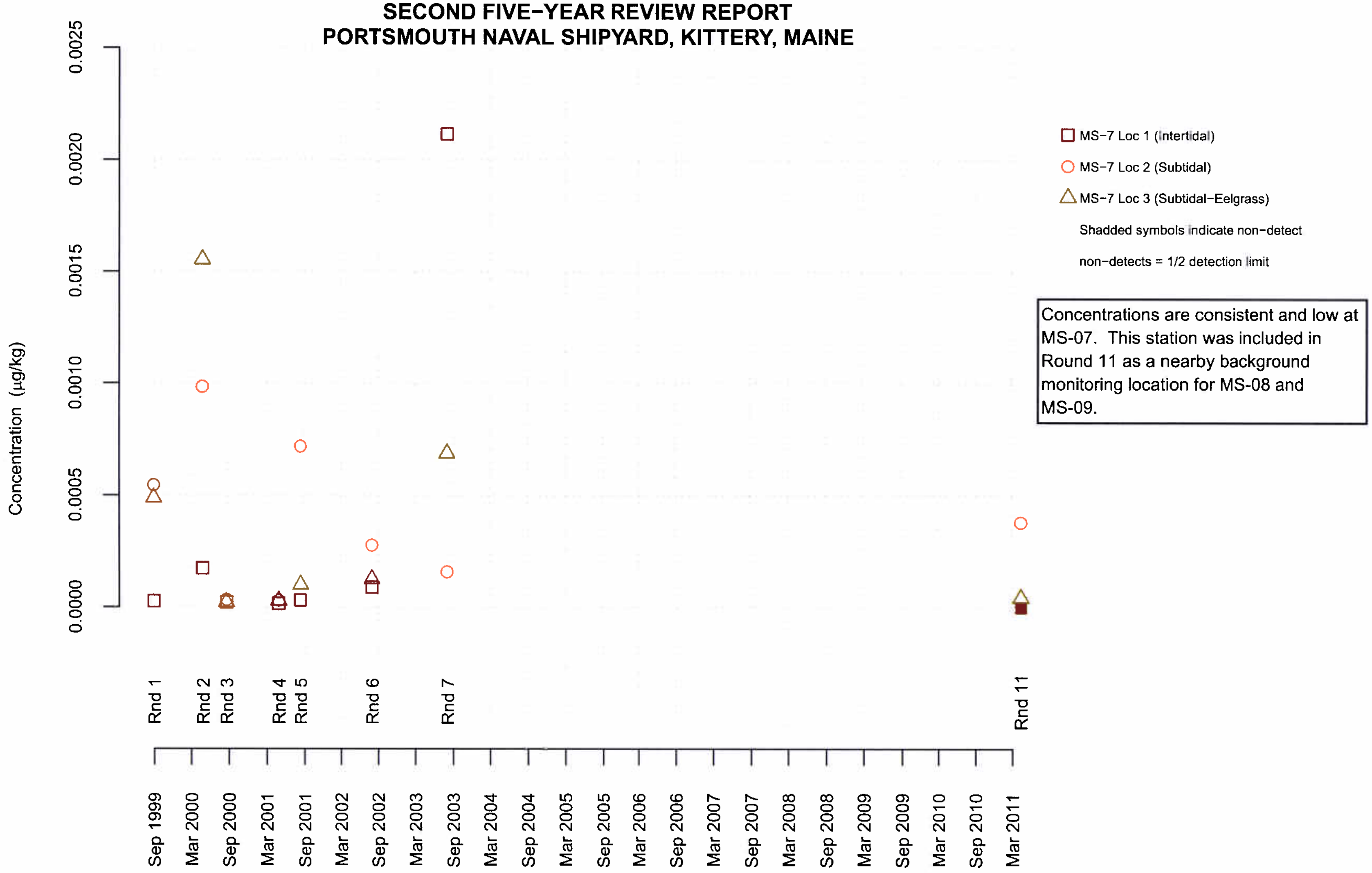


FIGURE D.2. 33
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ DIOXINS/FURANS AT MS−07
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

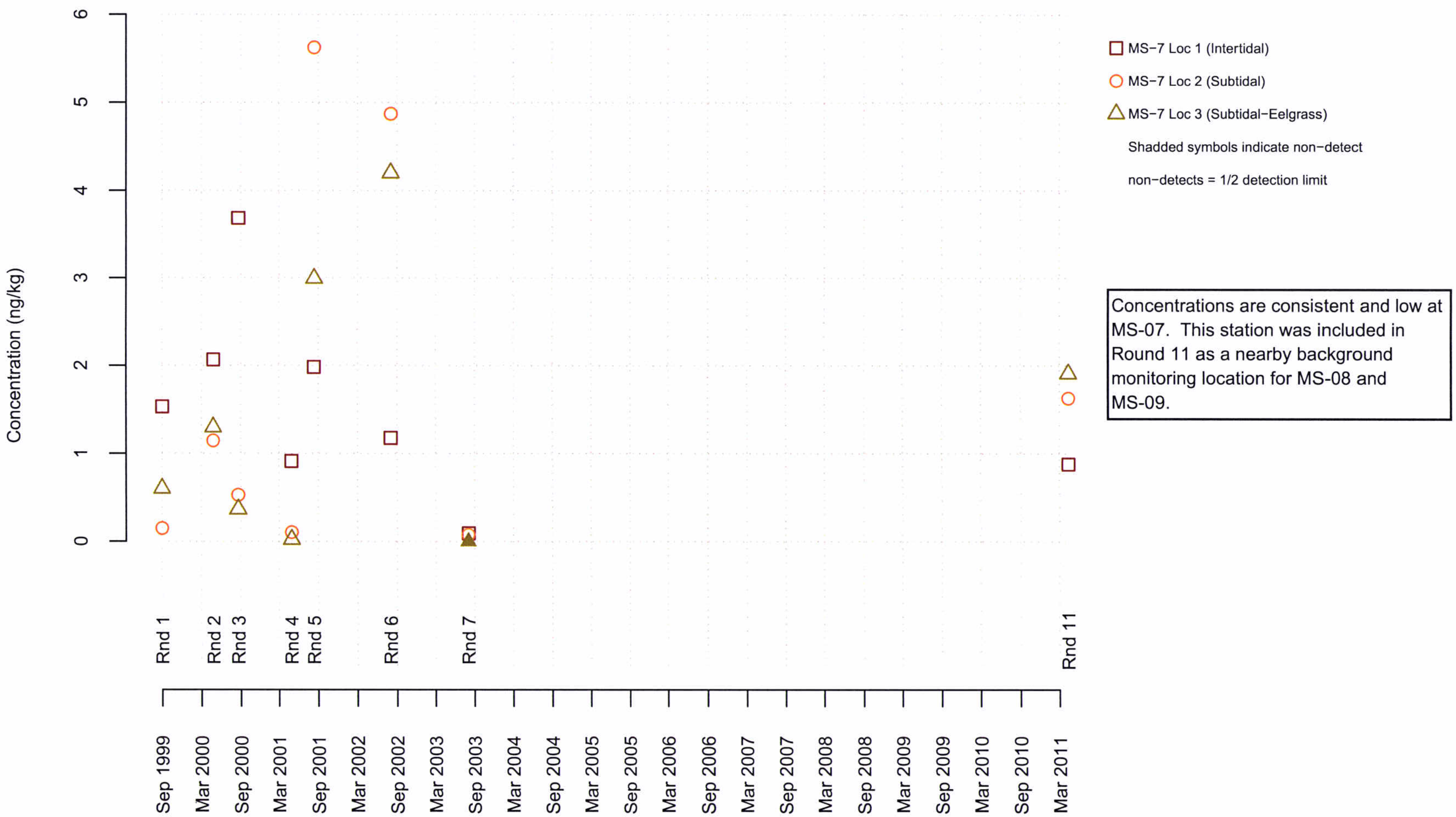


FIGURE D.2. 34
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ DIOXINS/FURANS BIRD AT MS−07
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

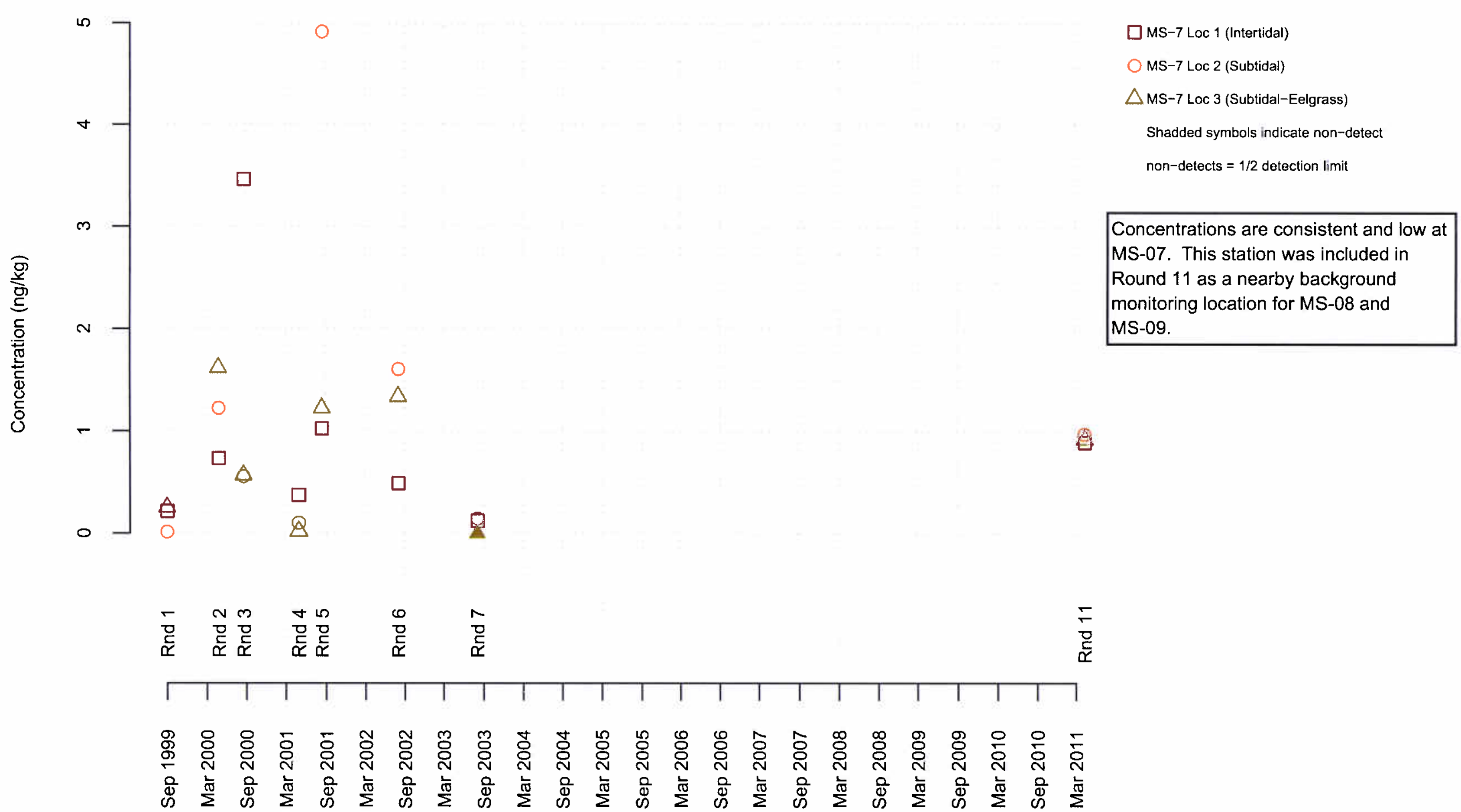


FIGURE D.2. 35
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ DIOXINS/FURANS FISH AT MS−07
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

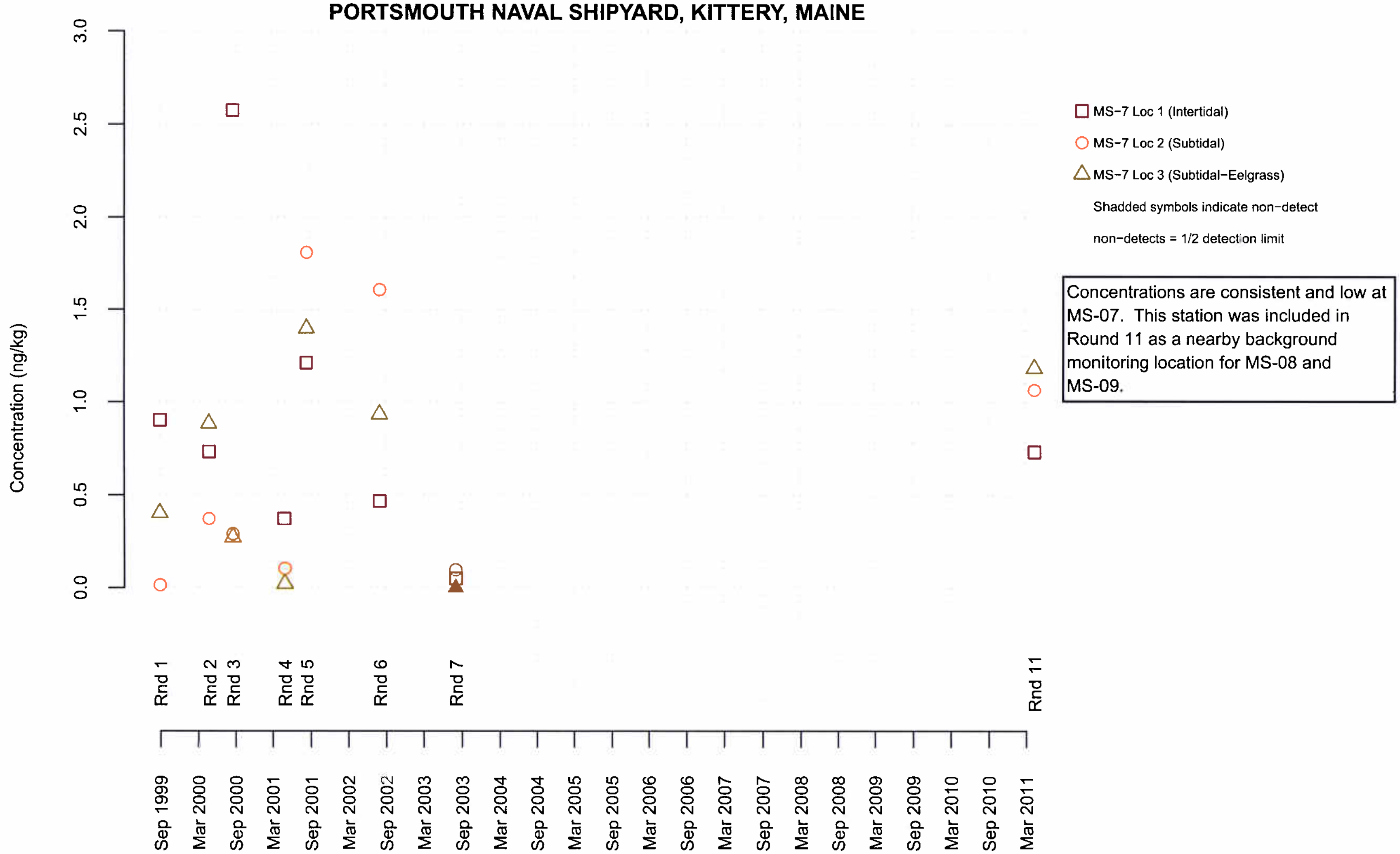


FIGURE D.2. 36
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS-08
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

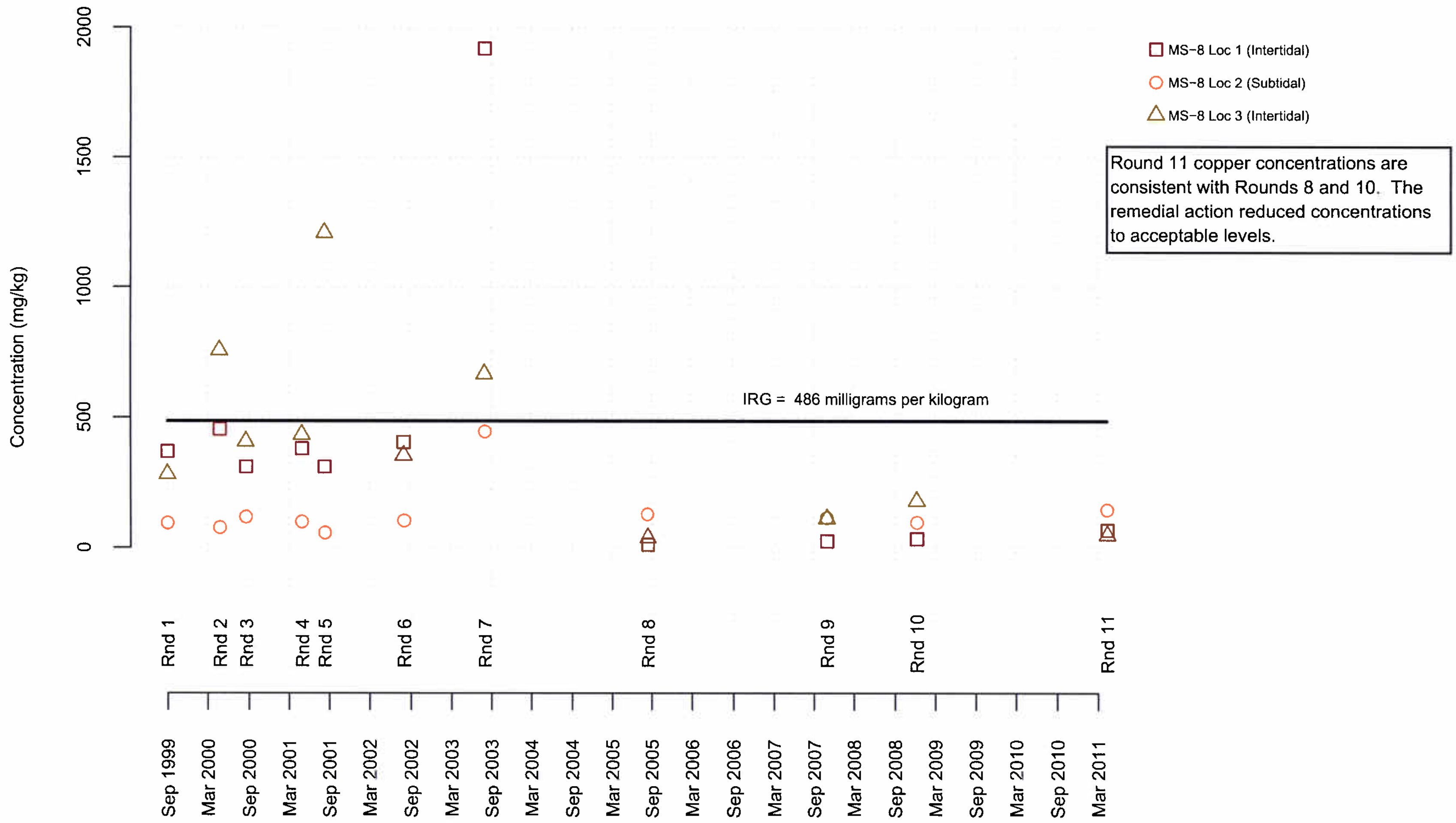


FIGURE D.2. 37
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR LEAD AT MS-08
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

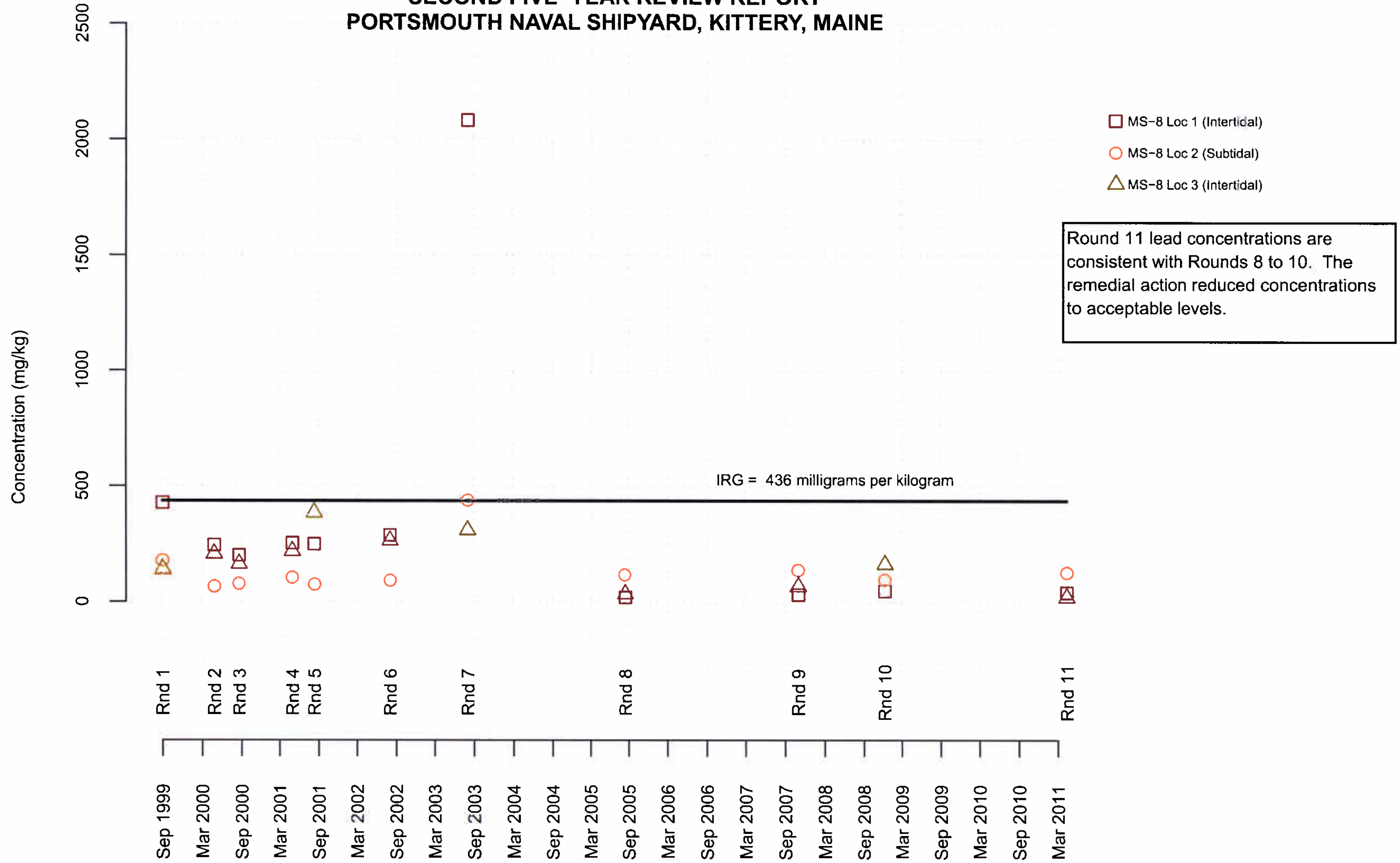


FIGURE D.2. 38
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR NICKEL AT MS-08
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

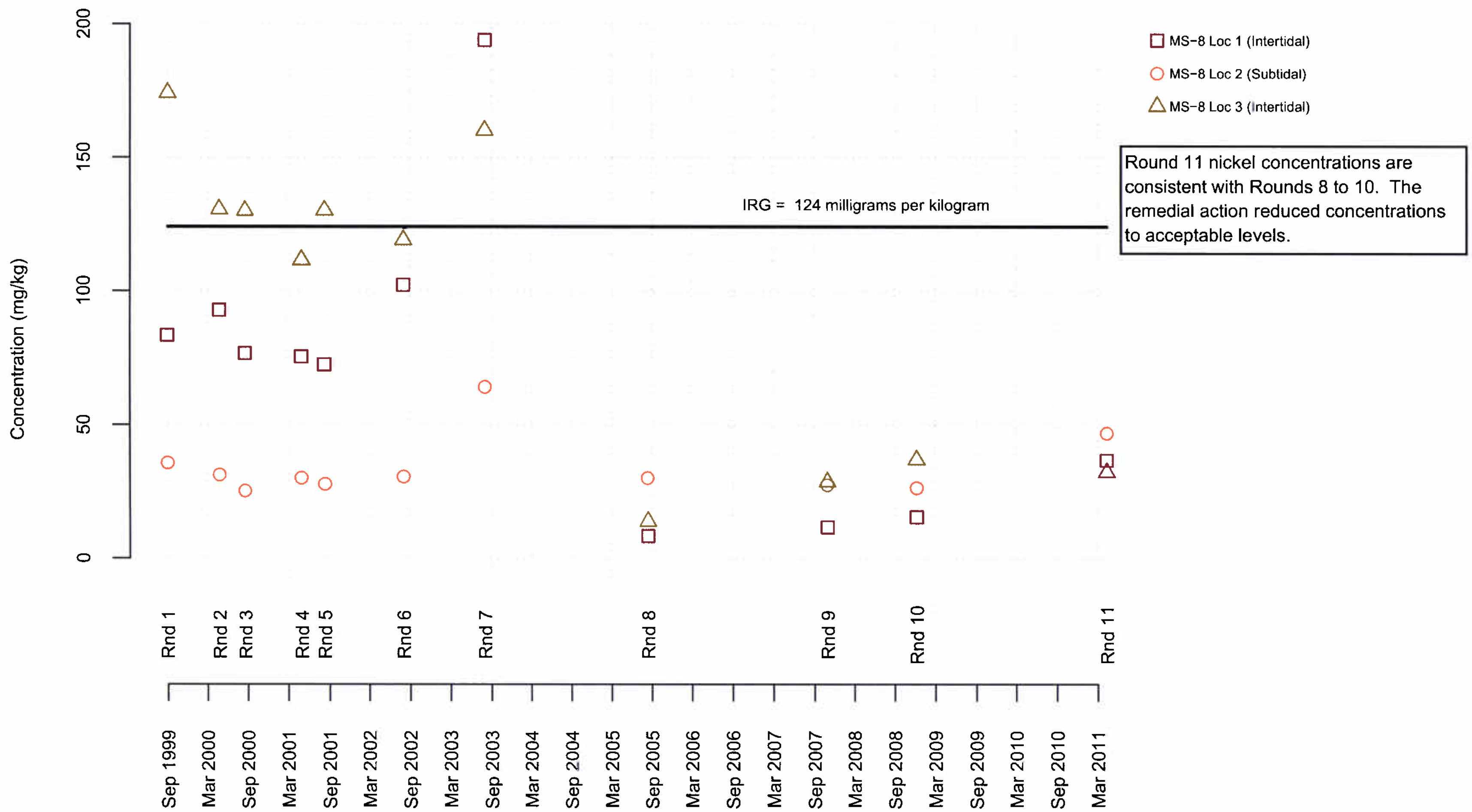


FIGURE D.2. 39
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ACENAPHTHYLENE AT MS-08
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

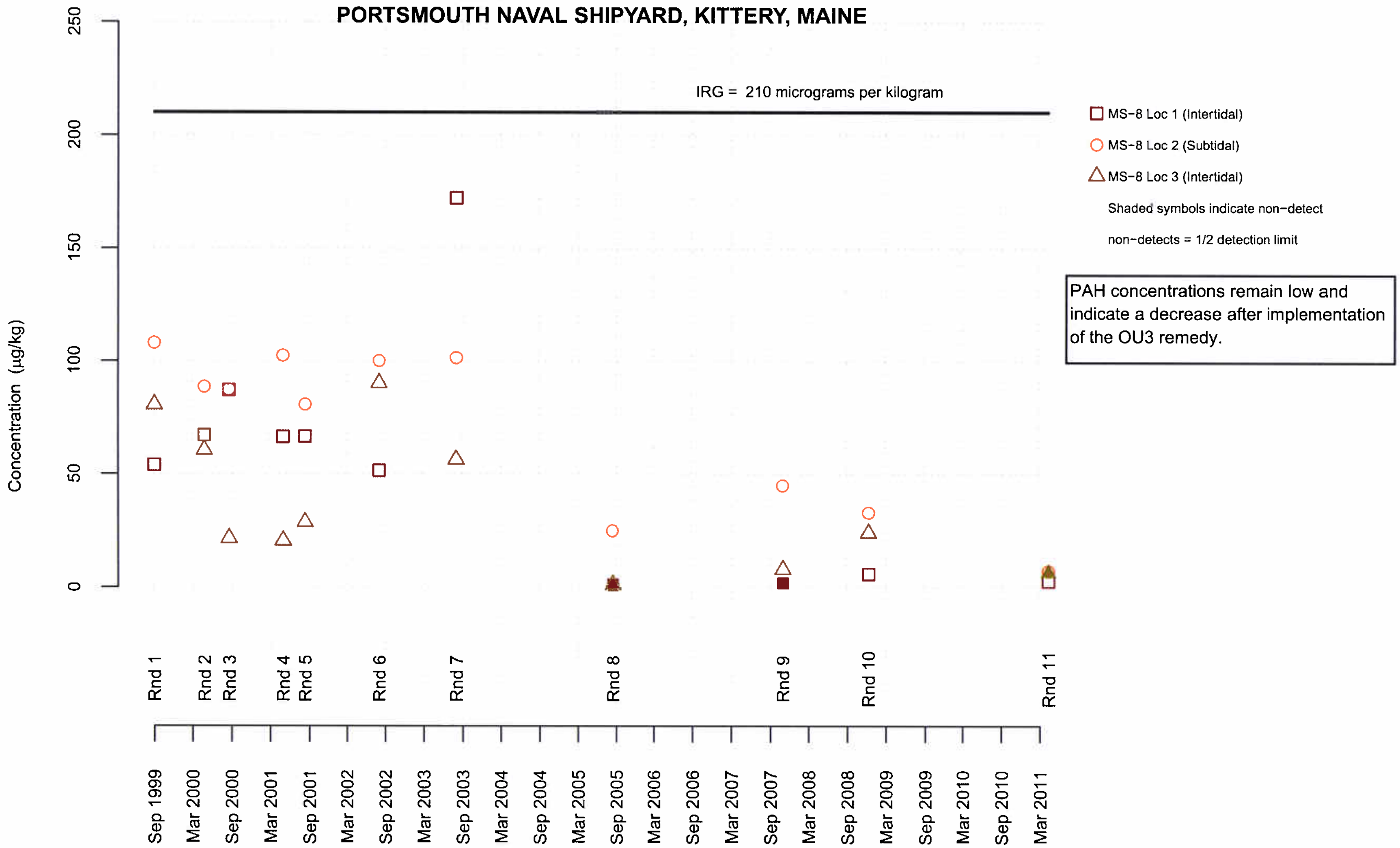


FIGURE D.2. 40
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ANTHRACENE AT MS−08
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

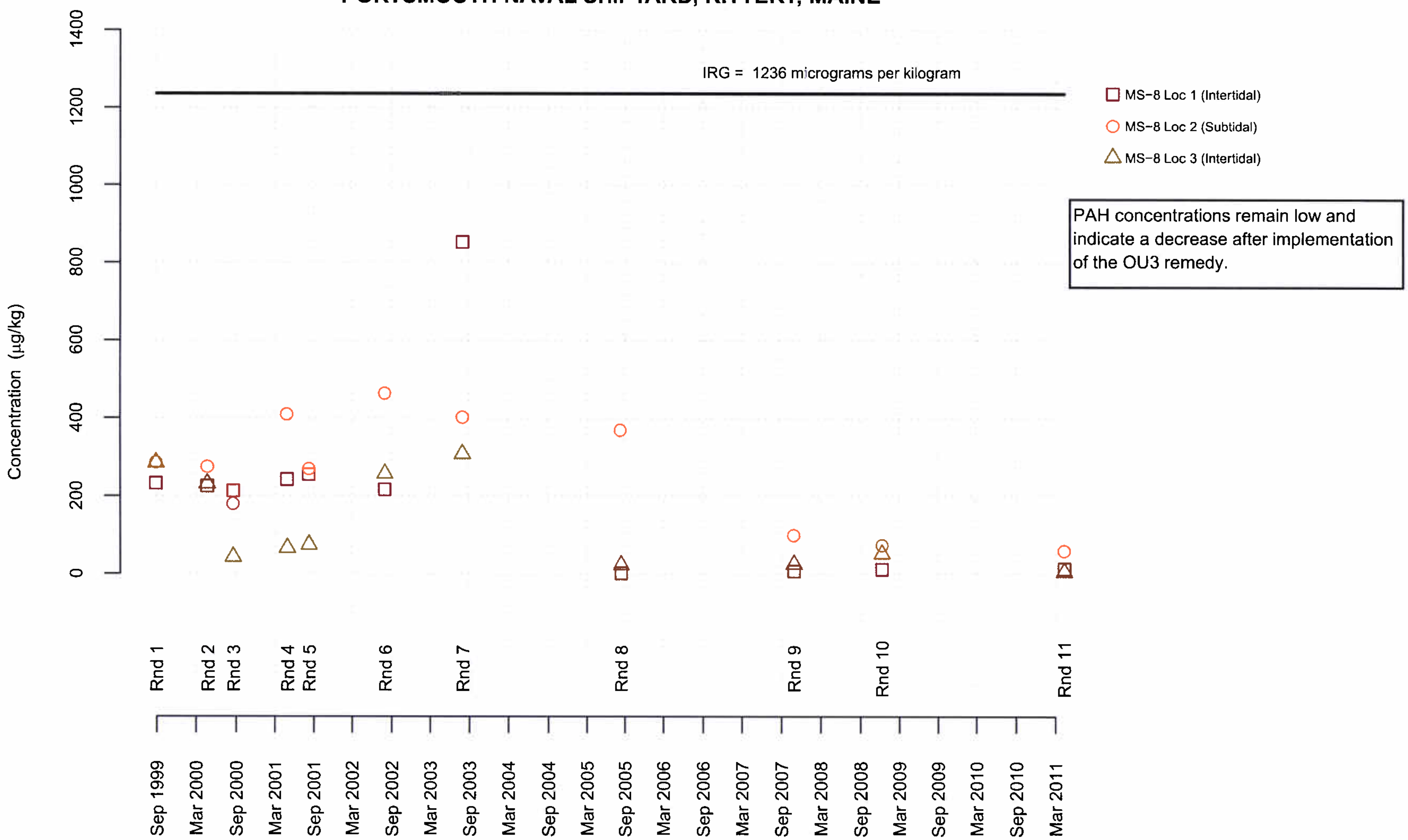


FIGURE D.2. 41
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR FLUORENE AT MS-08
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

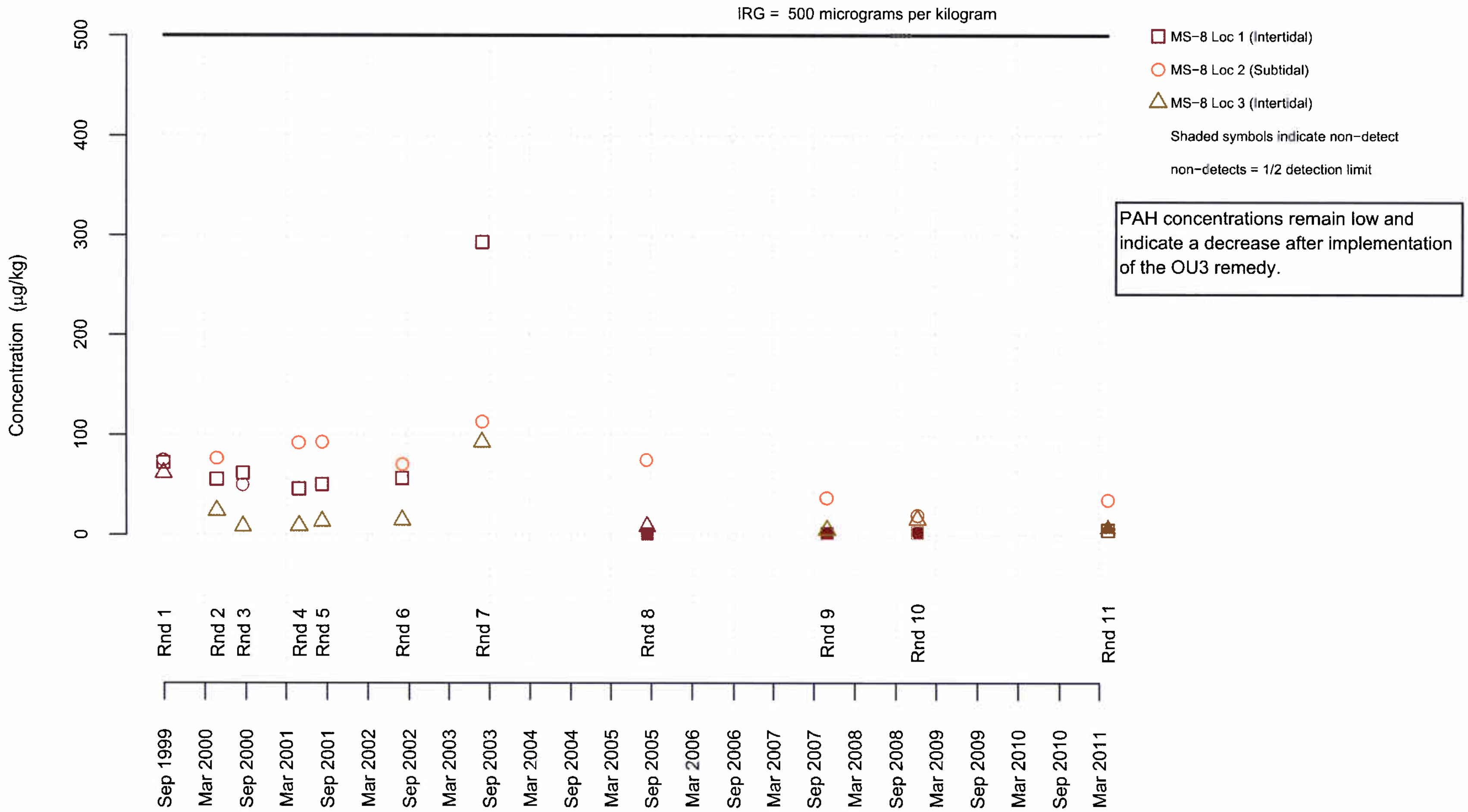


FIGURE D.2. 42
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS-08
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

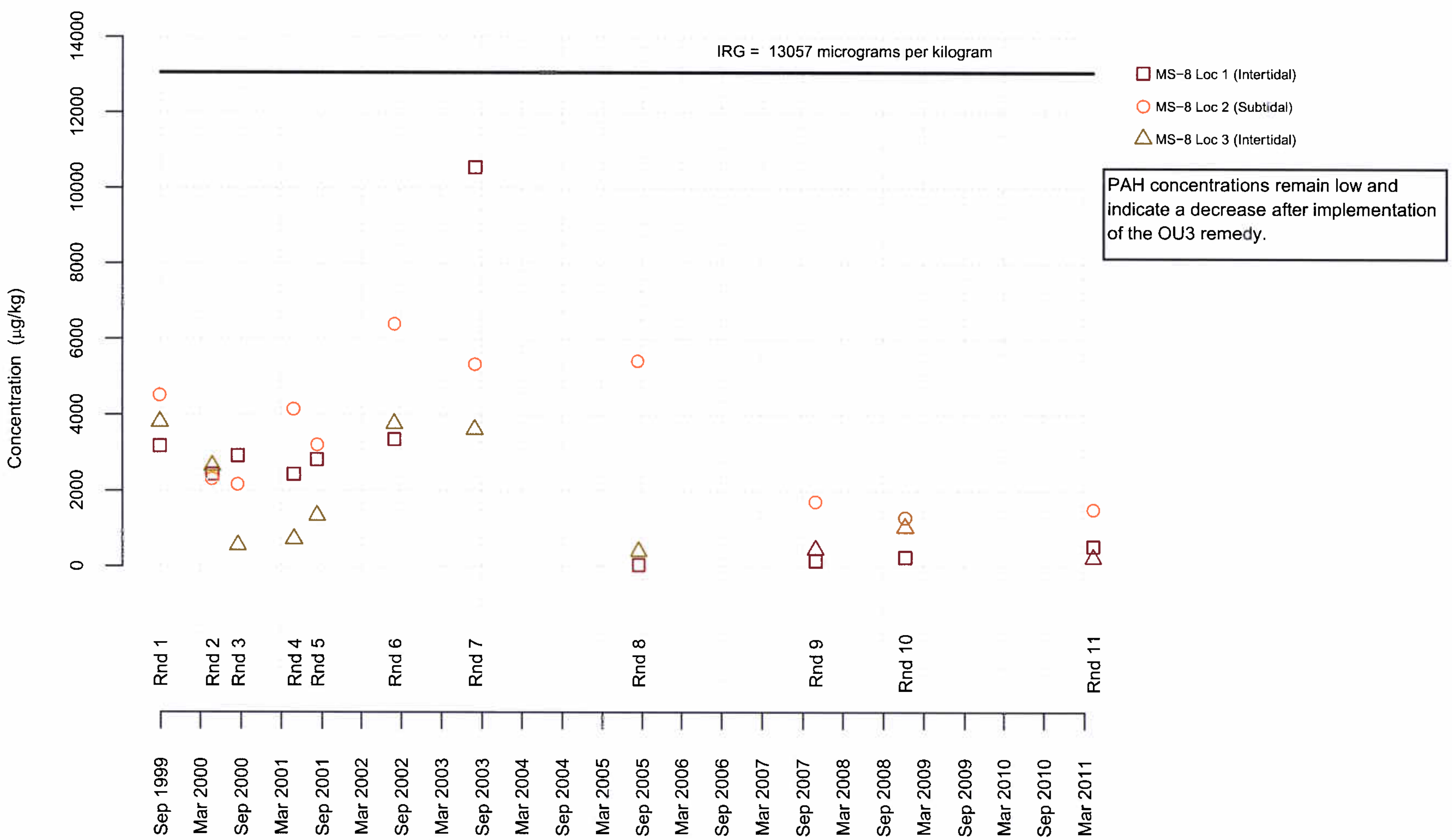


FIGURE D.2. 43
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR 4,4'−DDT AT MS−08
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

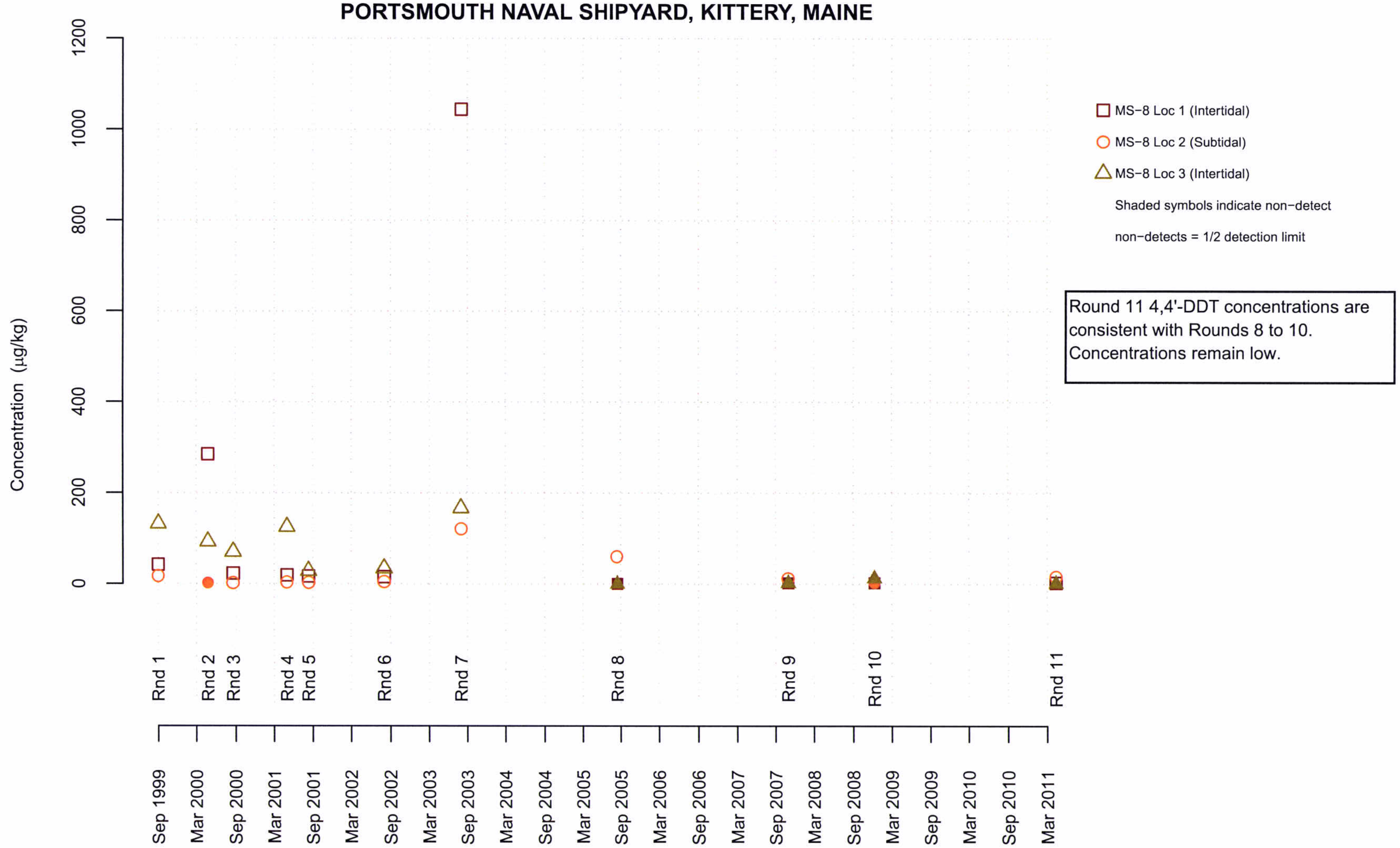


FIGURE D.2. 44
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ PCB AT MS-08
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

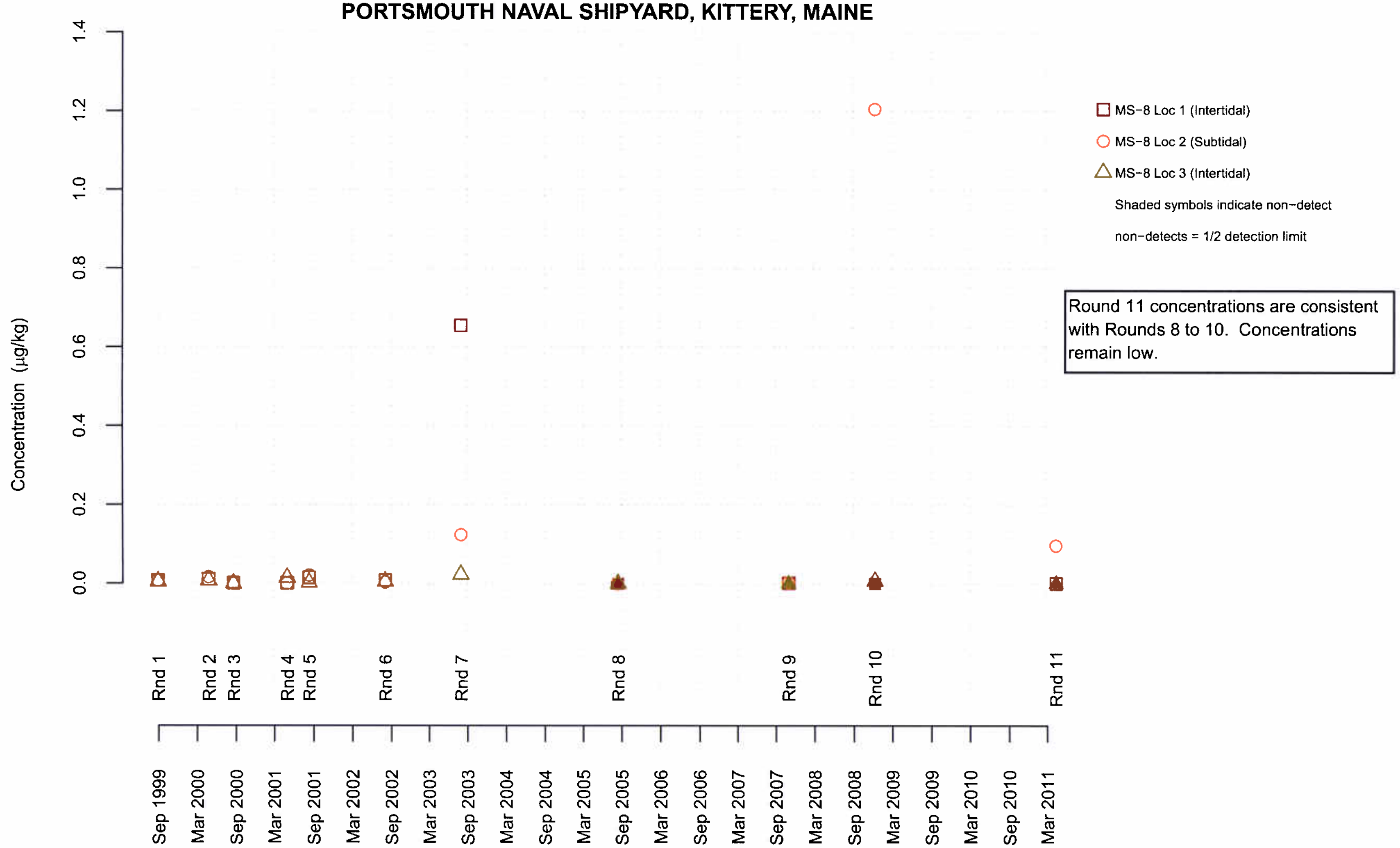


FIGURE D.2. 45
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ PCB BIRD AT MS−08
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

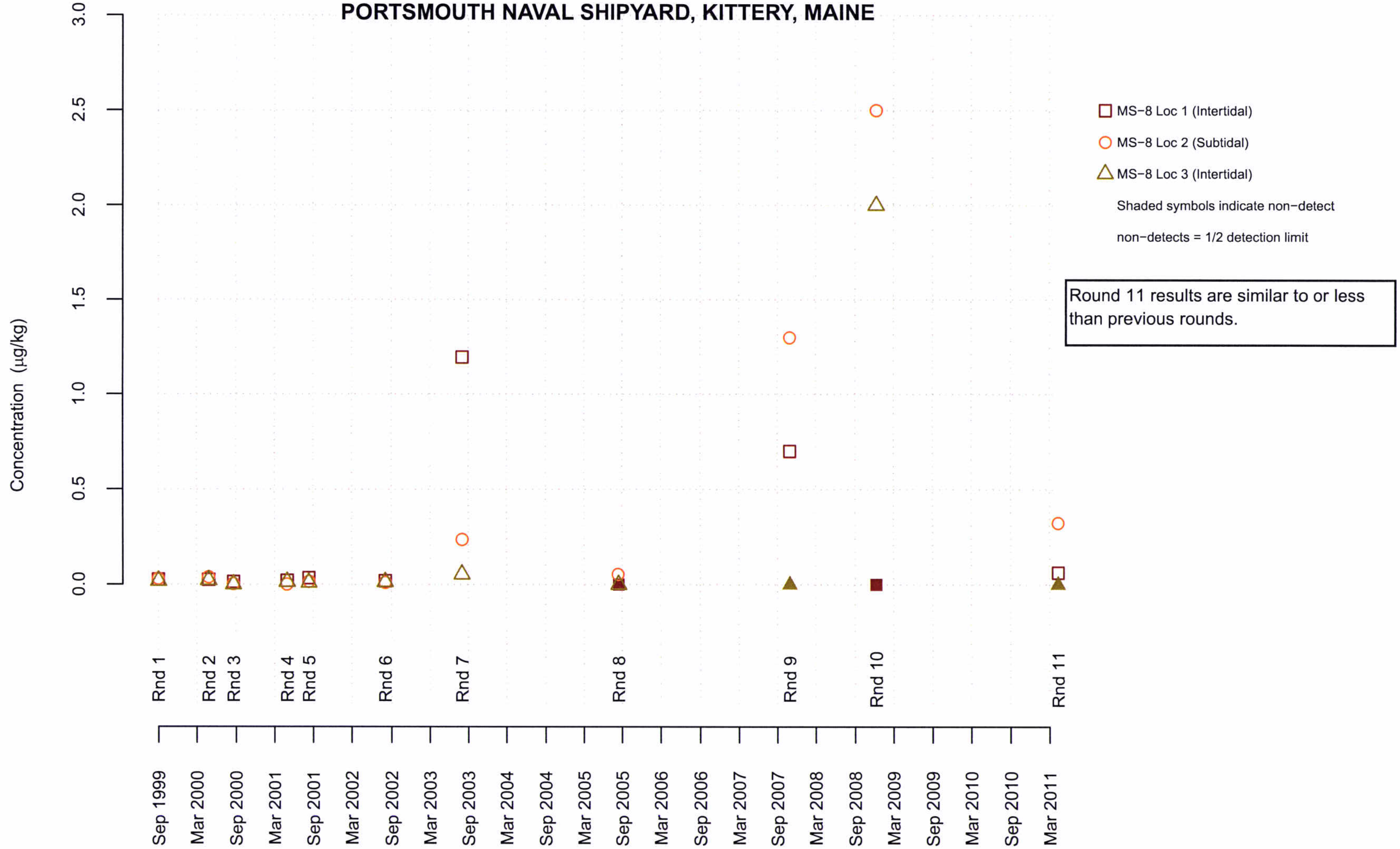


FIGURE D.2. 46
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ PCB FISH AT MS−08
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

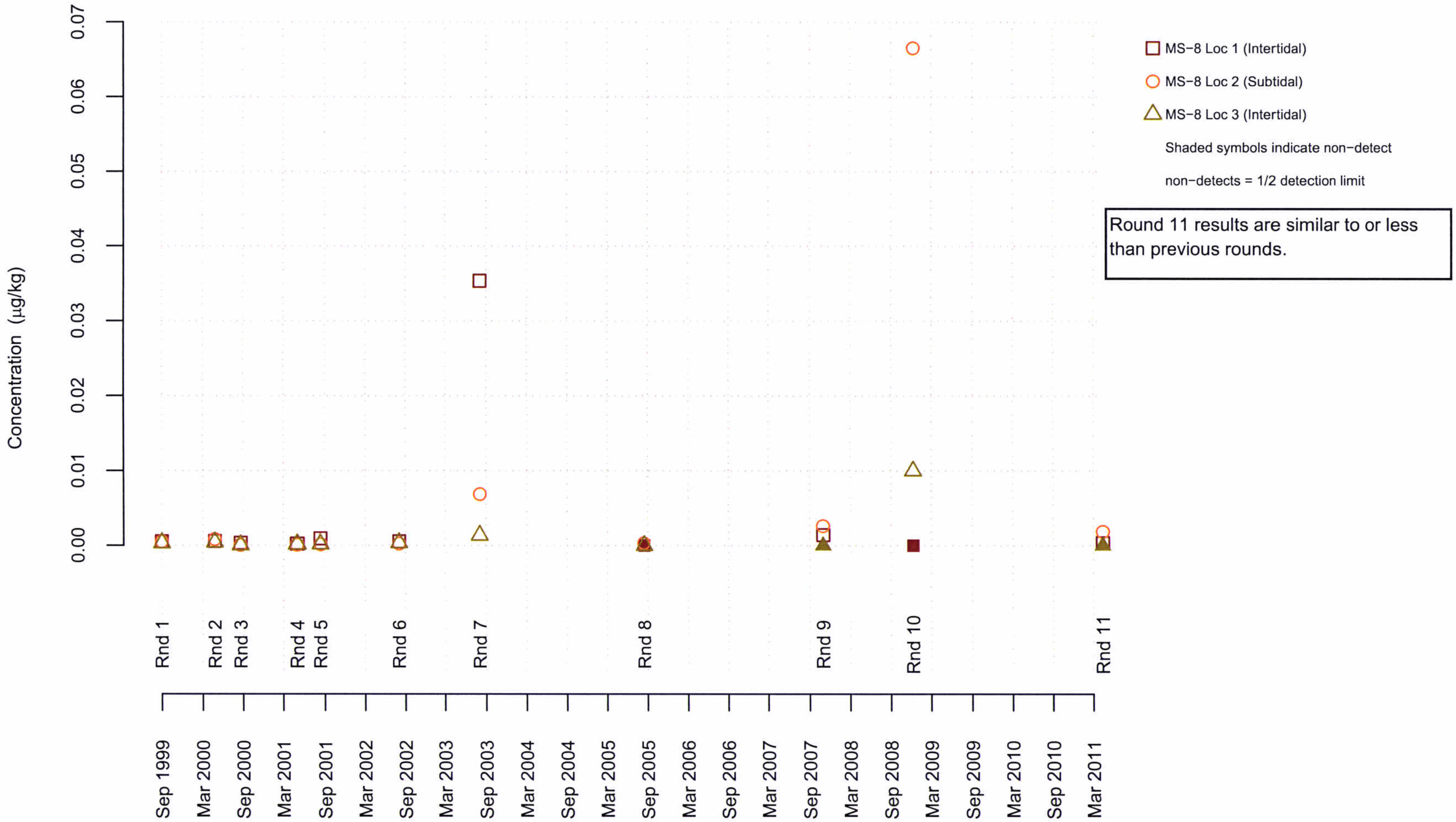


FIGURE D.2. 47
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ DIOXINS/FURANS AT MS−08
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

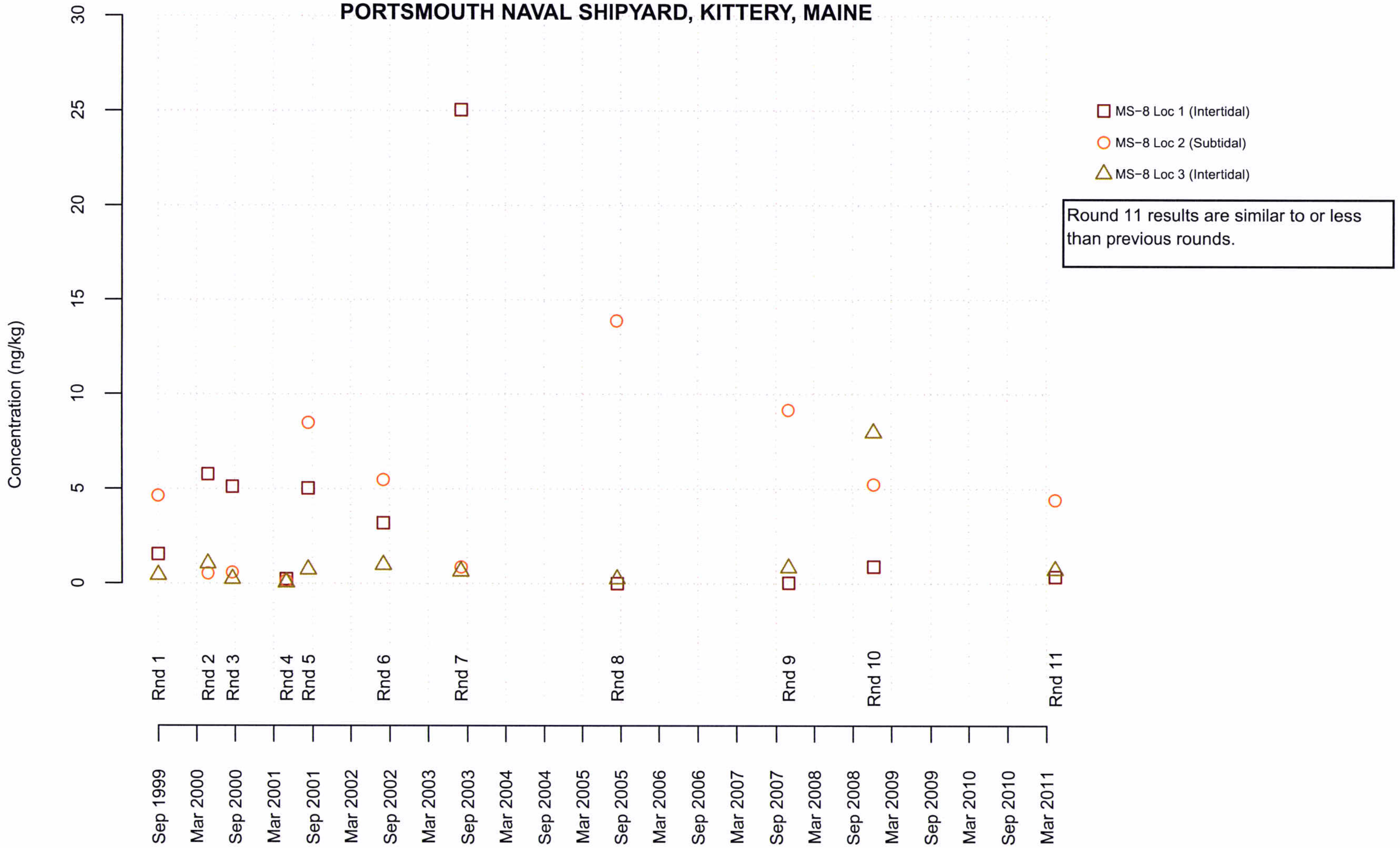


FIGURE D.2. 48
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ DIOXINS/FURANS BIRD AT MS-08
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

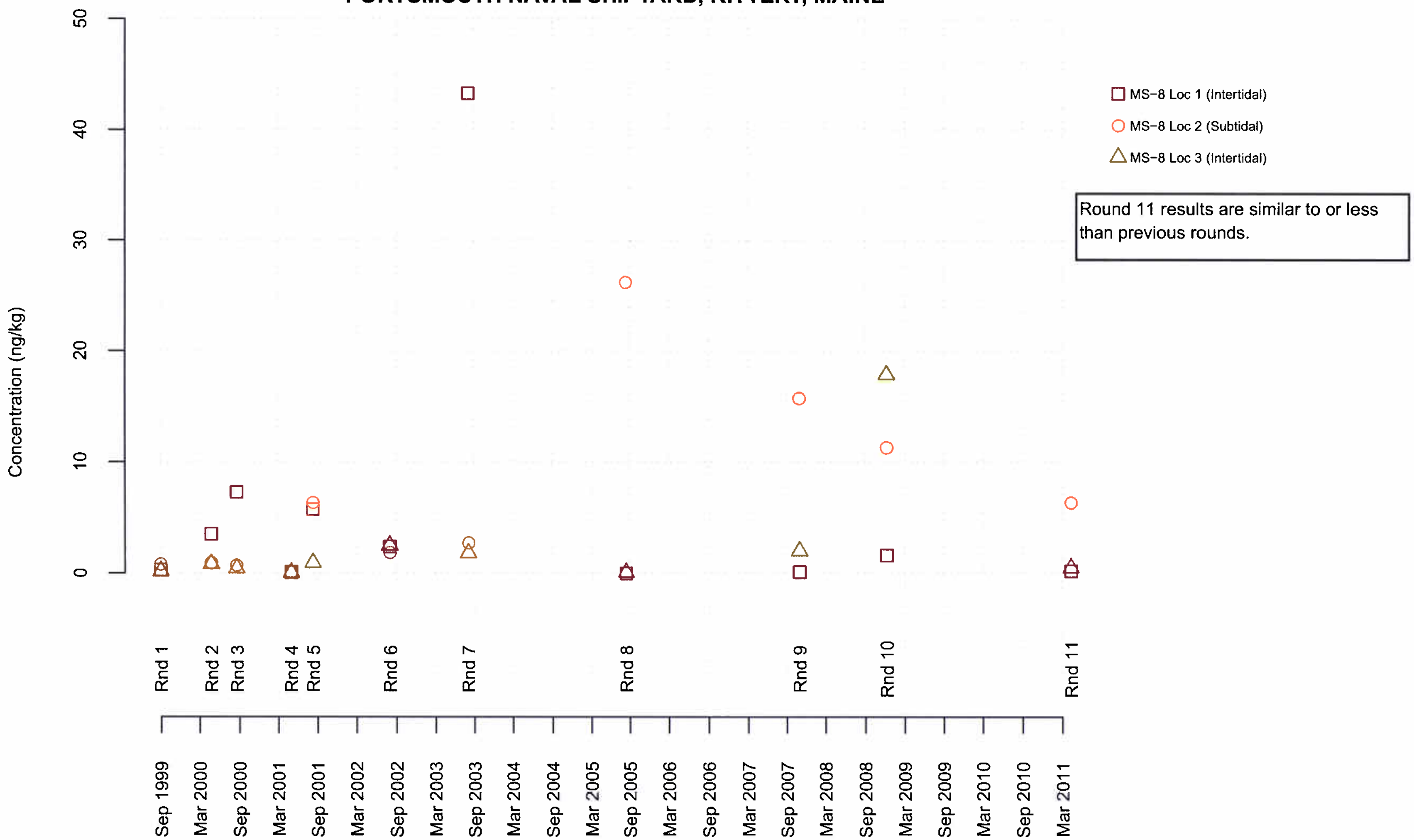


FIGURE D.2. 49
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ DIOXINS/FURANS FISH AT MS-08
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

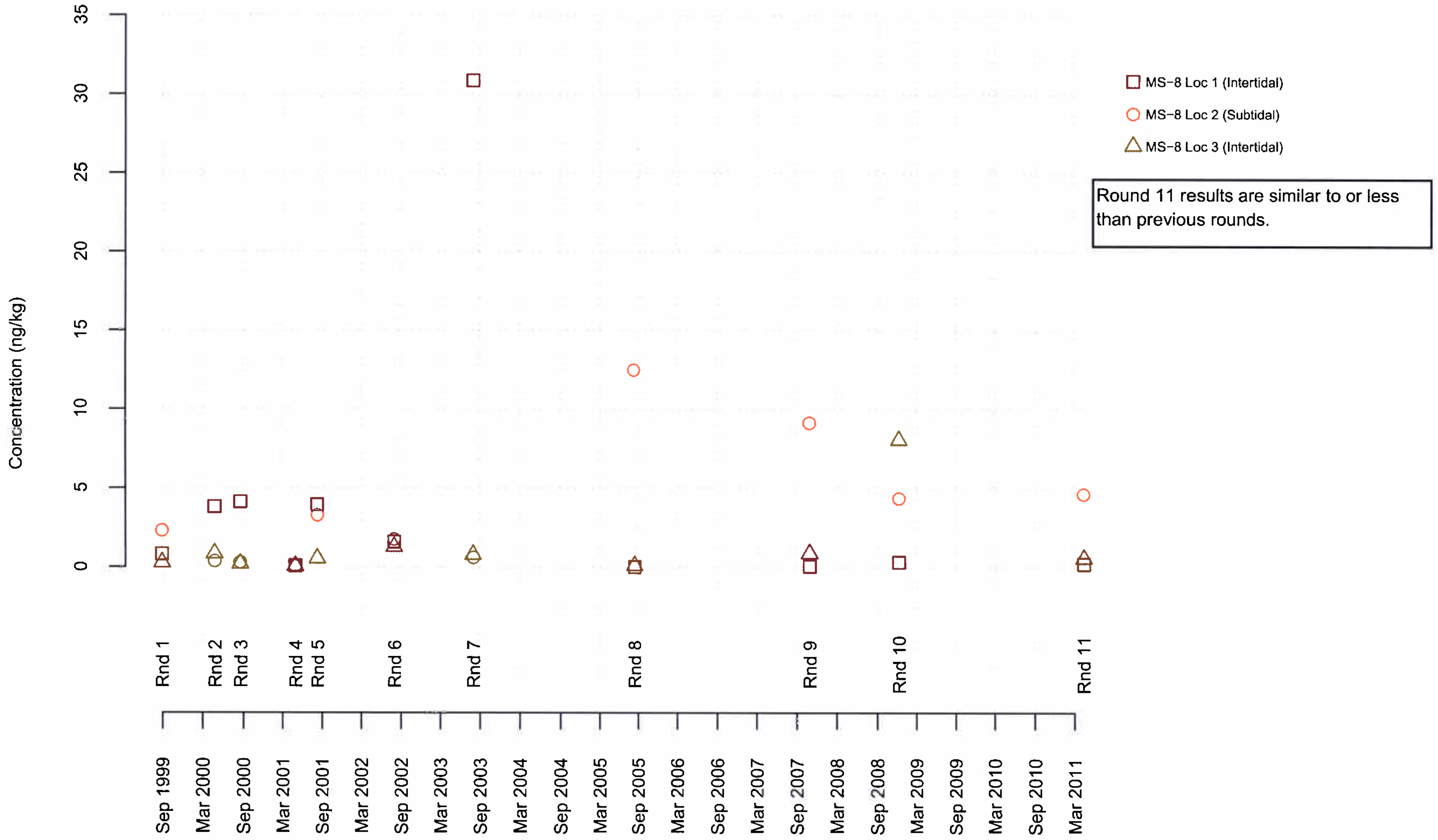


FIGURE D.2. 50
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

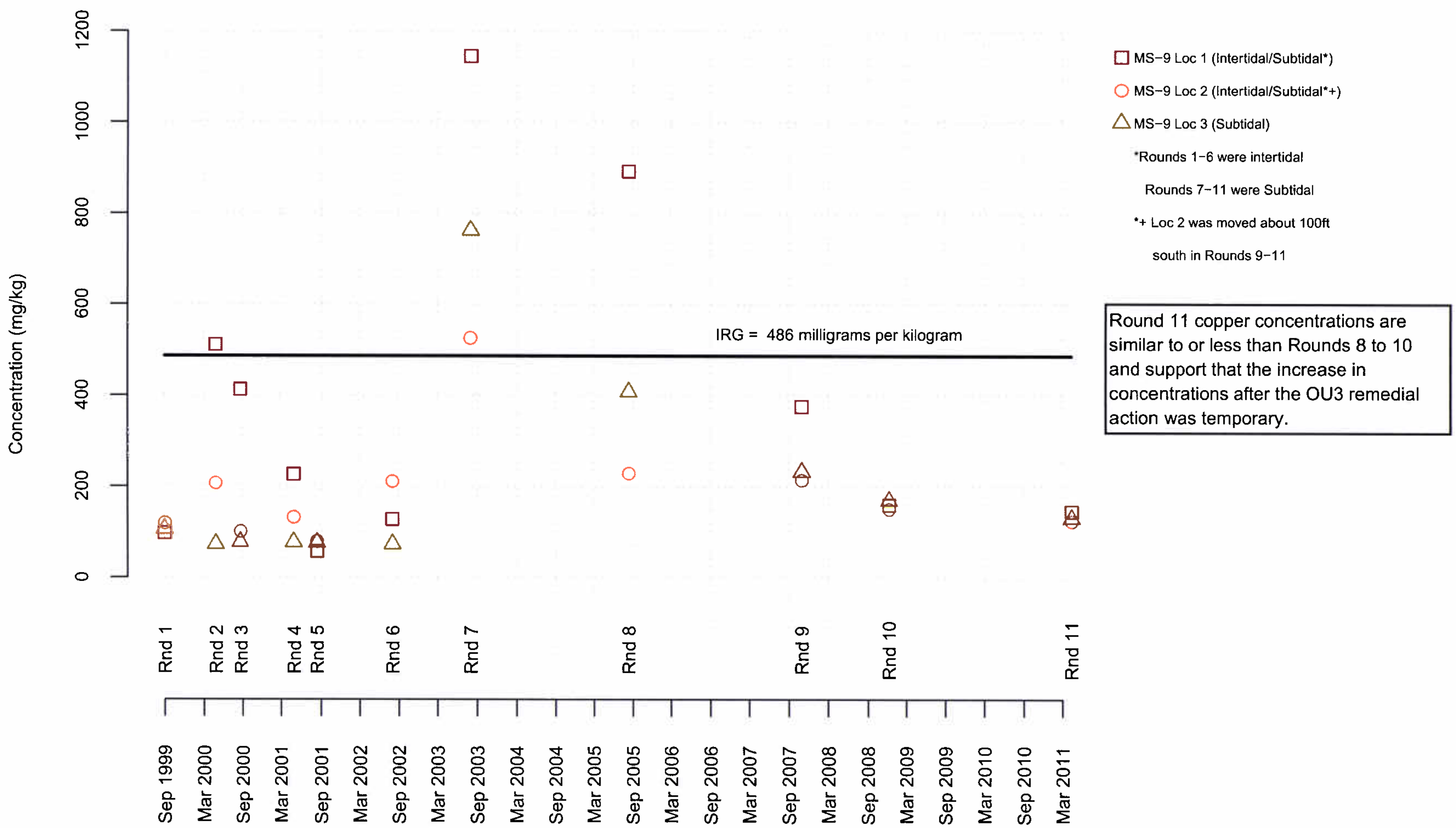


FIGURE D.2. 51
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR LEAD AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

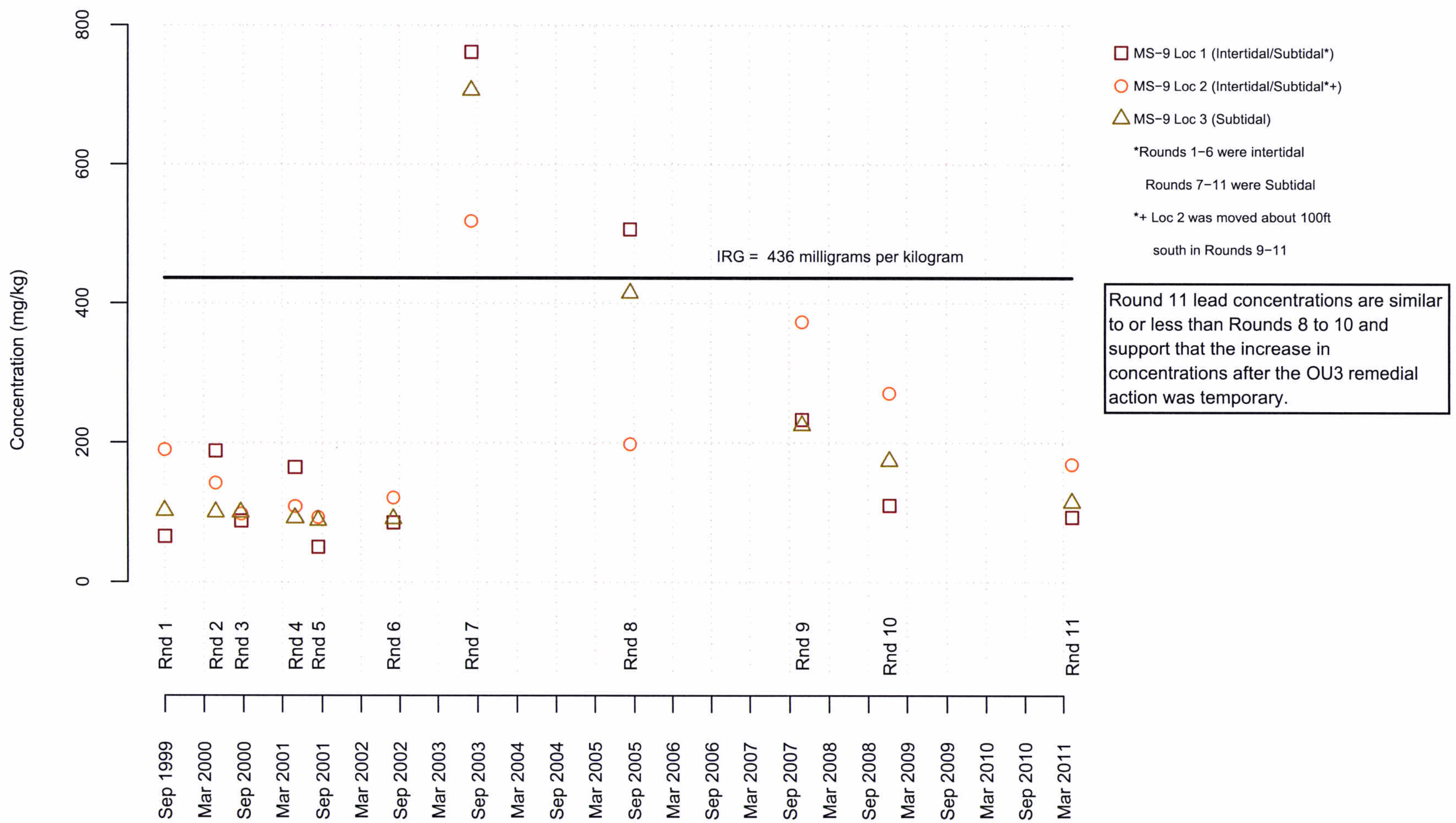


FIGURE D.2. 52
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR NICKEL AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

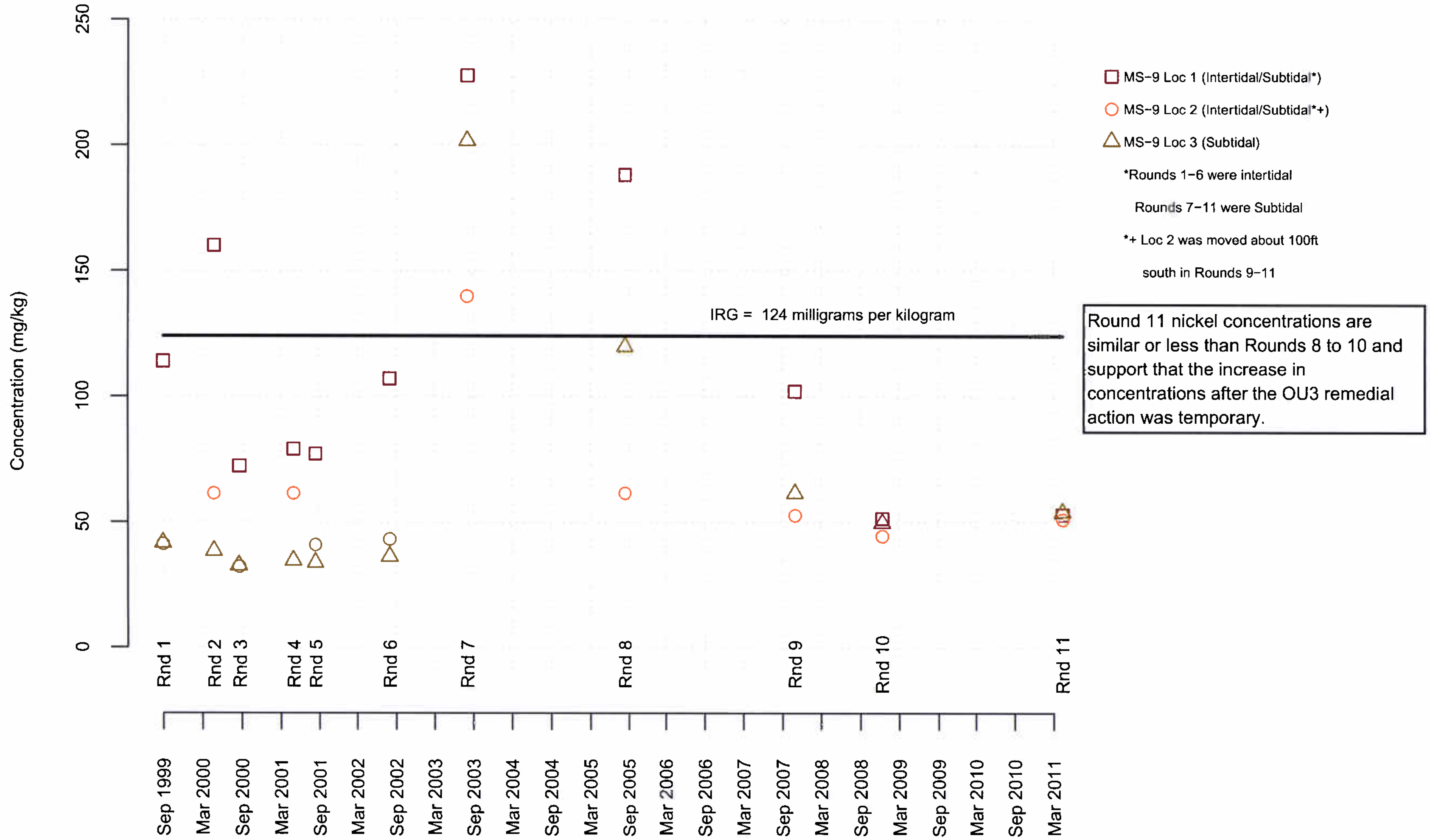


FIGURE D.2. 53
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ACENAPHTHYLENE AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

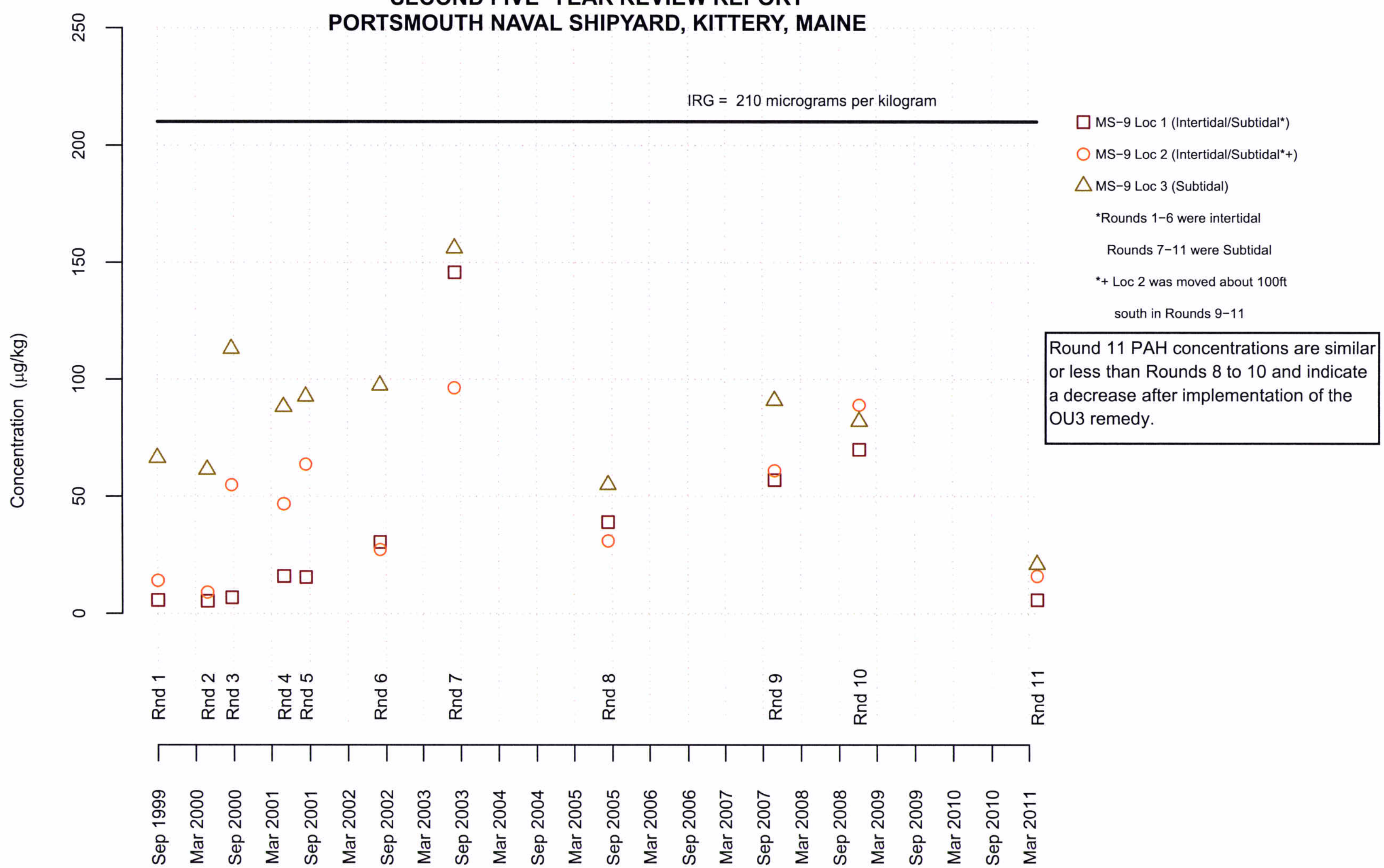


FIGURE D.2. 54
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ANTHRACENE AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

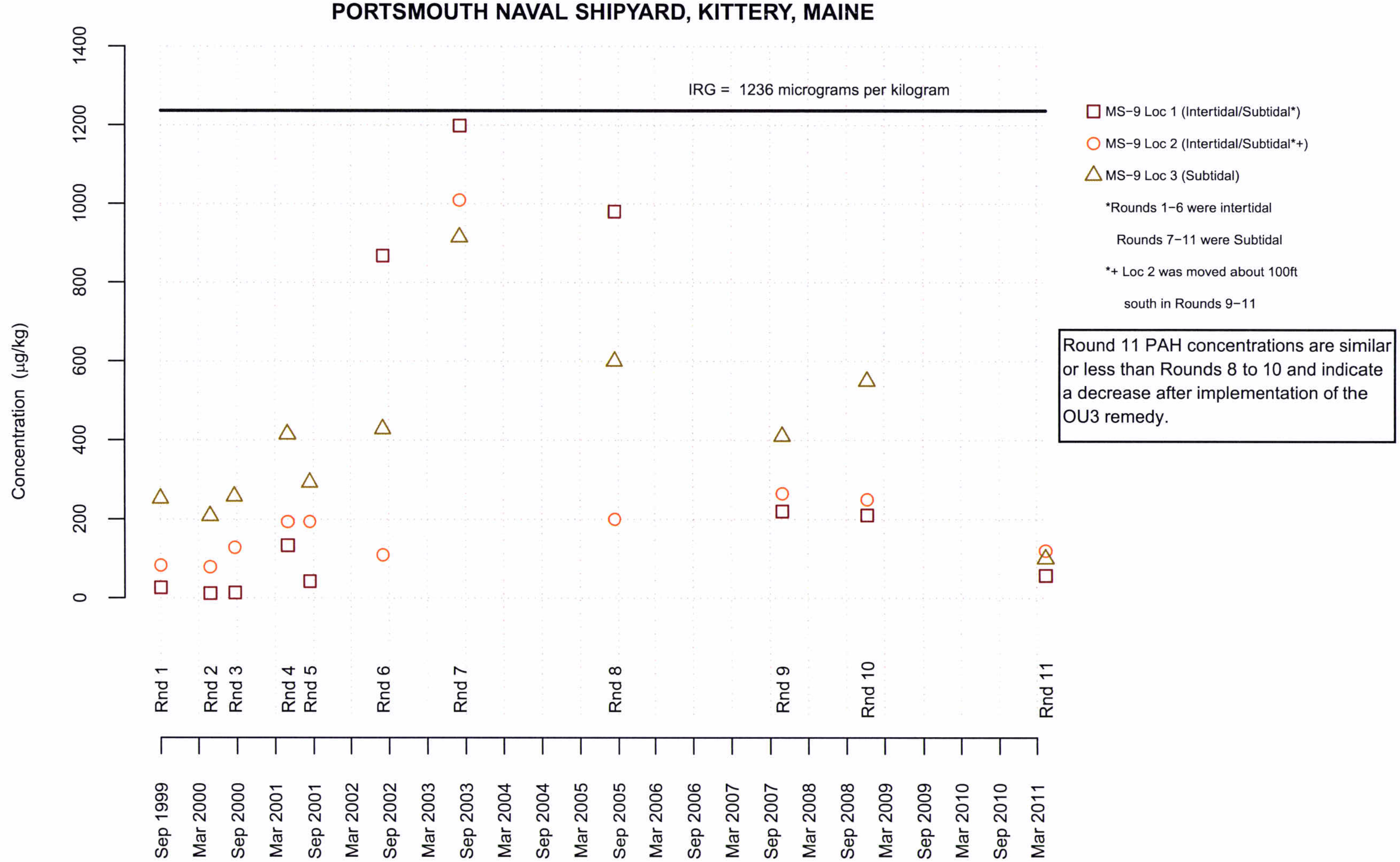


FIGURE D.2. 55
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR FLUORENE AT MS−9
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

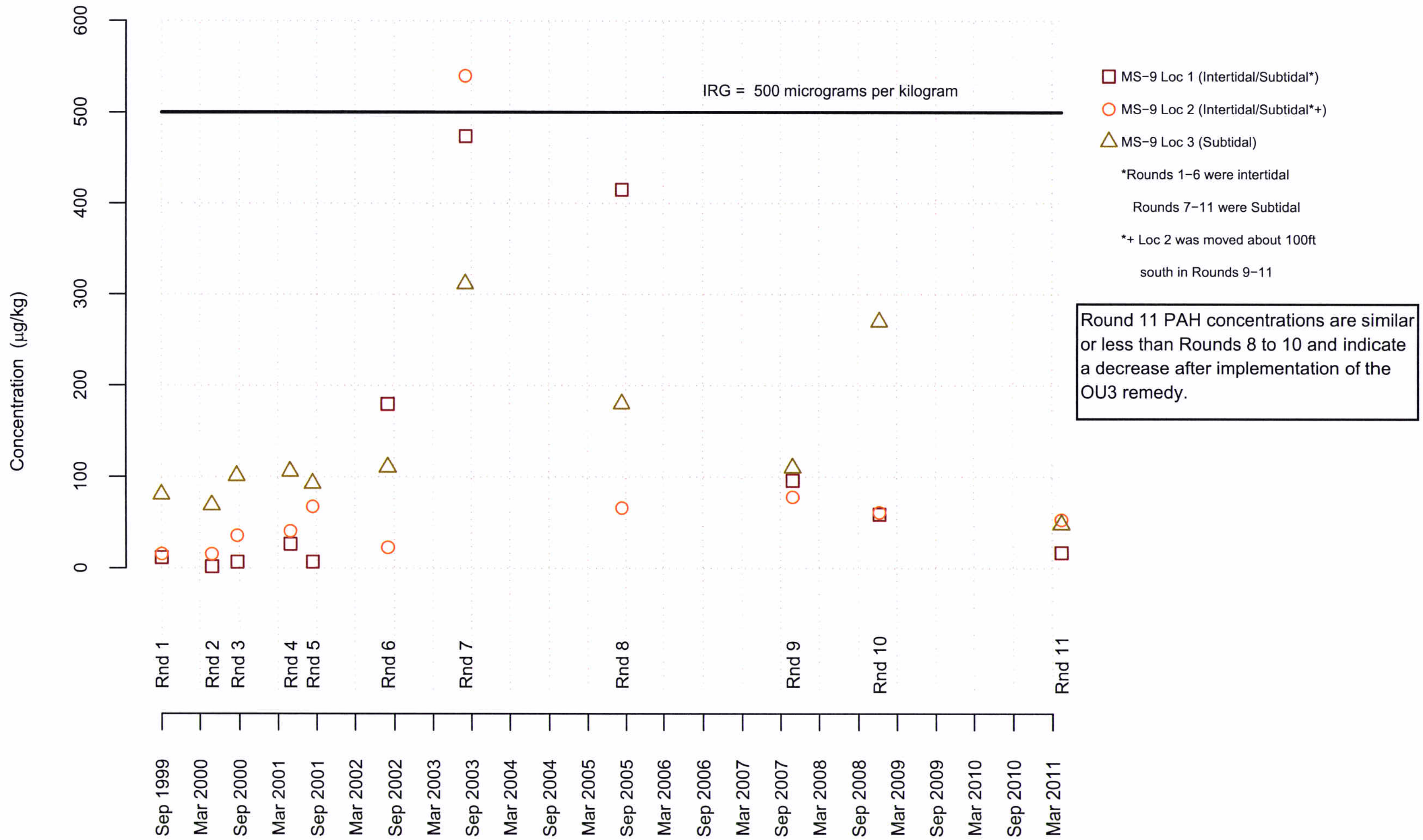


FIGURE D.2. 56
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

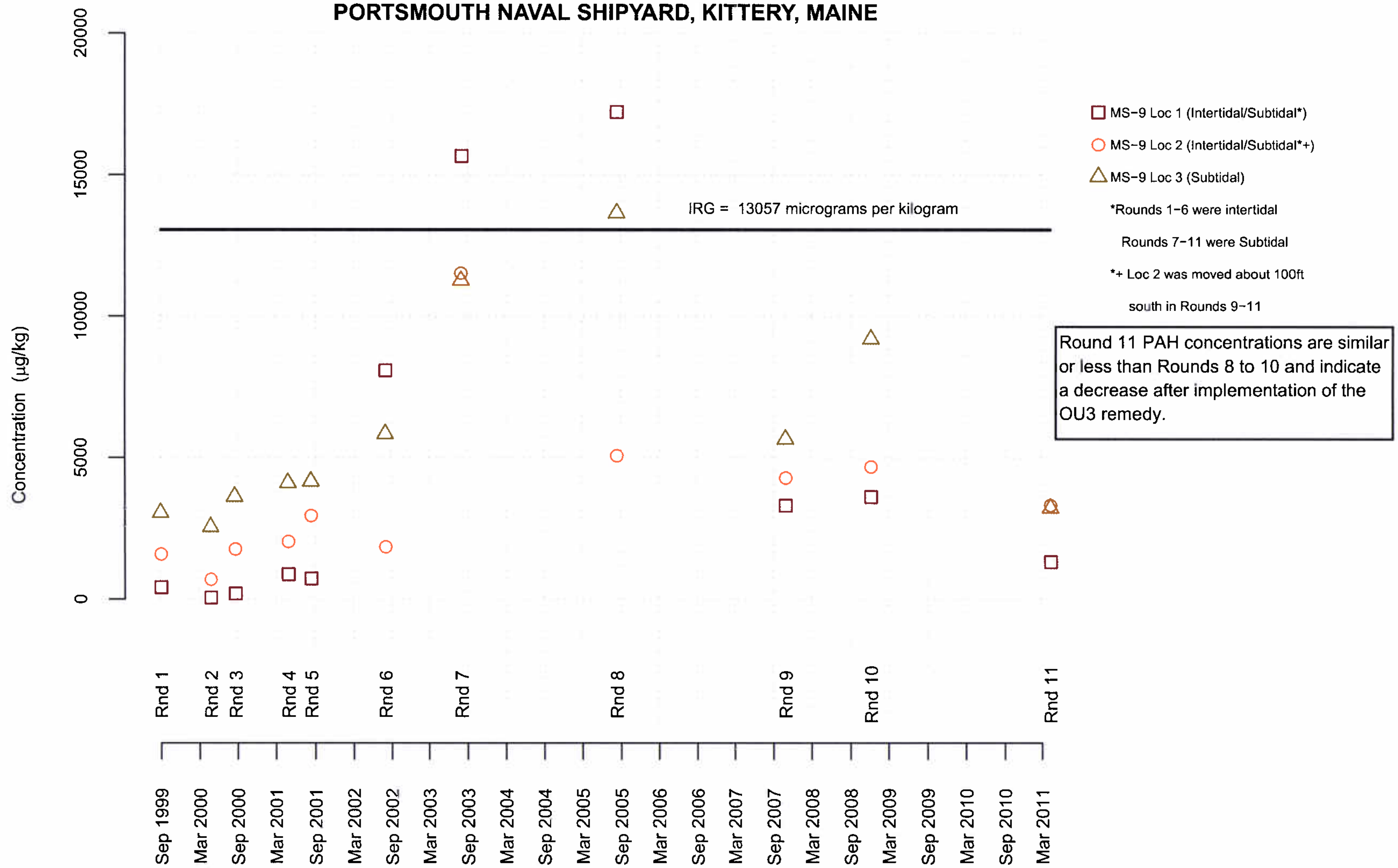


FIGURE D.2. 57
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR 4,4'-DDT AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

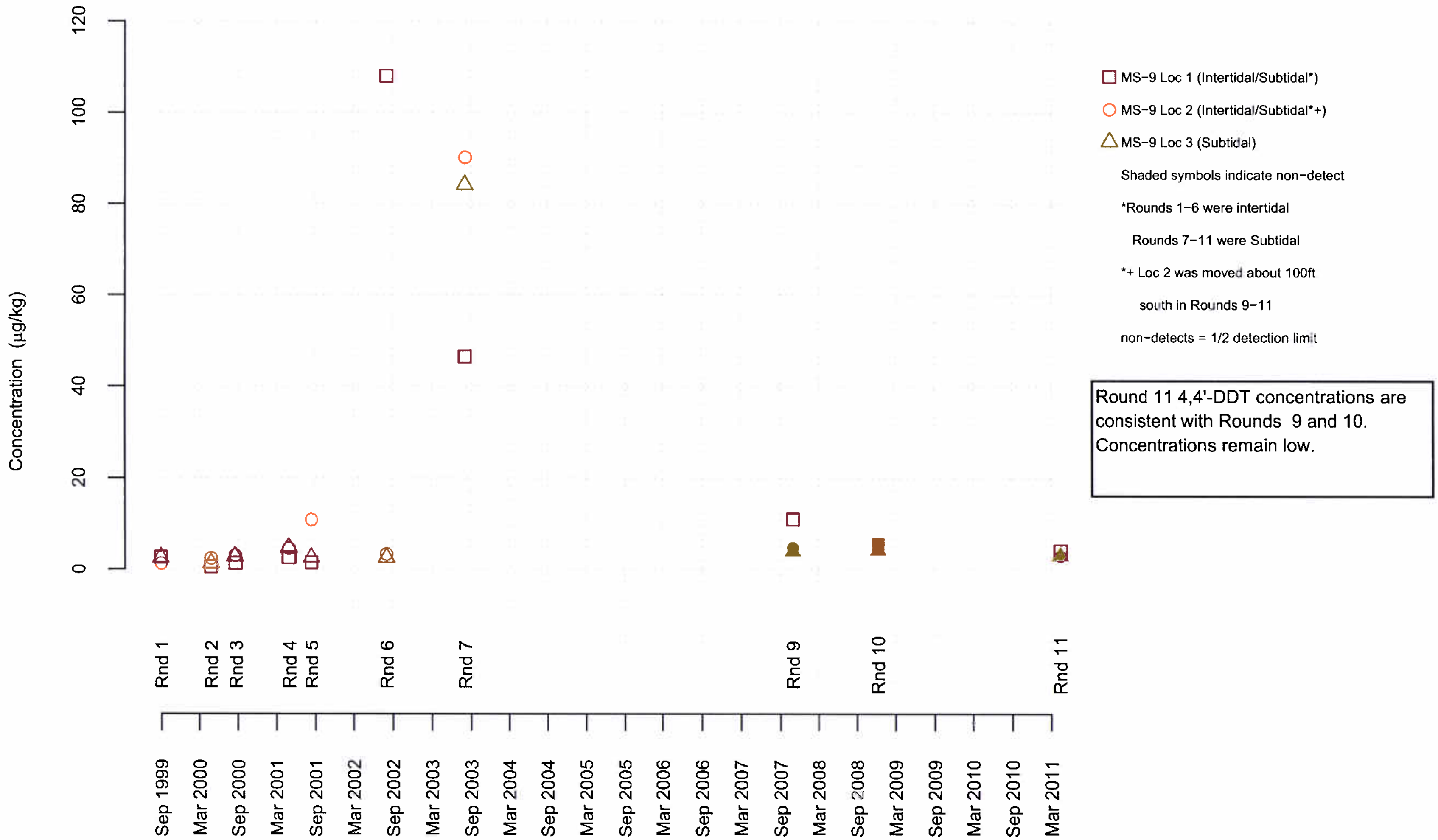


FIGURE D.2. 58
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ PCB BIRD AT MS−9
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

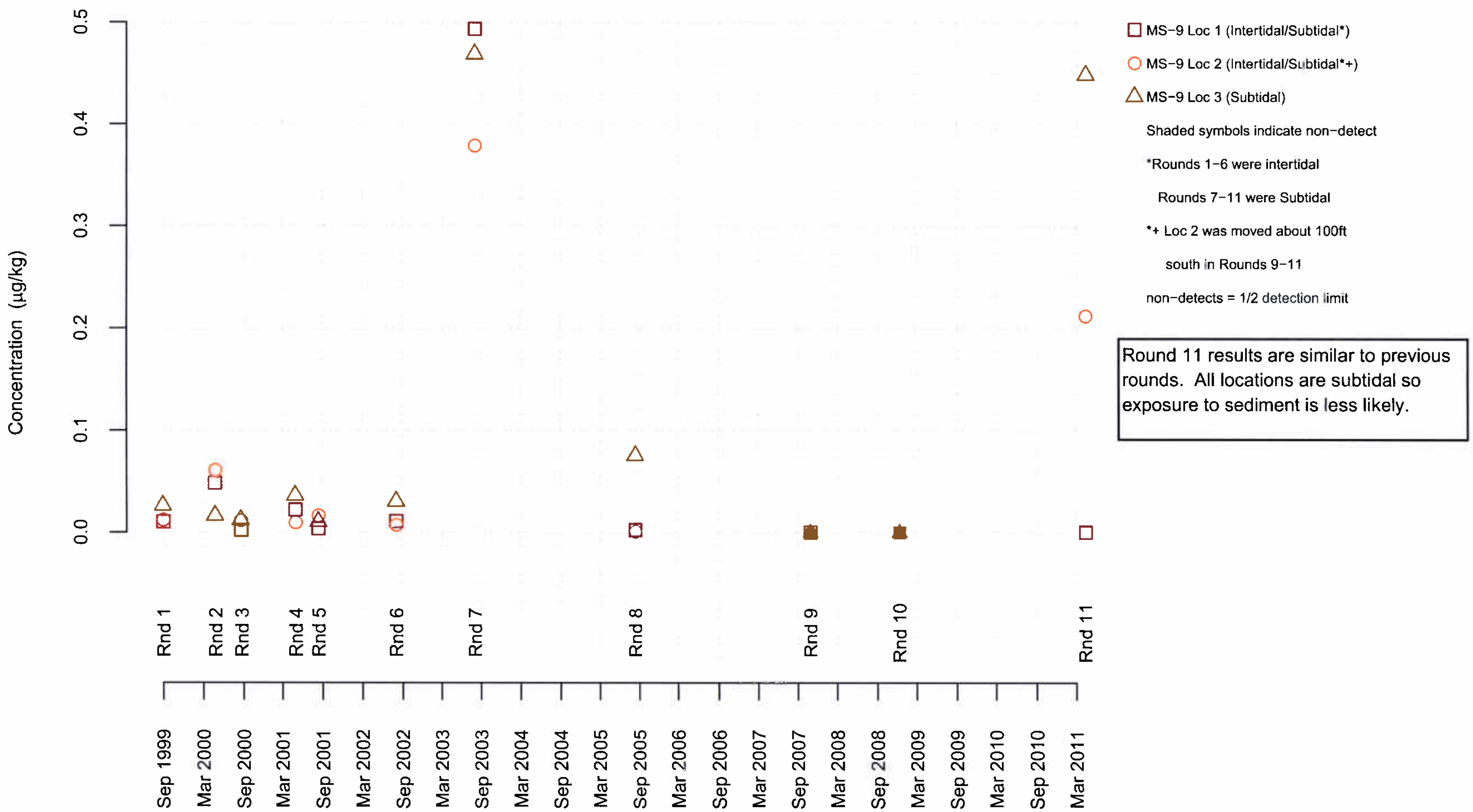


FIGURE D.2. 59
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ PCB FISH AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

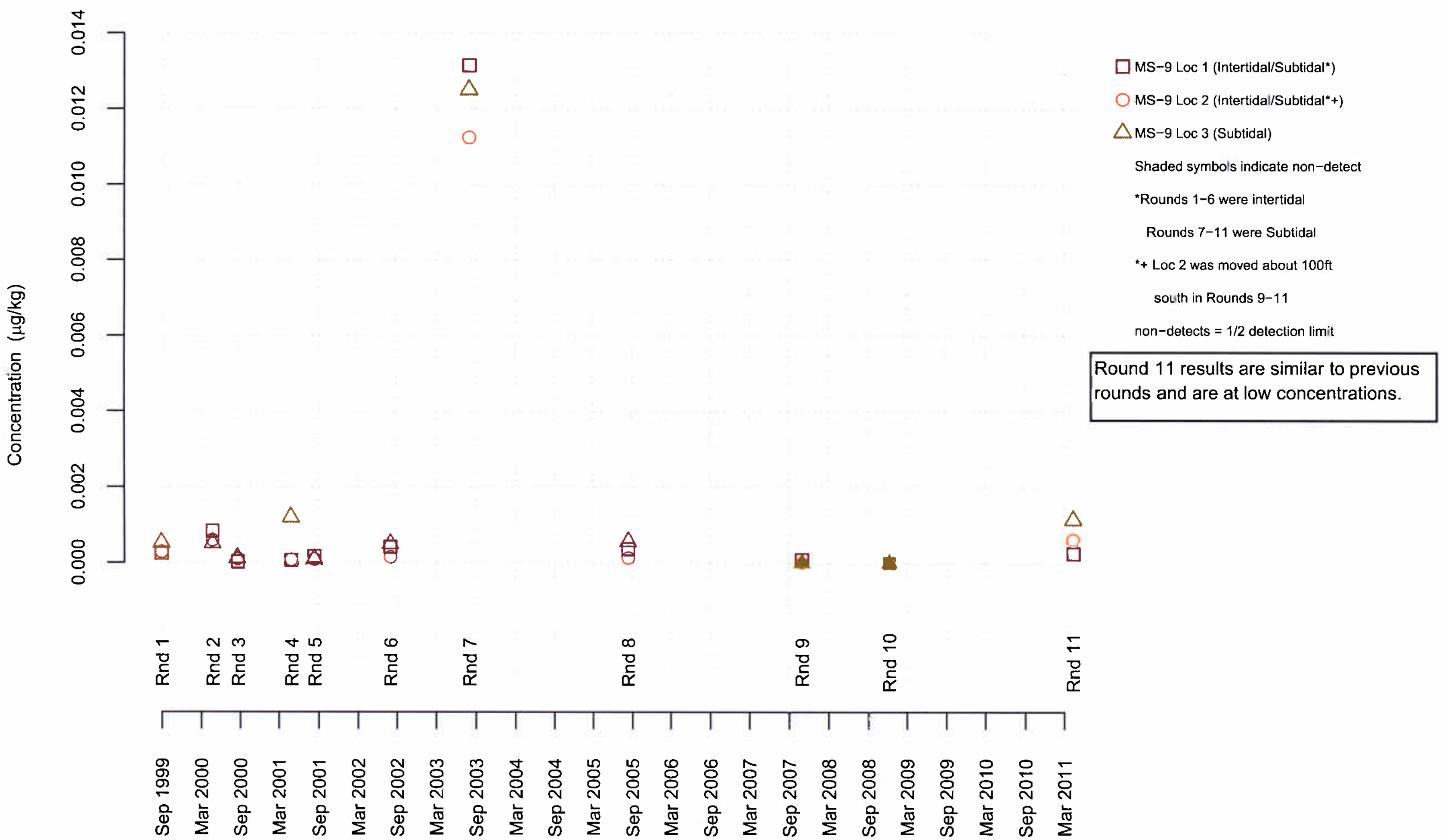


FIGURE D.2. 60
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ DIOXINS/FURANS BIRD AT MS-9
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

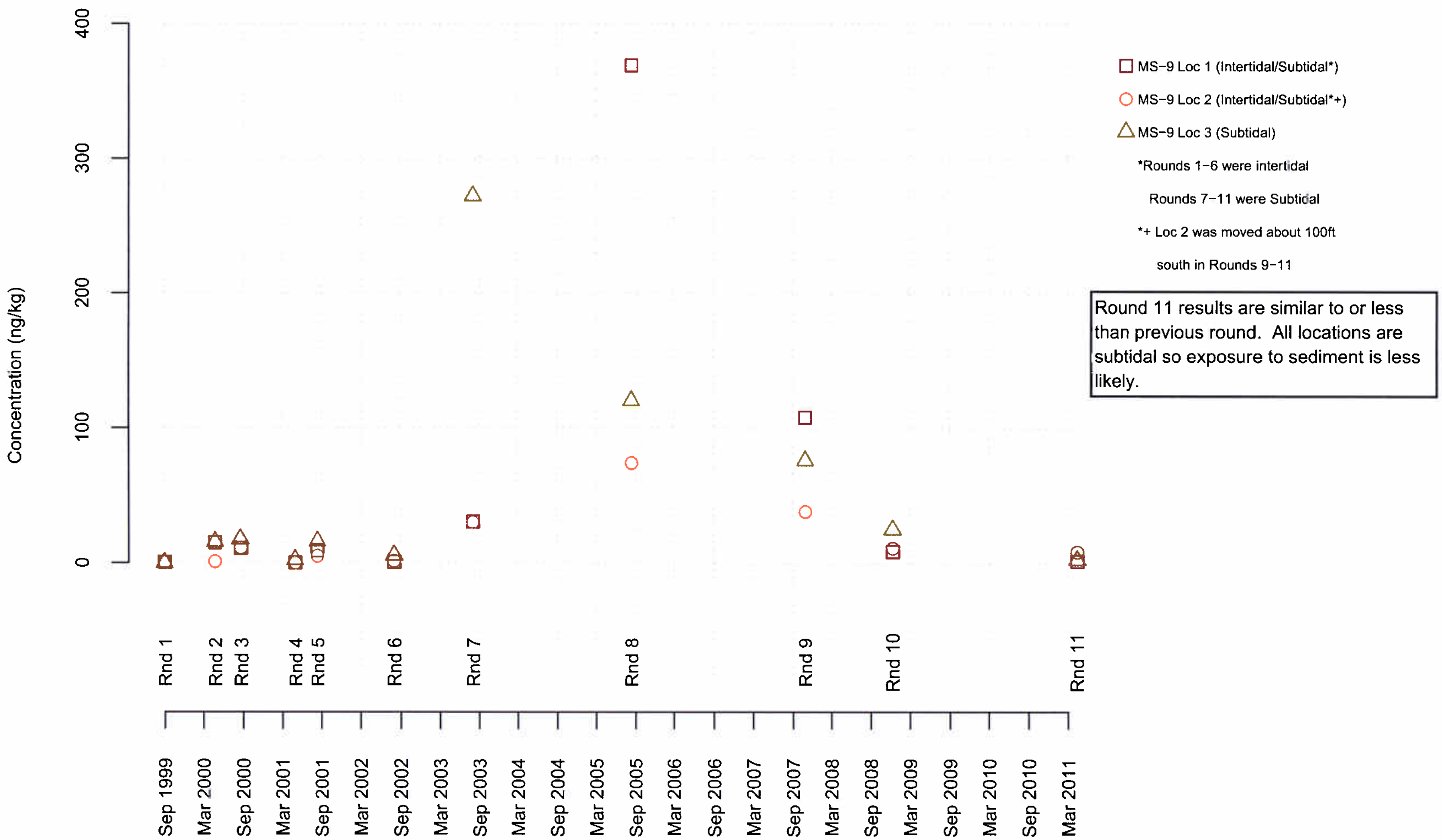


FIGURE D.2. 61
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR TEQ DIOXINS/FURANS FISH AT MS−9
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

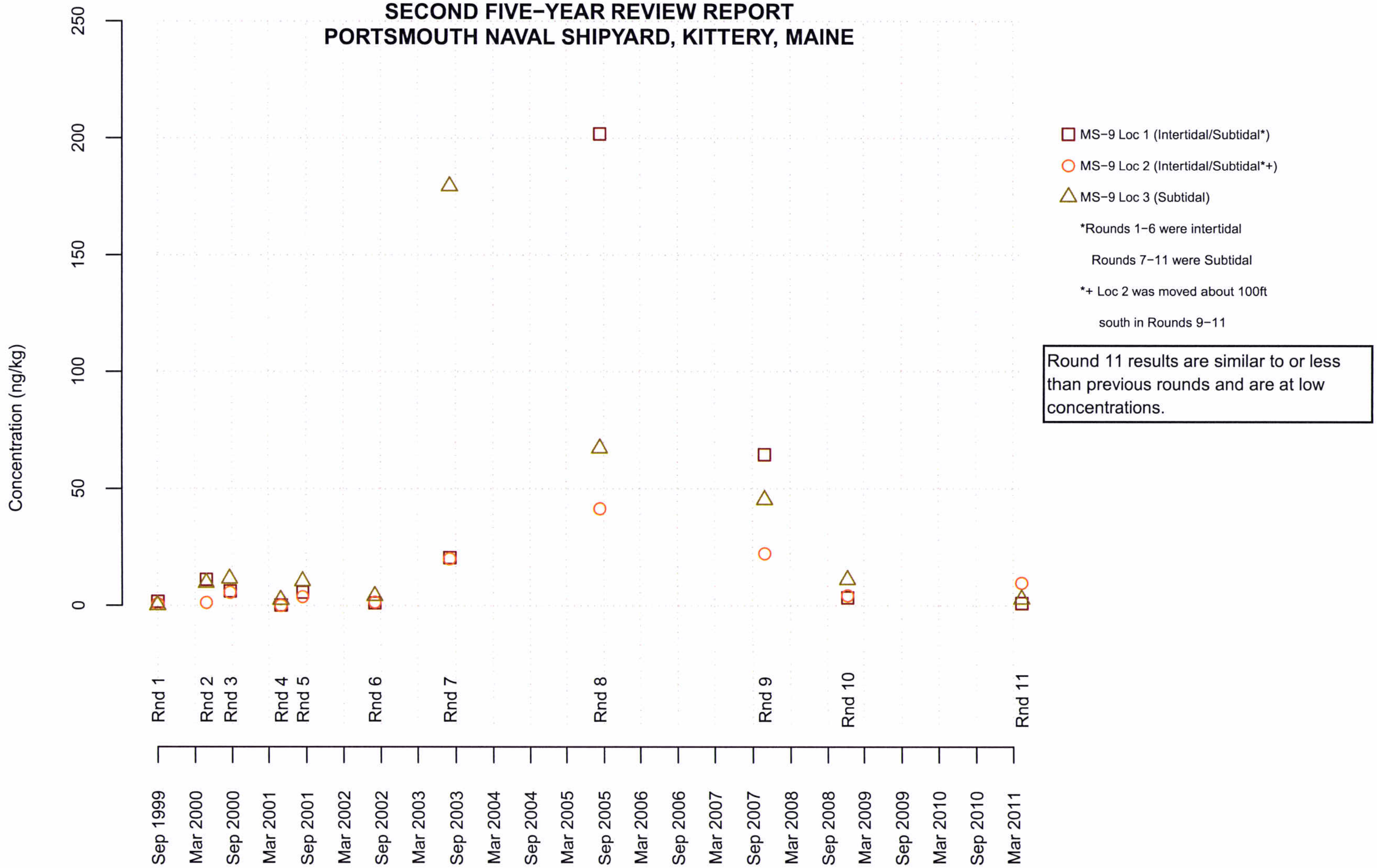


FIGURE D.2. 62
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR COPPER AT MS-11
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

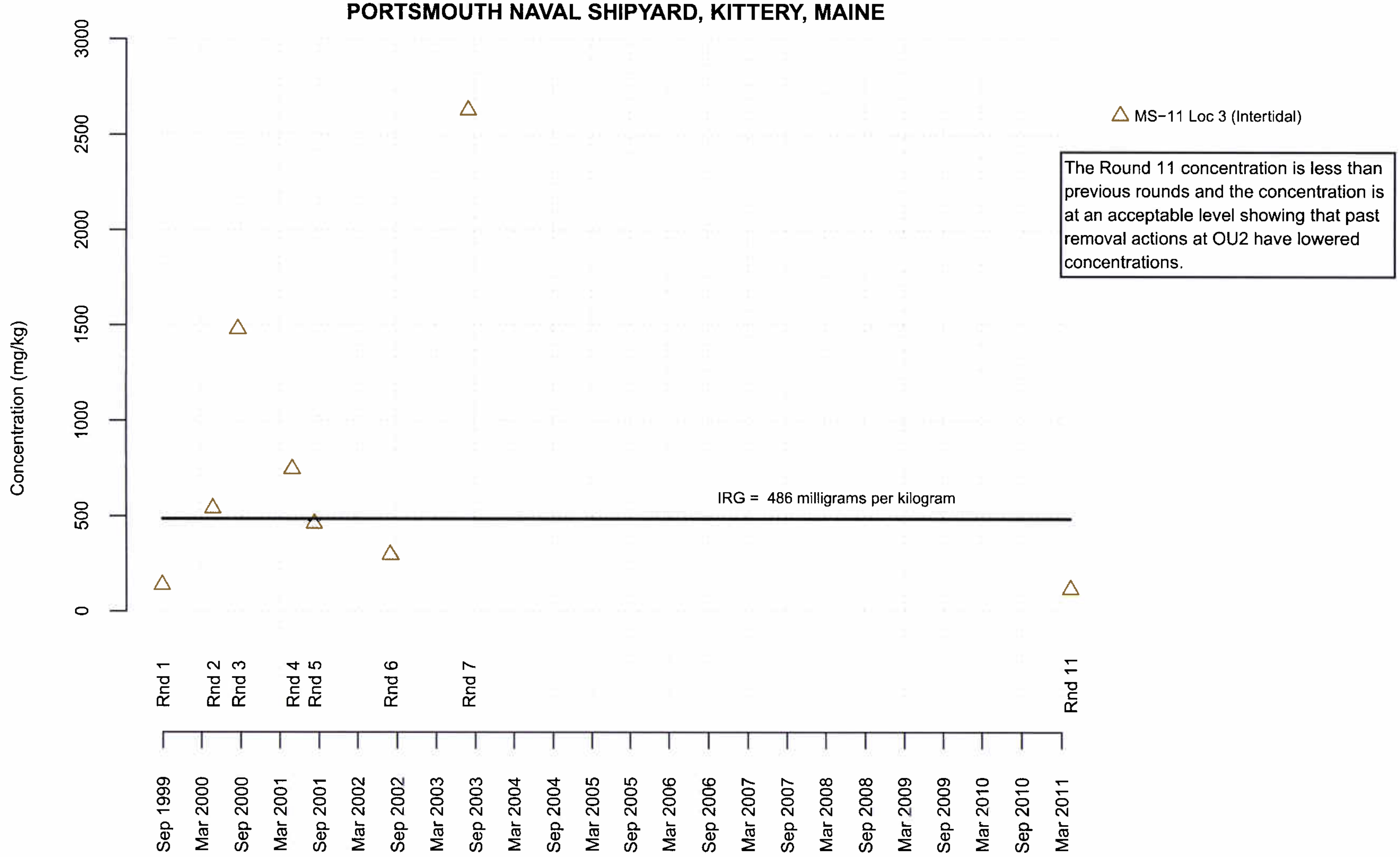


FIGURE D.2. 63
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR LEAD AT MS−11
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

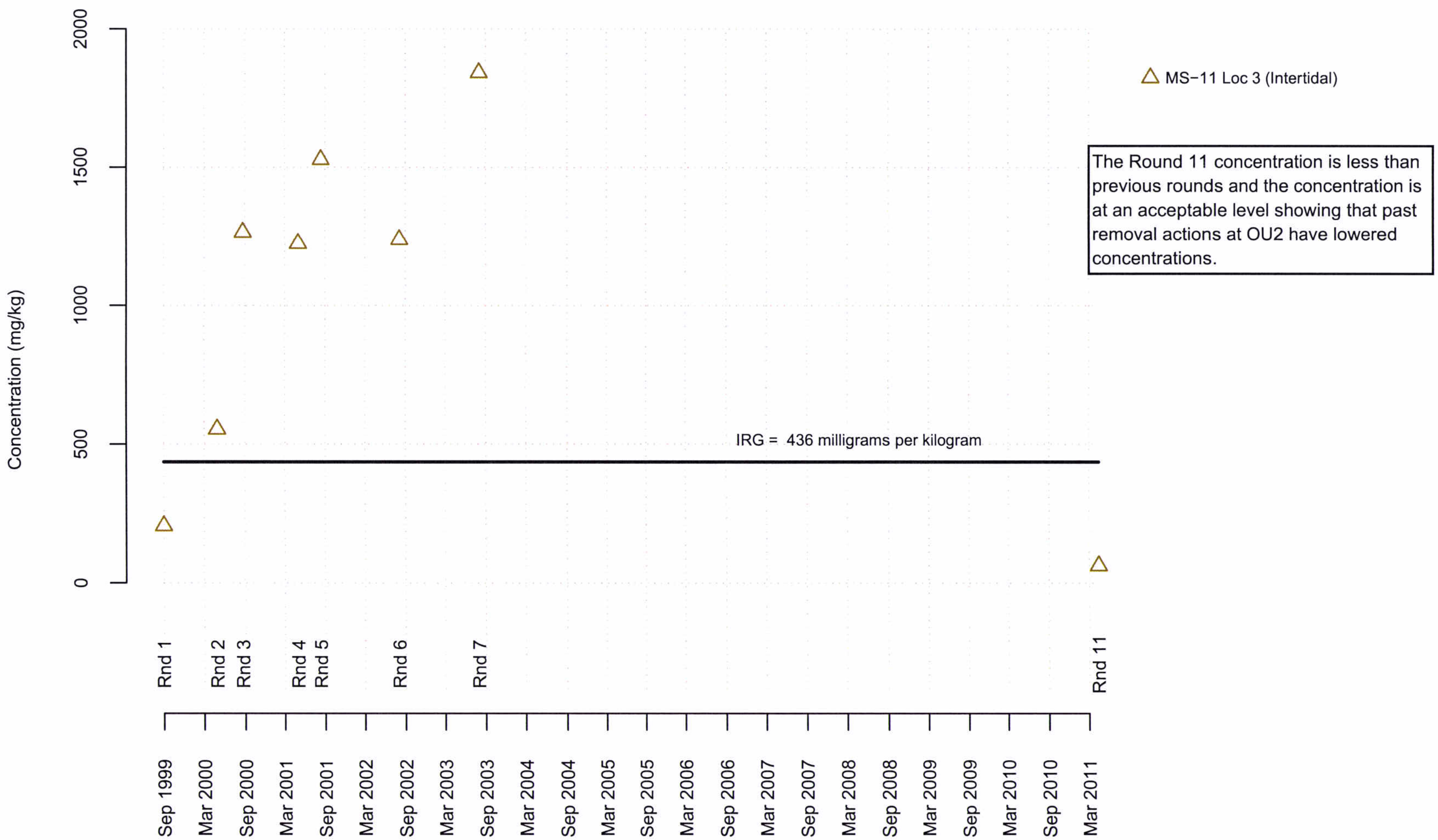


FIGURE D.2. 64
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR NICKEL AT MS-11
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

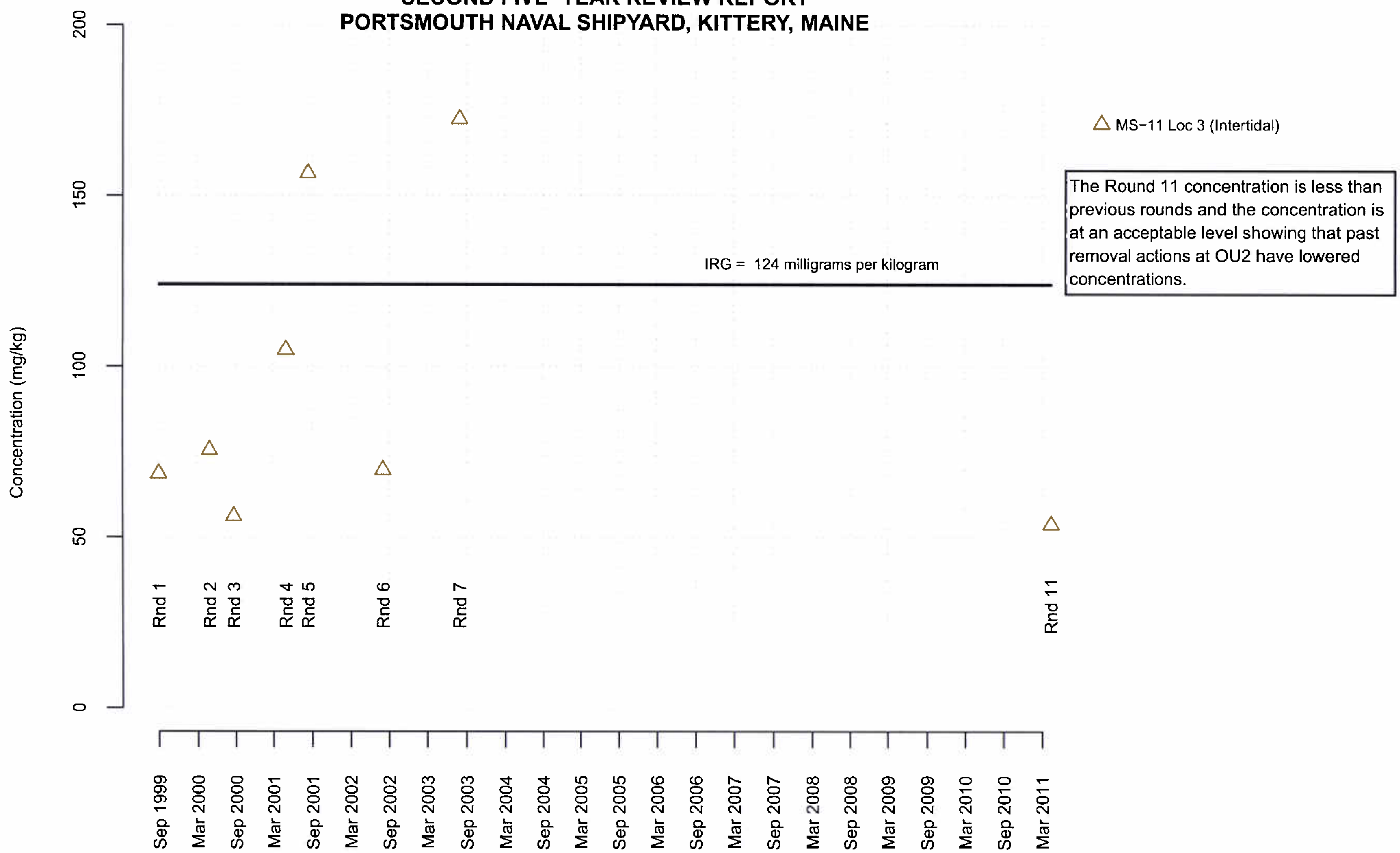


FIGURE D.2. 65
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR LEAD AT MS−12
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

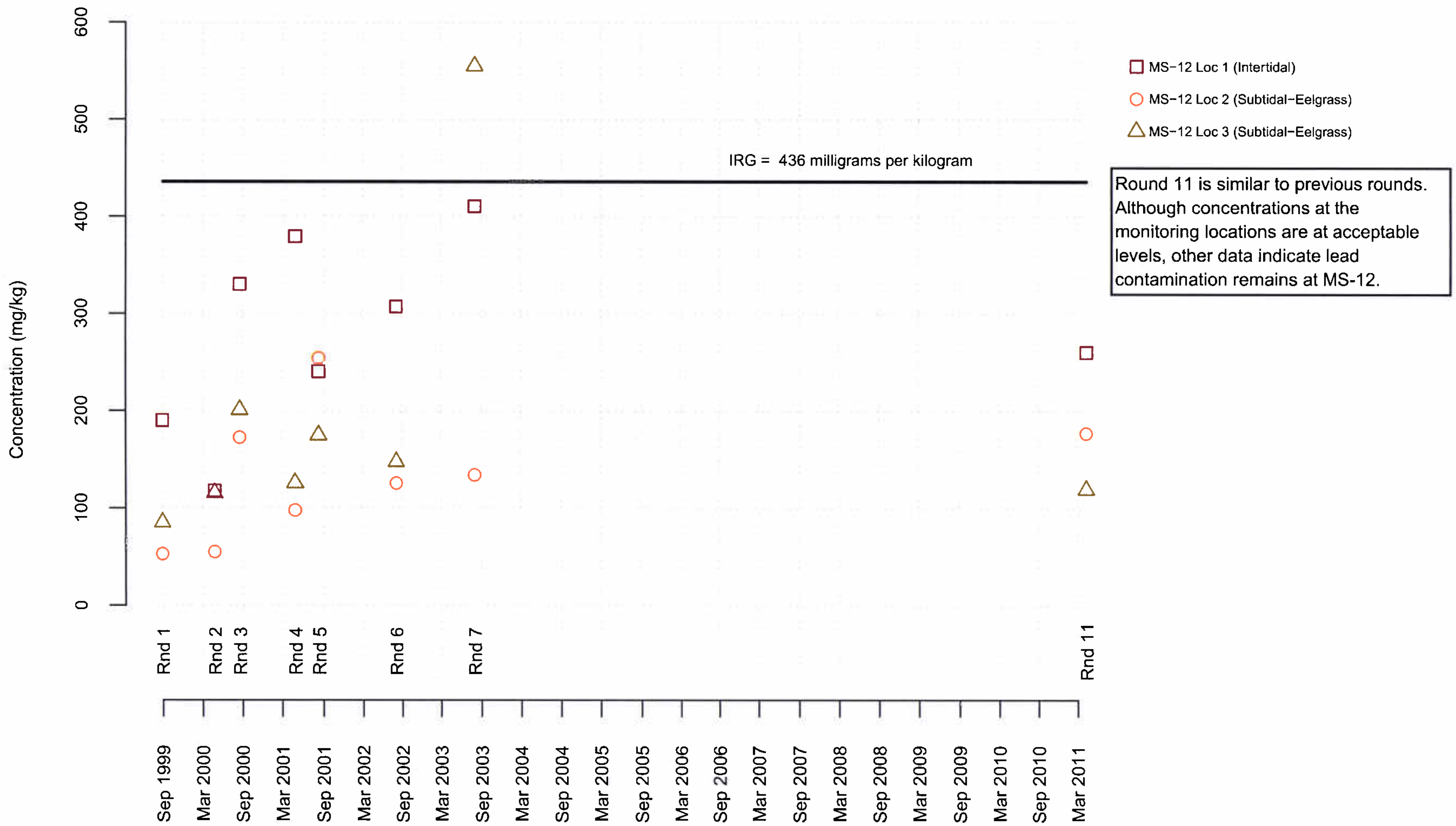


FIGURE D.2. 66
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ACENAPHTHYLENE AT MS−12
SECOND FIVE−YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

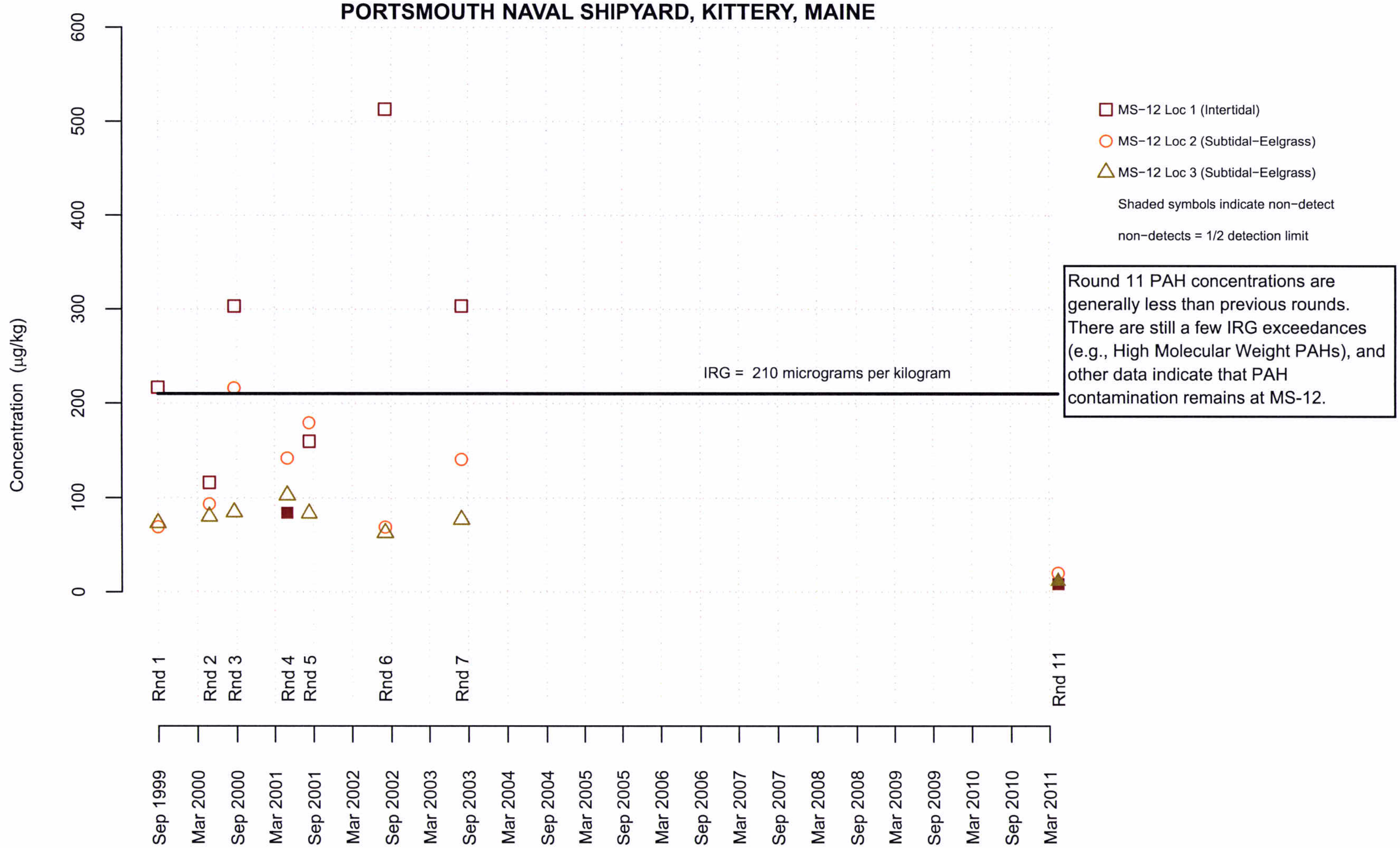


FIGURE D.2. 67
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR ANTHRACENE AT MS-12
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

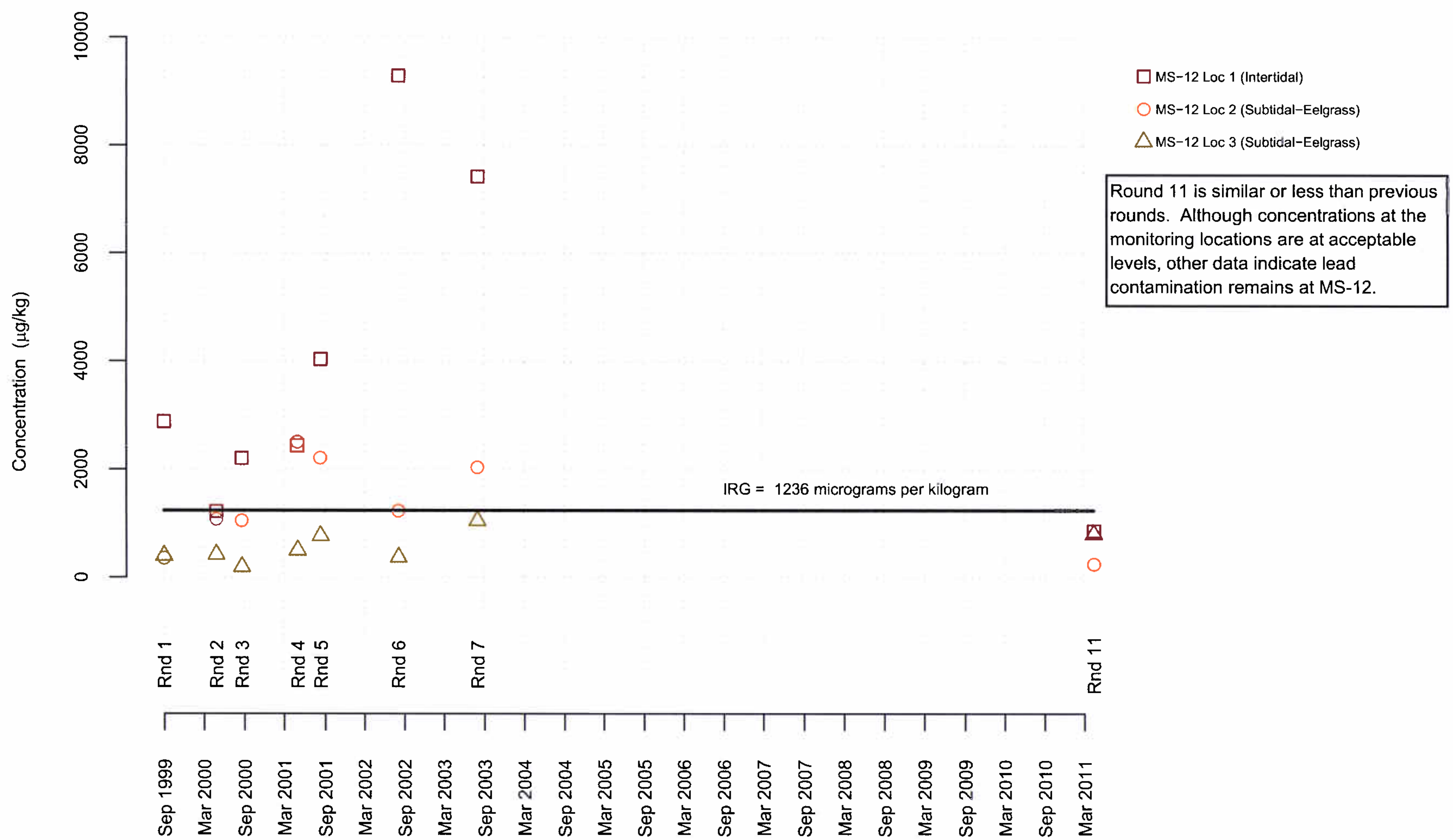


FIGURE D.2. 68
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR FLUORENE AT MS-12
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

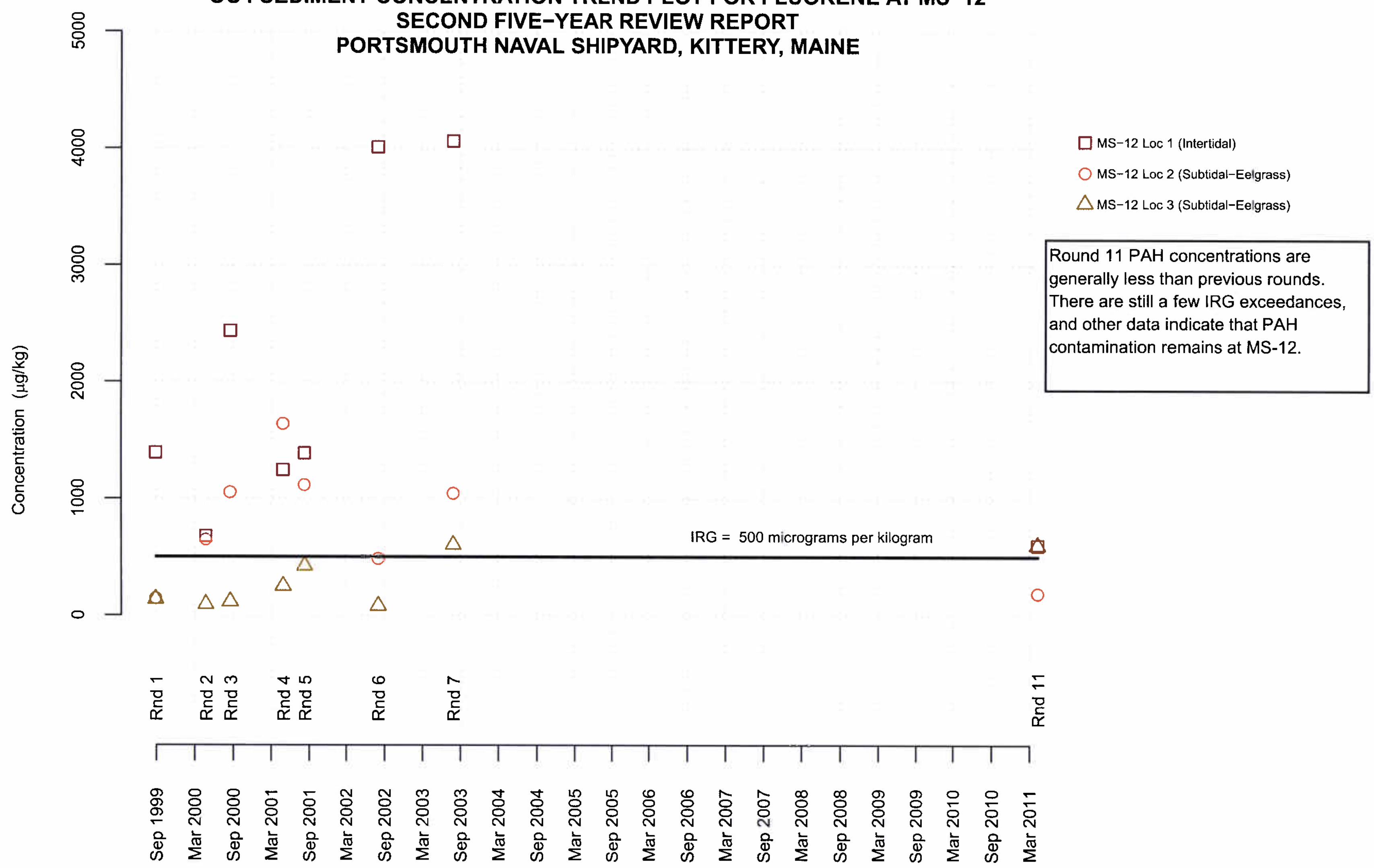
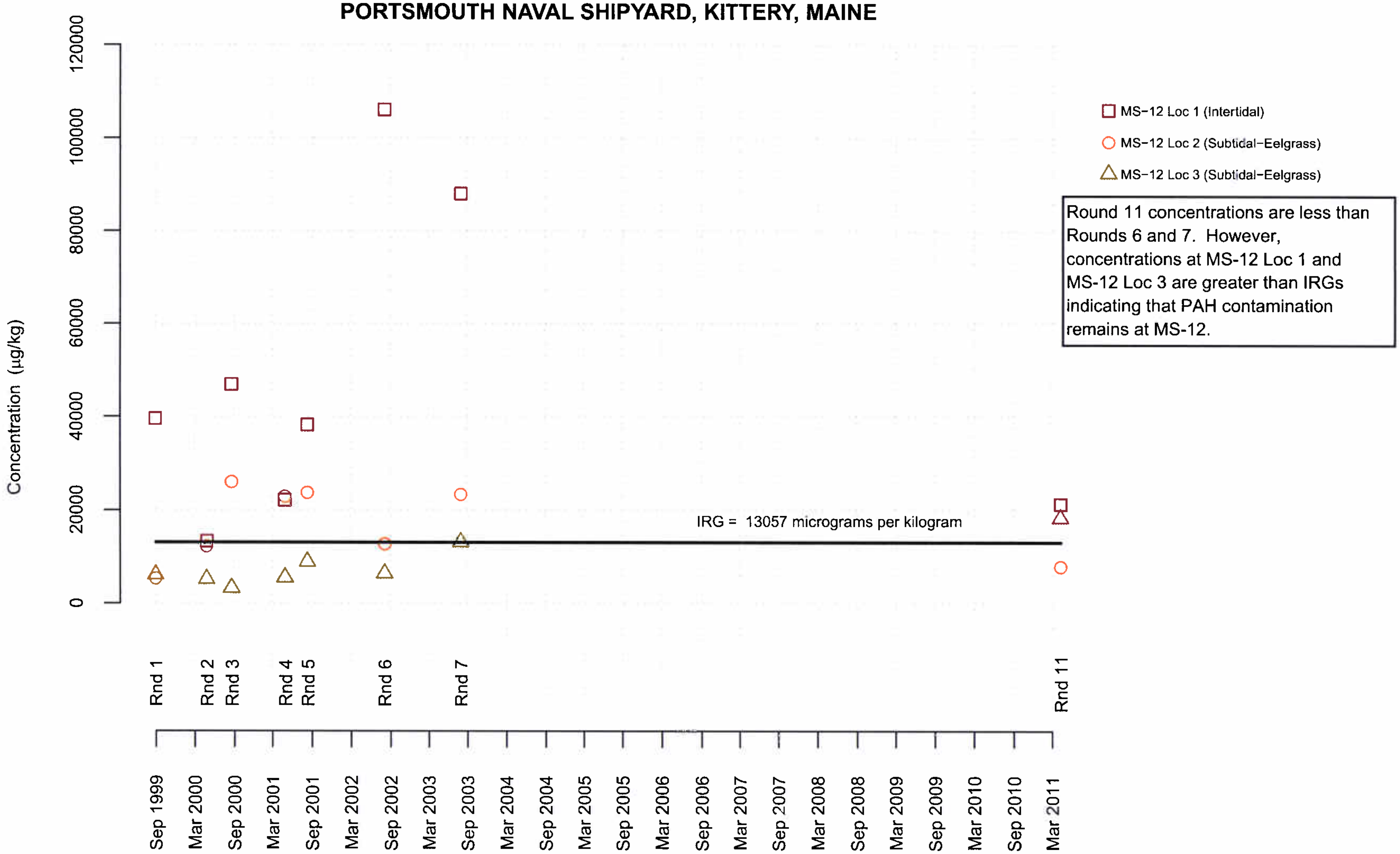


FIGURE D.2. 69
OU4 SEDIMENT CONCENTRATION TREND PLOT FOR HIGH MOLECULAR WEIGHT PAHs AT MS-12
SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE



DATA SUMMARY TABLES AND FIGURES FROM OU4 FS REPORT

TABLE 1-1

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 1
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE
PAGE 1 OF 2

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-01	LOC.1	OU4-SD-M01-199A	01	19990910	0 - 0.33	72 J	100	25	940	47 J	158 J	24
MS-01	LOC.1	OU4-SD-M01-100B	02	20000504	0 - 0.33	295	276	187 J	5179	44	77	30
MS-01	LOC.1	OU4-SD-M01-100A	03	20000828	0 - 0.33	151 J	1471 J	761 J	17965	35	63	13 J
MS-01	LOC.1	OU4-SD-M01-101B	04	20010508	0 - 0.33	76 J	215 J	73 J	2316	25	63	19
MS-01	LOC.1	OU4-SD-M01-101A	05	20010819	0 - 0.33	592 J	1852 J	518 J	19158	53	253	17
MS-01	LOC.1	OU4-SD-M01-102A	06	20020813	0 - 0.33	231 J	245 J	53 J	3328	24	146	11
MS-01	LOC.1	OU4-SD-M01-103A	07	20030809	0 - 0.33	805	8747	5546	54452	68	63	19 J
MS-01	LOC.2	OU4-SD-M01-299A	01	19990909	0 - 0.33	189 J	766	202	8204	29 J	116 J	22
MS-01	LOC.2	OU4-SD-M01-200B	02	20000504	0 - 0.33	160	614	182 J	7113	44	174	25
MS-01	LOC.2	OU4-SD-M01-200A	03	20000828	0 - 0.33	114	146	22	1536	26	100	20 J
MS-01	LOC.2	OU4-SD-M01-201B	04	20010507	0 - 0.33	219	533	139 J	6094	43	453	29
MS-01	LOC.2	OU4-SD-M01-201A	05	20010819	0 - 0.33	213	306 J	90 J	3635	18	83	18
MS-01	LOC.2	OU4-SD-M01-202A	06	20020811	0 - 0.33	600 J	1184	552 J	23700	23	114	19 J
MS-01	LOC.2	OU4-SD-M01-203A	07	20030811	0 - 0.33	117	288	104	2443	85 J	90 J	32
MS-01	LOC.3	OU4-SD-M01-399A	01	19990910	0 - 0.33	166	508 J	195	7360	44 J	106 J	27
MS-01	LOC.3	OU4-SD-M01-300B	02	20000504	0 - 0.33	544 J	2650 J	1660 J	22509	200	209	31
MS-01	LOC.3	OU4-SD-M01-300B-AVG	02	20000504	0 - 0.33	371 J	1575 J	915 J	14257	175	196	30
MS-01	LOC.3	OU4-SD-M01-300B-D	02	20000504	0 - 0.33	198 J	499 J	169 J	6005	150	182	29
MS-01	LOC.3	OU4-SD-M01-300A	03	20000828	0 - 0.33	449 J	846 J	215 J	9382	37	137	15 J
MS-01	LOC.3	OU4-SD-M01-300A-AVG	03	20000828	0 - 0.33	451 J	616 J	174 J	9312	48	120	20 J
MS-01	LOC.3	OU4-SD-M01-300A-D	03	20000828	0 - 0.33	453 J	385 J	133	9242	58 J	102 J	24 J
MS-01	LOC.3	OU4-SD-M01-301B	04	20010508	0 - 0.33	796	3471 J	2109 J	37252	101 J	269 J	20
MS-01	LOC.3	OU4-SD-M01-301B-AVG	04	20010508	0 - 0.33	1116 J	2522 J	1350 J	34591	81 J	196 J	21
MS-01	LOC.3	OU4-SD-M01-301B-D	04	20010508	0 - 0.33	1435 J	1573 J	590 J	31930	60 J	123 J	22
MS-01	LOC.3	OU4-SD-M01-301A	05	20010819	0 - 0.33	242	363 J	68 J	4538	161 J	137 J	24
MS-01	LOC.3	OU4-SD-M01-301A-AVG	05	20010819	0 - 0.33	181 J	1419 J	722 J	17999	114	215 J	23
MS-01	LOC.3	OU4-SD-M01-301A-D	05	20010819	0 - 0.33	120 J	2475 J	1377 J	31461	67	294 J	21
MS-01	LOC.3	OU4-SD-M01-302A-D	06	20020810	0 - 0.33	884 J	5643 J	2220 J	46554	89	110 J	20
MS-01	LOC.3	OU4-SD-M01-302A	06	20020813	0 - 0.33	370 J	655	298 J	11016	95	224 J	22
MS-01	LOC.3	OU4-SD-M01-302A-AVG	06	20020813	0 - 0.33	627 J	3149 J	1259 J	28785	92	167 J	21
MS-01	LOC.3	OU4-SD-M01-303A	07	20030809	0 - 0.33	189	276	98	4676	85	172	16 U
MS-01	LOC.3	OU4-SD-M01-303A-AVG	07	20030809	0 - 0.33	195	304	116	4800	88	170	17 J
MS-01	LOC.3	OU4-SD-M01-303A-D	07	20030809	0 - 0.33	202	332	135	4925	91	168	25 J
MS-01	SD01	AS01-SD-SD01	ASP1	20050822	0 - 0.33	17	26 J	6 J	527	-	-	-
MS-01	SD01	AS01-SD-SD01-AVG	ASP1	20050822	0 - 0.33	22 J	42 J	12 J	693	-	-	-
MS-01	SD01	AS01-SD-SD01-D	ASP1	20050822	0 - 0.33	27 J	58	17 J	858	-	-	-
MS-01	SD03	AS01-SD-SD03	ASP1	20050822	0 - 0.33	560	1500	690	25330	-	-	-
MS-01	SD03	AS01-SD-SD03-AVG	ASP1	20050822	0 - 0.33	560	1500	690	25330	-	-	-
MS-01	SD05	AS01-SD-SD05	ASP1	20050822	0 - 0.33	1000	1400	550	14400	-	-	-
MS-01	SD07	AS01-SD-SD07	ASP1	20050822	0 - 0.33	16	23	5	437	-	-	-
MS-01	SD100	MS01-SD-SD100-0000	OU9PI	20090825	0 - 0.33	16000	10000	6800	170000	-	-	-
MS-01	SD100	MS01-SD-SD100-0000-AVG	OU9PI	20090825	0 - 0.33	13000 J	8650	6100	134150	-	-	-
MS-01	SD100	MS01-SD-SD100-0000-D	OU9PI	20090825	0 - 0.33	10000 J	7300	5400	98300	-	-	-
MS-01	SD100	MS01-SD-SD100-0102	OU9PI	20090825	1 - 2	710 J	250	220 J	3340	-	-	-
MS-01	SD100	MS01-SD-SD100-0102-AVG	OU9PI	20090825	1 - 2	520 J	215	180 J	3115	-	-	-
MS-01	SD100	MS01-SD-SD100-0102-D	OU9PI	20090825	1 - 2	330 J	180	140 J	2890	-	-	-
MS-01	SD101	MS01-SD-SD101-0000	OU9PI	20090825	0 - 0.33	130 J	89 J	53 J	2580	-	-	-
MS-01	SD102	MS01-SD-SD102-0000	OU9PI	20090825	0 - 0.33	340	270	210 J	7670	-	-	-
MS-01	SD102	MS01-SD-SD102-0102	OU9PI	20090825	1 - 2	27	18	13 J	441	-	-	-

TABLE 1-1

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 1
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-01	SD103	MS01-SD-SD103-0000	OU9PI	20090825	0 - 0.33	**260**	150	110 J	3600	-	-	-
MS-01	SD104	MS01-SD-SD104-0000	OU9PI	20090825	0 - 0.33	140 J	260	110	4700	-	-	-
MS-01	SD104	MS01-SD-SD104-0102	OU9PI	20090825	1 - 2	**720**	**1700**	330	**20300**	-	-	-
MS-01	SD105	MS01-SD-SD105-0000	OU9PI	20090825	0 - 0.33	**2300**	1100	**1100**	**38000**	-	-	-
MS-01	SD105	MS01-SD-SD105-0102	OU9PI	20090825	1 - 2	**1200**	340	260	**26780**	-	-	-
MS-01	SD106	MS01-SD-SD106-0000	OU9PI	20090825	0 - 0.33	**1600**	1000	460	**22830**	-	-	-
MS-01	SD106	MS01-SD-SD106-0102	OU9PI	20090825	1 - 2	**3900 J**	**2100**	**1000**	**58800**	-	-	-
MS-01	SD107	MS01-SD-SD107-0000	OU9PI	20090825	0 - 0.33	**4000 J**	**2500**	**2000**	**54200**	-	-	-
MS-01	SD108	MS01-SD-SD108-0000	OU9PI	20090825	0 - 0.33	**220 J**	240	110	5400	-	-	-
MS-01	SD108	MS01-SD-SD108-0102	OU9PI	20090825	1 - 2	6 J	4 J	4 U	92	-	-	-
MS-01	SD109	MS01-SD-SD109-0000	OU9PI	20090825	0 - 0.33	57 J	49	25	1183	-	-	-
MS-01	SD109	MS01-SD-SD109-0102	OU9PI	20090825	1 - 2	5 J	4 U	4 U	51	-	-	-
MS-01	SD110	MS01-SD-SD110-0000	OU9PI	20090825	0 - 0.33	110 J	140	130	2193	-	-	-
MS-01	SD110	MS01-SD-SD110-0102	OU9PI	20090825	1 - 2	5 J	4 U	4 U	33	-	-	-
MS-01	SD111	MS01-SD-SD111-0000	OU9PI	20090824	0 - 0.33	98 J	100	57	2200	-	-	-
MS-01	SD112	MS01-SD-SD112-0000	OU9PI	20090826	0 - 0.33	23 J	27	11	560	-	-	-
MS-01	SD113	MS01-SD-SD113-0000	OU9PI	20090824	0 - 0.33	150 J	230	88	5090	-	-	-
MS-01	SD113	MS01-SD-SD113-0102	OU9PI	20090824	1 - 2	7 J	11	5	163	-	-	-
MS-01	SD114	MS01-SD-SD114-0000	OU9PI	20090824	0 - 0.33	**240 J**	160 J	130 J	4030	-	-	-
MS-01	SD114	MS01-SD-SD114-0000-AVG	OU9PI	20090824	0 - 0.33	195 J	150 J	90 J	3935	-	-	-
MS-01	SD114	MS01-SD-SD114-0000-D	OU9PI	20090824	0 - 0.33	150 J	140	49 J	3840	-	-	-
MS-01	SD114	MS01-SD-SD114-0102	OU9PI	20090824	1 - 2	**540 J**	470	160	12530	-	-	-
MS-01	SD114	MS01-SD-SD114-0102-AVG	OU9PI	20090824	1 - 2	**540 J**	460	195	12090	-	-	-
MS-01	SD114	MS01-SD-SD114-0102-D	OU9PI	20090824	1 - 2	**540 J**	450	230	11650	-	-	-
MS-01	SD115	MS01-SD-SD115-0000	OU9PI	20090824	0 - 0.33	**1000**	810	380	**16400**	-	-	-
MS-01	SD116	MS01-SD-SD116-0000	OU9PI	20090825	0 - 0.33	**700**	320	230	8300	-	-	-
MS-01	SD116	MS01-SD-SD116-0102	OU9PI	20090825	1 - 2	190 J	75 J	43 J	1642	-	-	-
MS-01	SD117	MS01-SD-SD117-0000	OU9PI	20090825	0 - 0.33	130 J	140	79	3080	-	-	-
MS-01	SD117	MS01-SD-SD117-0102	OU9PI	20090825	1 - 2	59 J	110	73	1250	-	-	-
MS-01	SD118	MS01-SD-SD118-0000	OU9PI	20090825	0 - 0.33	150 J	77	39	2010	-	-	-
MS-01	SD119	MS01-SD-SD119-0000	OU9PI	20090826	0 - 0.33	61 J	72	32	1352	-	-	-
MS-01	SD120	MS01-SD-SD120-0000	OU9PI	20090825	0 - 0.33	68 J	54	29	1590	-	-	-
MS-01	SD120	MS01-SD-SD120-0102	OU9PI	20090825	1 - 2	24 J	77	23	859	-	-	-
MS-01	SD121	MS01-SD-SD121-0000	OU9PI	20090825	0 - 0.33	68 J	200	95	2672	-	-	-
MS-01	SD122	MS01-SD-SD122-0000	OU9PI	20090825	0 - 0.33	180 J	260	120	5320	-	-	-
MS-01	SD122	MS01-SD-SD122-0102	OU9PI	20090825	1 - 2	8 J	4 J	5 UJ	115	-	-	-
MS-01	SD122	MS01-SD-SD122-0102-AVG	OU9PI	20090825	1 - 2	7 J	11 J	9 J	133	-	-	-
MS-01	SD122	MS01-SD-SD122-0102-D	OU9PI	20090825	1 - 2	6 J	19 J	15 J	152	-	-	-
MS-01	SD123	MS01-SD-SD123-0000	OU9PI	20090825	0 - 0.33	37 J	270	130	2263	-	-	-
MS-01	SD124	MS01-SD-SD124-0000	OU9PI	20090826	0 - 0.33	90 J	**1700**	**930**	**14870**	-	-	-
MS-01	SD124	MS01-SD-SD124-0102	OU9PI	20090826	1 - 2	36 J	92	32	1312	-	-	-
MS-01	SD125	MS01-SD-SD125-0000	OU9PI	20090826	0 - 0.33	110 J	1000	340	10530	-	-	-
MS-01	SD125	MS01-SD-SD125-0102	OU9PI	20090826	1 - 2	110 J	1200	420	12470	-	-	-

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal

ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram

J - Estimated value
U - Not detected at the indicated value.

TABLE 1-2

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 2
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-02	LOC.1	OU4-SD-M02-199A	01	19990910	0 - 0.33	65 J	161	36	1764	32 J	69 J	28
MS-02	LOC.1	OU4-SD-M02-100B	02	20000504	0 - 0.33	80 J	191 J	41 J	1997	65	202	26
MS-02	LOC.1	OU4-SD-M02-100A	03	20000828	0 - 0.33	13	22	5	201	39	36	23 J
MS-02	LOC.1	OU4-SD-M02-101B	04	20010506	0 - 0.33	71	152	33 J	1605	33	73	28
MS-02	LOC.1	OU4-SD-M02-101A	05	20010819	0 - 0.33	6	18 J	5 J	185	13	31	19
MS-02	LOC.1	OU4-SD-M02-102A	06	20020810	0 - 0.33	58 J	170	28 J	1744	34	69	25 J
MS-02	LOC.1	OU4-SD-M02-103A	07	20030809	0 - 0.33	80	397	186	1747	58	68	17 U
MS-02	LOC.2	OU4-SD-M02-299A	01	19990910	0 - 0.33	60 J	118	33	1678	31 J	128 J	31
MS-02	LOC.2	OU4-SD-M02-200B	02	20000504	0 - 0.33	76	190	35 J	2119	51	170	35
MS-02	LOC.2	OU4-SD-M02-200A	03	20000828	0 - 0.33	79	110	33	1386	68	146	28 J
MS-02	LOC.2	OU4-SD-M02-201B	04	20010506	0 - 0.33	69	258	102 J	2182	53	146	37
MS-02	LOC.2	OU4-SD-M02-201A	05	20010819	0 - 0.33	38	107 J	19 J	1082	34	121	29
MS-02	LOC.2	OU4-SD-M02-202A	06	20020810	0 - 0.33	54 J	183	28 J	1807	45	116	28 J
MS-02	LOC.2	OU4-SD-M02-203A	07	20030809	0 - 0.33	31	75	15	858	76	136	19 J
MS-02	LOC.3	OU4-SD-M02-399A	01	19990910	0 - 0.33	67 J	178	44	2138	43 J	142 J	33
MS-02	LOC.3	OU4-SD-M02-300B	02	20000504	0 - 0.33	70	161	40	2000	46	95	27
MS-02	LOC.3	OU4-SD-M02-300A	03	20000828	0 - 0.33	46	83	22	867	37	88	24 J
MS-02	LOC.3	OU4-SD-M02-301B	04	20010506	0 - 0.33	81	184	38 J	1978	39	81	30
MS-02	LOC.3	OU4-SD-M02-301A	05	20010819	0 - 0.33	69	197 J	33 J	2035	34	72	23
MS-02	LOC.3	OU4-SD-M02-302A	06	20020810	0 - 0.33	63 J	118	25 J	1652	22	67	25 J
MS-02	LOC.3	OU4-SD-M02-303A	07	20030809	0 - 0.33	97	251	47	2391	64	97	9 U

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value
U - Not detected at the indicated value.

TABLE 1-3

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATIONS 3 AND 4
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)				
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER EPA METHOD	COPPER NOAA METHOD	LEAD	NICKEL EPA METHOD	NICKEL NOAA METHOD
						IRG 210	IRG 1236	IRG 500	IRG 13057	-	IRG 486	2x ER-M 436	-	IRG 124
MS-03	LOC.1	OU4-SD-M03-199A-D	01	19990909	0 - 0.33	116 J	314	60	3891	-	236 J	126 J	-	48
MS-03	LOC.1	OU4-SD-M03-199A	01	19990910	0 - 0.33	107 J	248	51	3867	-	173 J	128 J	-	43
MS-03	LOC.1	OU4-SD-M03-199A-AVG	01	19990910	0 - 0.33	112 J	281	56	3879	-	205 J	127 J	-	46
MS-03	LOC.1	OU4-SD-M03-100B	02	20000504	0 - 0.33	143	621	176 J	6416	-	185	133	-	45
MS-03	LOC.1	OU4-SD-M03-100A	03	20000827	0 - 0.33	153	274 J	62 J	3322	-	186 J	164	-	39 J
MS-03	LOC.1	OU4-SD-M03-101B	04	20010506	0 - 0.33	152	576	83 J	5898	-	182	127	-	43
MS-03	LOC.1	OU4-SD-M03-101A	05	20010819	0 - 0.33	97	500 J	65 J	5468	-	309	127	-	41
MS-03	LOC.1	OU4-SD-M03-102A	06	20020810	0 - 0.33	88 J	388	62 J	6628	-	231	168	-	47 J
MS-03	LOC.1	OU4-SD-M03-103A	07	20030809	0 - 0.33	70	912	479	8821	-	215	135	-	26 J
MS-03	LOC.2	OU4-SD-M03-299A	01	19990910	0 - 0.33	77 J	353	126	4442	-	**3720**	206 J	-	86 J
MS-03	LOC.2	OU4-SD-M03-200B	02	20000504	0 - 0.33	78	281	79 J	3556	-	**1090**	229	-	79
MS-03	LOC.2	OU4-SD-M03-200A	03	20000827	0 - 0.33	63	126 J	34 J	1841	-	**1902** J	292	-	102 J
MS-03	LOC.2	OU4-SD-M03-201B	04	20010506	0 - 0.33	74	266	51 J	2858	-	**564**	184	-	63
MS-03	LOC.2	OU4-SD-M03-201A	05	20010819	0 - 0.33	118	774 J	87 J	3713	-	**664**	180	-	72
MS-03	LOC.2	OU4-SD-M03-202A	06	20020810	0 - 0.33	134 J	668	67 J	12055	-	**975**	272	-	110
MS-03	LOC.2	OU4-SD-M03-203A	07	20030809	0 - 0.33	66	242	69	3412	-	**732**	180	-	**315** J
MS-03	LOC.3	OU4-SD-M03-399A	01	19990910	0 - 0.33	62 J	150	33	2407	-	125	79 J	-	30 J
MS-03	LOC.3	OU4-SD-M03-300B	02	20000504	0 - 0.33	88	247	74 J	2989	-	106	81	-	27
MS-03	LOC.3	OU4-SD-M03-300A	03	20000827	0 - 0.33	62	182 J	73 J	1909	-	27	52	-	15 J
MS-03	LOC.3	OU4-SD-M03-301B	04	20010506	0 - 0.33	54	142	31 J	1612	-	30	51	-	19
MS-03	LOC.3	OU4-SD-M03-301A	05	20010819	0 - 0.33	113	408 J	73 J	3848	-	115	93	-	30
MS-03	LOC.3	OU4-SD-M03-302A	06	20020810	0 - 0.33	44 J	190	39 J	2014	-	23	52	-	20 J
MS-03	LOC.3	OU4-SD-M03-303A	07	20030809	0 - 0.33	42	124	26	1420	-	61	41	-	12 U
MS-04	LOC.1	OU4-SD-M04-199A	01	19990910	0 - 0.33	80 J	197	41	2939	-	**565**	110 J	-	61 J
MS-04	LOC.1	OU4-SD-M04-100B	02	20000504	0 - 0.33	**345**	715	157	7053	-	**1780**	316	-	**193**
MS-04	LOC.1	OU4-SD-M04-100A	03	20000827	0 - 0.33	**216**	621 J	137 J	9530	-	**20507** J	**788**	-	**197** J
MS-04	LOC.1	OU4-SD-M04-101B	04	20010506	0 - 0.33	**217** J	**2408** J	**557** J	**17894**	-	**2225**	**522**	-	**282**
MS-04	LOC.1	OU4-SD-M04-101B-AVG	04	20010506	0 - 0.33	**387** J	**4165** J	**889** J	**30823**	-	**2452**	**462**	-	**297**
MS-04	LOC.1	OU4-SD-M04-101B-D	04	20010506	0 - 0.33	**557** J	**5921** J	**1221** J	**43753**	-	**2680**	402	-	**313**
MS-04	LOC.1	OU4-SD-M04-101A	05	20010819	0 - 0.33	162	**1399** J	179 J	8604	-	**2697**	**450**	-	**389**
MS-04	LOC.1	OU4-SD-M04-101A-AVG	05	20010819	0 - 0.33	156	1136	171 J	9854	-	**2450**	**566**	-	**422**
MS-04	LOC.1	OU4-SD-M04-101A-D	05	20010819	0 - 0.33	149	874	162 J	11104	-	**2203**	**682**	-	**455**
MS-04	LOC.1	OU4-SD-M04-102A	06	20020810	0 - 0.33	**216** J	**2305** J	176 J	**25264**	-	**3100**	**510**	-	**591** J
MS-04	LOC.1	OU4-SD-M04-102A-AVG	06	20020810	0 - 0.33	141 J	**1483** J	152 J	**16873**	-	**3466**	**519** J	-	**480** J
MS-04	LOC.1	OU4-SD-M04-102A-D	06	20020810	0 - 0.33	65 J	662 J	127	8482	-	**3831**	**528** J	-	**369**
MS-04	LOC.1	OU4-SD-M04-103A	07	20030809	0 - 0.33	131	1009 J	125 J	12126	-	**6421**	**747**	-	**385** J
MS-04	LOC.1	OU4-SD-M04-103A-AVG	07	20030809	0 - 0.33	157	**1466** J	240 J	**17232**	-	**7073**	**790**	-	**336** J
MS-04	LOC.1	OU4-SD-M04-103A-D	07	20030809	0 - 0.33	183	**1923** J	355 J	**22337**	-	**7725**	**834**	-	**287** J
MS-04	LOC.2	OU4-SD-M04-299A	01	19990909	0 - 0.33	53 J	120	17	1237	-	22	47 J	-	19 J
MS-04	LOC.2	OU4-SD-M04-200B	02	20000504	0 - 0.33	61	160	37 J	1695	-	60	47	-	23
MS-04	LOC.2	OU4-SD-M04-200A	03	20000827	0 - 0.33	78	123 J	32	1472	-	33 J	58	-	17 J
MS-04	LOC.2	OU4-SD-M04-201B	04	20010506	0 - 0.33	53	152	31 J	1449	-	34	62	-	22
MS-04	LOC.2	OU4-SD-M04-201A	05	20010819	0 - 0.33	98	343 J	42 J	2390	-	27	54	-	21
MS-04	LOC.2	OU4-SD-M04-202A	06	20020810	0 - 0.33	55 J	137	26 J	1639	-	24	51	-	21 J
MS-04	LOC.2	OU4-SD-M04-203A	07	20030810	0 - 0.33	56	150	41	1821	-	59	66	-	7 U
MS-04	LOC.3	OU4-SD-M04-399A	01	19990910	0 - 0.33	26 J	61	9	1903	-	140	67 J	-	39 J
MS-04	LOC.3	OU4-SD-M04-300B	02	20000504	0 - 0.33	9	25	4	300	-	393	145	-	**158**
MS-04	LOC.3	OU4-SD-M04-300A	03	20000827	0 - 0.33	18	29 J	5	1108	-	118 J	123	-	25 J
MS-04	LOC.3	OU4-SD-M04-301B	04	20010506	0 - 0.33	8	22	4 J	376	-	243	156	-	39
MS-04	LOC.3	OU4-SD-M04-301A	05	20010819	0 - 0.33	9	25 J	3 J	243	-	149	75	-	32
MS-04	LOC.3	OU4-SD-M04-302A	06	20020810	0 - 0.33	17 J	27	6 J	549	-	176	71	-	28
MS-04	LOC.3	OU4-SD-M04-303A	07	20030809	0 - 0.33	13	29	6	488	-	139	63	-	34 J
MS-04	LOC.4	OU4-SD-M04-401B	04	20010508	0 - 0.33	-	-	-	-	-	121	80	-	35
MS-04	LOC.5	OU4-SD-M04-501B	04	20010508	0 - 0.33	-	-	-	-	-	**4281**	**589**	-	**508**
MS-04	LOC.6	OU4-SD-M04-601B	04	20010508	0 - 0.33	-	-	-	-	-	**3728**	401	-	**286**
TP	D120	TPSD1200004		20081216	0 - 0.33	-	-	-	-	147	166	-	-	-
TP	D120	TPSD1201216		20081216	1 - 1.33	-	-	-	-	181	208	-	-	-
TP	D120	TPSD1201216-AVG		20081216	1 - 1.33	-	-	-	-	182	208	-	-	-

TABLE 1-3

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATIONS 3 AND 4
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)				
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER		LEAD	NICKEL	
										EPA METHOD	NOAA METHOD		EPA METHOD	NOAA METHOD
						IRG 210	IRG 1236	IRG 500	IRG 13057	-	IRG 486	2x ER-M 436	-	IRG 124
TP	D120	TPSD1201216-D		20081216	1 - 1.33	-	-	-	-	182	209	-	-	-
TP	SD01	TPSD010006		20030522	0 - 0.5	-	-	-	-	174 J	199	-	41	59
TP	SD01	TPSD010612		20030522	0.5 - 1	-	-	-	-	159 J	181	-	39	57
TP	SD01	TPSD010612-AVG		20030522	0.5 - 1	-	-	-	-	166 J	189	-	39	57
TP	SD01	TPSD010612-D		20030522	0.5 - 1	-	-	-	-	173 J	198	-	39	58
TP	SD02	TPSD020006		20030522	0 - 0.5	-	-	-	-	79 J	83	-	26	46
TP	SD03	TPSD030006		20030813	0 - 0.5	-	-	-	-	140	158	-	32	51
TP	SD03	TPSD030006-AVG		20030813	0 - 0.5	-	-	-	-	155	176	-	34	53
TP	SD03	TPSD030006-D		20030813	0 - 0.5	-	-	-	-	170	194	-	35	54
TP	SD03	TPSD030612		20030813	0.5 - 1	-	-	-	-	184	211	-	40	58
TP	SD04	TPSD040006		20030522	0 - 0.5	-	-	-	-	1840 J	2080	-	352	330
TP	SD04	TPSD040612		20030522	0.5 - 1	-	-	-	-	1660 J	1878	-	67	81
TP	SD05	TPSD050006		20030522	0 - 0.5	-	-	-	-	115 J	127	-	28	48
TP	SD05	TPSD050612		20030522	0.5 - 1	-	-	-	-	101 J	110	-	26	46
TP	SD06	TPSD060006		20030522	0 - 0.5	-	-	-	-	169 J	193	-	25	45
TP	SD06	TPSD060006-AVG		20030522	0 - 0.5	-	-	-	-	132 J	147	-	24	44
TP	SD06	TPSD060006-D		20030522	0 - 0.5	-	-	-	-	94 J	101	-	23	43
TP	SD06	TPSD060612		20030522	0.5 - 1	-	-	-	-	65 J	66	-	20	41
TP	SD07	TPSD070006		20030522	0 - 0.5	-	-	-	-	231 J	269	-	34	53
TP	SD07	TPSD070612		20030522	0.5 - 1	-	-	-	-	469 J	559	-	51	67
TP	SD09	TPSD090006		20030522	0 - 0.5	-	-	-	-	72 J	75	-	18 J	39
TP	SD09	TPSD090612		20030522	0.5 - 1	-	-	-	-	9 J	-2	-	13 J	35
TP	SD09	TPSD090612-AVG		20030522	0.5 - 1	-	-	-	-	57 J	56	-	17 J	38
TP	SD09	TPSD090612-D		20030522	0.5 - 1	-	-	-	-	105 J	115	-	21	42
TP	SD10	TPSD100006		20030522	0 - 0.5	-	-	-	-	206 J	238	-	26	46
TP	SD10	TPSD100612		20030522	0.5 - 1	-	-	-	-	195 J	225	-	27	47
TP	SD101	TPSD1010004		20081216	0 - 0.33	-	-	-	-	585	700	-	-	-
TP	SD101	TPSD1011216		20081216	1 - 1.33	-	-	-	-	969	1104	-	-	-
TP	SD102	TPSD1020004		20081216	0 - 0.33	-	-	-	-	521	622	-	-	-
TP	SD102	TPSD1021216		20081216	1 - 1.33	-	-	-	-	1140	1296	-	-	-
TP	SD103	TPSD1030004		20081216	0 - 0.33	-	-	-	-	914	1043	-	-	-
TP	SD103	TPSD1031216		20081216	1 - 1.33	-	-	-	-	68	70	-	-	-
TP	SD104	TPSD1040004		20081216	0 - 0.33	-	-	-	-	438	521	-	-	-
TP	SD104	TPSD1041216		20081216	1 - 1.33	-	-	-	-	68	70	-	-	-
TP	SD105	TPSD1050004		20081216	0 - 0.33	-	-	-	-	710	814	-	-	-
TP	SD105	TPSD1051216		20081216	1 - 1.33	-	-	-	-	946	1079	-	-	-
TP	SD106	TPSD1060004		20081216	0 - 0.33	-	-	-	-	1120	1274	-	-	-
TP	SD106	TPSD1061216		20081216	1 - 1.33	-	-	-	-	1160	1318	-	-	-
TP	SD107	TPSD1070004		20081216	0 - 0.33	-	-	-	-	442	526	-	-	-
TP	SD107	TPSD1071216		20081216	1 - 1.33	-	-	-	-	599	717	-	-	-
TP	SD108	TPSD1080004		20081216	0 - 0.33	-	-	-	-	229	266	-	-	-
TP	SD108	TPSD1081216		20081216	1 - 1.33	-	-	-	-	14	4	-	-	-
TP	SD109	TPSD1090004		20081216	0 - 0.33	-	-	-	-	675	810	-	-	-
TP	SD109	TPSD1091216		20081216	1 - 1.33	-	-	-	-	21	12	-	-	-
TP	SD110	TPSD1100004		20081216	0 - 0.33	-	-	-	-	1130	1285	-	-	-
TP	SD110	TPSD1101216		20081216	1 - 1.33	-	-	-	-	14	4	-	-	-
TP	SD111	TPSD1110004		20081216	0 - 0.33	-	-	-	-	340	402	-	-	-
TP	SD111	TPSD1111216		20081216	1 - 1.33	-	-	-	-	11	0	-	-	-
TP	SD112	TPSD1120004		20081216	0 - 0.33	83 J	160 J	44 J	2760	1120	1274	-	-	-
TP	SD112	TPSD1121216		20081216	1 - 1.33	4 UJ	1 J	4 UJ	35	12	1	-	-	-
TP	SD113	TPSD1130004		20081216	0 - 0.33	64	150	65	2498	407	483	-	-	-
TP	SD113	TPSD1131216		20081216	1 - 1.33	15	52	24	781	115	127	-	-	-
TP	SD114	TPSD1140004		20081216	0 - 0.33	38	74	29	1195	175	200	-	-	-
TP	SD114	TPSD1141216		20081216	1 - 1.33	6	7	2 J	178	5	-7	-	-	-
TP	SD115	TPSD1150004		20081216	0 - 0.33	72	91	24	1530	113	125	-	-	-
TP	SD115	TPSD1151216		20081216	1 - 1.33	10	12	5 J	180	26	18	-	-	-
TP	SD116	TPSD1160004		20081216	0 - 0.33	63	75	17	1432	118	131	-	-	-
TP	SD116	TPSD1160004-AVG		20081216	0 - 0.33	59	74	19	1326	119	132	-	-	-

TABLE 1-3

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATIONS 3 AND 4
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)				
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER		LEAD	NICKEL	
										EPA METHOD	NOAA METHOD		EPA METHOD	NOAA METHOD
						IRG 210	IRG 1236	IRG 500	IRG 13057	-	IRG 486	2x ER-M 436	-	IRG 124
TP	SD116	TPSD1160004-D		20081216	0 - 0.33	55	73	21	1219	120	133	-	-	-
TP	SD116	TPSD1161216		20081216	1 - 1.33	59	68	17	1149	47	44	-	-	-
TP	SD117	TPSD1170004		20081216	0 - 0.33	-	-	-	-	64	65	-	-	-
TP	SD117	TPSD1171216		20081216	1 - 1.33	-	-	-	-	97	105	-	-	-
TP	SD118	TPSD1180004		20081216	0 - 0.33	-	-	-	-	281	330	-	-	-
TP	SD118	TPSD1181216		20081216	1 - 1.33	-	-	-	-	14	4	-	-	-
TP	SD119	TPSD1190004		20081216	0 - 0.33	-	-	-	-	114	126	-	-	-
TP	SD119	TPSD1190004-AVG		20081216	0 - 0.33	-	-	-	-	100	108	-	-	-
TP	SD119	TPSD1190004-D		20081216	0 - 0.33	-	-	-	-	85	91	-	-	-
TP	SD119	TPSD1191216		20081216	1 - 1.33	-	-	-	-	17 J	7	-	-	-
TP	SD119	TPSD1191216-AVG		20081216	1 - 1.33	-	-	-	-	25 J	17	-	-	-
TP	SD119	TPSD1191216-D		20081216	1 - 1.33	-	-	-	-	33 J	27	-	-	-
TP	SD12	TPSD120006		20030521	0 - 0.5	-	-	-	-	270 J	316	-	23	43
TP	SD12	TPSD120612		20030521	0.5 - 1	-	-	-	-	228 J	265	-	37	56
TP	SD12	TPSD120612-AVG		20030521	0.5 - 1	-	-	-	-	1174 J	1334	-	31	50
TP	SD12	TPSD120612-D		20030521	0.5 - 1	-	-	-	-	2120 J	2394	-	24	44
TP	SD12	TPSD120612-RE		20030521	0.5 - 1	-	-	-	-	320	377	-	24	44
TP	SD12	TPSD120612-RE-AVG		20030521	0.5 - 1	-	-	-	-	382	452	-	24	44
TP	SD12	TPSD120612-RE-D		20030521	0.5 - 1	-	-	-	-	443	527	-	24	44
TP	SD13	TPSD130006		20030522	0 - 0.5	-	-	-	-	56 J	55	-	20 J	41
TP	SD13	TPSD130612		20030522	0.5 - 1	-	-	-	-	13 J	2	-	14 J	36
TP	SD14	TPSD140006		20030521	0 - 0.5	-	-	-	-	104 J	114	-	22	42
TP	SD14	TPSD140612		20030521	0.5 - 1	-	-	-	-	88 J	95	-	19	40
TP	SD15	TPSD150006		20030522	0 - 0.5	-	-	-	-	59 J	58	-	25	45
TP	SD15	TPSD150006-AVG		20030522	0 - 0.5	-	-	-	-	34 J	29	-	20 J	40
TP	SD15	TPSD150006-D		20030522	0 - 0.5	-	-	-	-	10 J	-1	-	14 J	36
TP	SD15	TPSD150612		20030522	0.5 - 1	-	-	-	-	17 J	7	-	16 J	38
TP	SD16	TPSD160006		20030521	0 - 0.5	-	-	-	-	320 J	377	-	24	45
TP	SD16	TPSD160612		20030521	0.5 - 1	-	-	-	-	86	91	-	23	43
TP	SD17	TPSD170006		20030521	0 - 0.5	-	-	-	-	61	61	-	22	43
TP	SD17	TPSD170612		20030521	0.5 - 1	-	-	-	-	65	66	-	24	44
TP	SD18	TPSD180006		20030521	0 - 0.5	-	-	-	-	113	125	-	25	45
TP	SD18	TPSD180612		20030521	0.5 - 1	-	-	-	-	70	72	-	25	45
TP	SD19	TPSD190006		20030521	0 - 0.5	-	-	-	-	60	59	-	27	47
TP	SD19	TPSD190612		20030521	0.5 - 1	-	-	-	-	56 J	55	-	22	43
TP	SD19	TPSD190612-AVG		20030521	0.5 - 1	-	-	-	-	119 J	131	-	26	46
TP	SD19	TPSD190612-D		20030521	0.5 - 1	-	-	-	-	181 J	208	-	31	50
TP	SD20	TPSD200006		20030521	0 - 0.5	-	-	-	-	103	112	-	28	48
TP	SD20	TPSD200612		20030521	0.5 - 1	-	-	-	-	135	151	-	33	52
TP	SD21	TPSD210006		20030521	0 - 0.5	-	-	-	-	51	49	-	24	44
TP	SD21	TPSD210612		20030521	0.5 - 1	-	-	-	-	98	106	-	18	39
TP	SD22	TPSD220006		20030520	0 - 0.5	-	-	-	-	127 J	142	-	31	50
TP	SD22	TPSD220612		20030520	0.5 - 1	-	-	-	-	125 J	139	-	30	49
TP	SD23	TPSD230006		20030521	0 - 0.5	-	-	-	-	82	87	-	27	47
TP	SD23	TPSD230612		20030521	0.5 - 1	-	-	-	-	157	178	-	31	50
TP	SD24	TPSD240006		20030520	0 - 0.5	-	-	-	-	100 J	108	-	31	51
TP	SD24	TPSD240612		20030520	0.5 - 1	-	-	-	-	195 J	225	-	28	48
TP	SD25	TPSD250006		20030521	0 - 0.5	-	-	-	-	124	138	-	33	52
TP	SD25	TPSD250612		20030521	0.5 - 1	-	-	-	-	234	272	-	30	49
TP	SD25	TPSD250612-AVG		20030521	0.5 - 1	-	-	-	-	217	251	-	29	49
TP	SD25	TPSD250612-D		20030521	0.5 - 1	-	-	-	-	199	229	-	29	49
TP	SD26	TPSD260006		20030520	0 - 0.5	-	-	-	-	111 J	122	-	32	51
TP	SD26	TPSD260612		20030520	0.5 - 1	-	-	-	-	182 J	209	-	29	49
TP	SD27	TPSD270006		20030521	0 - 0.5	-	-	-	-	85	90	-	26	46
TP	SD27	TPSD270612		20030521	0.5 - 1	-	-	-	-	98	107	-	25	45
TP	SD28	TPSD280006		20030520	0 - 0.5	-	-	-	-	267 J	312	-	44	62
TP	SD28	TPSD280612		20030520	0.5 - 1	-	-	-	-	274 J	321	-	34	53
TP	SD29	TPSD290006		20030521	0 - 0.5	-	-	-	-	101	110	-	28	48

TABLE 1-3

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATIONS 3 AND 4
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)				
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER		LEAD	NICKEL	
										EPA METHOD	NOAA METHOD		EPA METHOD	NOAA METHOD
						IRG 210	IRG 1236	IRG 500	IRG 13057	-	IRG 486	2x ER-M 436	-	IRG 124
TP	SD29	TPSD290612		20030521	0.5 - 1	-	-	-	-	120 J	133	-	35	54
TP	SD30	TPSD300006		20030520	0 - 0.5	-	-	-	-	282 J	331	-	49	66
TP	SD30	TPSD300612		20030520	0.5 - 1	-	-	-	-	342 J	404	-	35	54
TP	SD33	TPSD330006		20030521	0 - 0.5	-	-	-	-	111 J	122	-	31	50
TP	SD33	TPSD330612		20030521	0.5 - 1	-	-	-	-	59 J	59	-	22	42
TP	SD34	TPSD340006		20030520	0 - 0.5	-	-	-	-	317 J	373	-	47	64
TP	SD34	TPSD340612		20030520	0.5 - 1	-	-	-	-	35 J	29	-	17	38
TP	SD35	TPSD350006		20030521	0 - 0.5	-	-	-	-	135 J	151	-	31	50
TP	SD35	TPSD350612		20030521	0.5 - 1	-	-	-	-	189 J	217	-	33	52
TP	SD35	TPSD350612-AVG		20030521	0.5 - 1	-	-	-	-	205 J	236	-	33	52
TP	SD35	TPSD350612-D		20030521	0.5 - 1	-	-	-	-	220 J	255	-	33	52
TP	SD36	TPSD360006		20030520	0 - 0.5	-	-	-	-	150 J	170	-	30	50
TP	SD37	TPSD370006		20030521	0 - 0.5	-	-	-	-	126 J	140	-	33	52
TP	SD37	TPSD370612		20030521	0.5 - 1	-	-	-	-	263 J	308	-	37	55
TP	SD38	TPSD380006		20030521	0 - 0.5	-	-	-	-	90 J	96	-	26	46
TP	SD38	TPSD380612		20030521	0.5 - 1	-	-	-	-	191 J	220	-	35	54

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
TP - Topeka Pier
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value
U - Not detected at the indicated value.

TABLE 1-4

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 5
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)					
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER		LEAD		NICKEL	
										EPA METHOD	NOAA METHOD	EPA METHOD	NOAA METHOD	EPA METHOD	NOAA METHOD
						IRG 210	IRG 1236	IRG 500	IRG 13057	-	IRG 486	-	2x ER-M 436	-	IRG 124
MS-05	LOC.1	OU4-SD-M05-199A	01	19990908	0 - 0.33	87 J	295	63	4928	-	105	-	187 J	-	32 J
MS-05	LOC.1	OU4-SD-M05-100B	02	20000504	0 - 0.33	73 J	177 J	45 J	2167	-	64	-	135	-	34
MS-05	LOC.1	OU4-SD-M05-100B-AVG	02	20000504	0 - 0.33	100 J	344 J	85 J	3754	-	63	-	133	-	33
MS-05	LOC.1	OU4-SD-M05-100B-D	02	20000504	0 - 0.33	126 J	511 J	125 J	5340	-	62	-	130	-	33
MS-05	LOC.1	OU4-SD-M05-100A	03	20000827	0 - 0.33	46 J	63 J	19 J	1226	-	65 J	-	116	-	25 J
MS-05	LOC.1	OU4-SD-M05-100A-AVG	03	20000827	0 - 0.33	77 J	119 J	31 J	1773	-	61 J	-	117	-	26 J
MS-05	LOC.1	OU4-SD-M05-100A-D	03	20000827	0 - 0.33	107 J	175 J	43 J	2320	-	57	-	118	-	26 J
MS-05	LOC.1	OU4-SD-M05-101B	04	20010506	0 - 0.33	53	130	32 J	1771	-	51	-	108	-	29
MS-05	LOC.1	OU4-SD-M05-101A	05	20010819	0 - 0.33	71	276 J	46 J	2617	-	56	-	117	-	32
MS-05	LOC.1A	OU4-SD-M05-102A	06	20020811	0 - 0.33	119 J	326	124	4056	-	325	-	474	-	50 J
MS-05	LOC.1A	OU4-SD-M05-103A	07	20030811	0 - 0.33	52	215	94	2146	-	685	-	694 J	-	76
MS-05	LOC.1A	OU4-SD-M05-105A	08	20050820	0 - 0.33	24 J	210	130	4964	-	988	-	829 J	-	107
MS-05	LOC.1A	OU4-SD-M05-105A-AVG	08	20050820	0 - 0.33	25 J	225	135	5207	-	983	-	824 J	-	110
MS-05	LOC.1A	OU4-SD-M05-105A-D	08	20050820	0 - 0.33	26 J	240	140	5450	-	977	-	819 J	-	113
MS-05	LOC.1A	OU4-SD-M05-107A	09	20071107	0 - 0.33	7 U	7 U	7 U	84	-	174 J	-	175 J	-	38 J
MS-05	LOC.1A	OU4-SD-M05-108A	10	20081217	0 - 0.33	53	59 J	17 J	1218	-	85	-	102	-	25
MS-05	LOC.1A	OU4-SD-M05-108A-AVG	10	20081217	0 - 0.33	67	100 J	34 J	1704	-	92	-	103	-	26
MS-05	LOC.1A	OU4-SD-M05-108A-D	10	20081217	0 - 0.33	81	140 J	51 J	2190	-	99	-	104	-	26
MS-05	LOC.2	OU4-SD-M05-299A	01	19990909	0 - 0.33	63 J	123	22	1762	-	32	-	60 J	-	29 J
MS-05	LOC.2	OU4-SD-M05-200B	02	20000504	0 - 0.33	81	271	88 J	2749	-	39	-	49	-	29
MS-05	LOC.2	OU4-SD-M05-200A	03	20000827	0 - 0.33	103	173 J	41 J	1891	-	33 J	-	67	-	25 J
MS-05	LOC.2	OU4-SD-M05-201B	04	20010507	0 - 0.33	67	169	33 J	1626	-	32	-	64	-	26
MS-05	LOC.2	OU4-SD-M05-201A	05	20010819	0 - 0.33	93	363 J	60 J	2564	-	29	-	57	-	27
MS-05	LOC.2	OU4-SD-M05-202A	06	20020810	0 - 0.33	76 J	184	38	2567	-	37	-	72	-	26 J
MS-05	LOC.2	OU4-SD-M05-205A	08	20050820	0 - 0.33	22	89	37	2507	-	31 J	-	58 J	-	23
MS-05	LOC.2A	OU4-SD-M05-203A	07	20030810	0 - 0.33	83	244	61	2384	-	83	-	78	-	14 U
MS-05	LOC.2A	OU4-SD-M05-207A	09	20071106	0 - 0.33	51	110	31	1641	-	501	-	509 J	-	61 J
MS-05	LOC.2A	OU4-SD-M05-208A	10	20081217	0 - 0.33	7 U	8	7 U	54	-	57	-	61	-	37
MS-05	LOC.3	OU4-SD-M05-399A	01	19990908	0 - 0.33	56 J	118	23	1583	-	24	-	47 J	-	30 J
MS-05	LOC.3	OU4-SD-M05-300B	02	20000504	0 - 0.33	57	142	37	1669	-	23	-	47	-	28
MS-05	LOC.3	OU4-SD-M05-300A	03	20000827	0 - 0.33	71	99 J	31 J	1524	-	31 J	-	65	-	23 J
MS-05	LOC.3	OU4-SD-M05-301B	04	20010506	0 - 0.33	56	203	64 J	2145	-	15	-	43	-	22
MS-05	LOC.3	OU4-SD-M05-301A	05	20010819	0 - 0.33	76	202 J	33 J	1532	-	23	-	63	-	24
MS-05	LOC.3	OU4-SD-M05-302A	06	20020811	0 - 0.33	55 J	110	24	1542	-	17	-	47	-	22 J
MS-05	LOC.3	OU4-SD-M05-303A	07	20030809	0 - 0.33	19	88	39	1096	-	51	-	42	-	13 U
MS-05	LOC.3	OU4-SD-M05-305A	08	20050821	0 - 0.33	13	29	18	1238	-	14 J	-	30 J	-	22
MS-05	LOC.3	OU4-SD-M05-307A	09	20071107	0 - 0.33	9	23	7	427	-	17 J	-	33 J	-	21 J
MS-05	LOC.3	OU4-SD-M05-308A	10	20081217	0 - 0.33	19	31	10	596	-	12	-	30	-	19
MS-05	LOC.4	OU4-SD-M05-407A	09	20071106	0 - 0.33	-	-	-	-	-	64	-	68	-	-
MS-05	LOC.4	OU4-SD-M05-408A	10	20081217	0 - 0.33	-	-	-	-	-	45	-	57	-	23
MS-05	SD01	AS05-SD-SD01	ASP1	20050821	0 - 0.33	-	-	-	-	231	269	235	287	39	58
MS-05	SD01	AS05-SD-SD01-AVG	ASP1	20050821	0 - 0.33	-	-	-	-	196	225	211	254	34	53
MS-05	SD01	AS05-SD-SD01-D	ASP1	20050821	0 - 0.33	-	-	-	-	160	182	186	222	28	48
MS-05	SD02	AS05-SD-SD02	ASP1	20050820	0 - 0.33	-	-	-	-	228	265	223	271	42	60
MS-05	SD02	AS05-SD-SD02-AVG	ASP1	20050820	0 - 0.33	-	-	-	-	188 J	215	201	242	35 J	54
MS-05	SD02	AS05-SD-SD02-D	ASP1	20050820	0 - 0.33	-	-	-	-	147 J	166	179	212	28 J	47
MS-05	SD03	AS05-SD-SD03	ASP1	20050820	0 - 0.33	-	-	-	-	423	503	426	541	58	74
MS-05	SD04	AS05-SD-SD04	ASP1	20050820	0 - 0.33	-	-	-	-	355	420	390	493	50	67
MS-05	SD05	AS05-SD-SD05	ASP1	20050820	0 - 0.33	-	-	-	-	43	39	58	52	20	41
MS-05	SD06	AS05-SD-SD06	ASP1	20050820	0 - 0.33	-	-	-	-	34	29	56	49	17	38
MS-05	SD07	AS05-SD-SD07	ASP1	20050820	0 - 0.33	-	-	-	-	57	57	86	88	23	43
MS-05	SD08	AS05-SD-SD08	ASP1	20050820	0 - 0.33	-	-	-	-	408	484	361	454	51	68
MS-05	SD09	AS05-SD-SD09	ASP1	20050820	0 - 0.33	-	-	-	-	71	73	98	104	21	41

TABLE 1-4

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 5
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)					
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER		LEAD		NICKEL	
										EPA METHOD	NOAA METHOD	EPA METHOD	NOAA METHOD	EPA METHOD	NOAA METHOD
						IRG 210	IRG 1236	IRG 500	IRG 13057	-	IRG 486	-	2x ER-M 436	-	IRG 124
MS-05	SD10	AS05-SD-SD10	ASP1	20050820	0 - 0.33	-	-	-	-	116	128	152	176	26	46
MS-05	SD13	AS05-SD-SD13	ASP1	20050820	0 - 0.33	-	-	-	-	122 J	136	124	139	27	47
MS-05	SD15	AS05-SD-SD15-00	09	20071107	0 - 0.33	-	-	-	-	27	20	40	27		-

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

NOAA - National Oceanic and Atmospheric Administration
EPA - Environmental protection Agency
MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value
U - Not detected at the indicated value.

TABLE 1-5

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 6
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-06	LOC.1	OU4-SD-M06-199A	01	19990908	0 - 0.33	71 J	120	25	1511	25	61 J	21 J
MS-06	LOC.1	OU4-SD-M06-100B	02	20000504	0 - 0.33	26	88	35	2343	15	37	21
MS-06	LOC.1	OU4-SD-M06-100A	03	20000829	0 - 0.33	42	84	22	1566	14	49	15 J
MS-06	LOC.1	OU4-SD-M06-101B	04	20010506	0 - 0.33	79	291	81 J	4359	14	42	17
MS-06	LOC.1	OU4-SD-M06-101A	05	20010819	0 - 0.33	15	246 J	78 J	3547	15	30	18
MS-06	LOC.1	OU4-SD-M06-102A	06	20020811	0 - 0.33	11 J	21	8	500	6	23	13 J
MS-06	LOC.1	OU4-SD-M06-103A	07	20030811	0 - 0.33	24	86	31	2118	86 J	55 J	30
MS-06	LOC.2	OU4-SD-M06-299A	01	19990908	0 - 0.33	73 J	260	50	2721	27	59 J	23 J
MS-06	LOC.2	OU4-SD-M06-299A-AVG	01	19990908	0 - 0.33	90 J	256	58	3002	26	65 J	24 J
MS-06	LOC.2	OU4-SD-M06-299A-D	01	19990908	0 - 0.33	107 J	252 J	67 J	3283	26 J	71 J	25
MS-06	LOC.2	OU4-SD-M06-200B	02	20000504	0 - 0.33	97	186	49 J	2637	28	46	27
MS-06	LOC.2	OU4-SD-M06-200A	03	20000827	0 - 0.33	116	192 J	45 J	2171	31 J	65	18 J
MS-06	LOC.2	OU4-SD-M06-201B	04	20010507	0 - 0.33	136	352	56 J	3250	17	49	20
MS-06	LOC.2	OU4-SD-M06-201A	05	20010819	0 - 0.33	64	428 J	57 J	2901	19	48	17
MS-06	LOC.2	OU4-SD-M06-202A	06	20020810	0 - 0.33	95 J	315	81	3623	19	54	21 J
MS-06	LOC.2	OU4-SD-M06-203A	07	20030810	0 - 0.33	59	141	33	2212	82	54	27 J
MS-06	LOC.3	OU4-SD-M06-399A	01	19990908	0 - 0.33	10 J	24	6	428	10	19 J	26 J
MS-06	LOC.3	OU4-SD-M06-300B	02	20000502	0 - 0.33	5	19	7	265	16	19	37
MS-06	LOC.3	OU4-SD-M06-300A	03	20000827	0 - 0.33	5	6 J	1 J	79	13 J	26	27 J
MS-06	LOC.3	OU4-SD-M06-301B	04	20010506	0 - 0.33	11	35	10 J	357	25	94	57
MS-06	LOC.3	OU4-SD-M06-301A	05	20010819	0 - 0.33	18	61 J	13 J	614	17	55	26
MS-06	LOC.3	OU4-SD-M06-302A	06	20020811	0 - 0.33	12 J	26	8	345	12	47	24 J
MS-06	LOC.3	OU4-SD-M06-303A	07	20030809	0 - 0.33	16	54	18	524	79	65	16 U

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value
U - Not detected at the indicated value.

TABLE 1-6

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 7
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-07	LOC.1	OU4-SD-M07-199A	01	19990909	0 - 0.33	21 J	37 J	10	713	20	39 J	26 J
MS-07	LOC.1	OU4-SD-M07-100B	02	20000504	0 - 0.33	31	92	23	1304	48	43	26
MS-07	LOC.1	OU4-SD-M07-100A	03	20000828	0 - 0.33	24	57	16	1025	18	51	19 J
MS-07	LOC.1	OU4-SD-M07-101B	04	20010506	0 - 0.33	23	74	17 J	931	22	70	23
MS-07	LOC.1	OU4-SD-M07-101A	05	20010819	0 - 0.33	25	74	28	1438	19	38	22
MS-07	LOC.1	OU4-SD-M07-102A	06	20020810	0 - 0.33	40 J	436	90	2517	17	31	21 J
MS-07	LOC.1	OU4-SD-M07-103A	07	20030811	0 - 0.33	18	64	18	1032	31	35	22
MS-07	LOC.2	OU4-SD-M07-299A	01	19990908	0 - 0.33	59 J	121	26	1595	32	60 J	31 J
MS-07	LOC.2	OU4-SD-M07-200B	02	20000503	0 - 0.33	74	168	42	2007	35	51	32
MS-07	LOC.2	OU4-SD-M07-200A	03	20000827	0 - 0.33	94	169 J	90 J	2375	36 J	70	20 J
MS-07	LOC.2	OU4-SD-M07-201B	04	20010507	0 - 0.33	83	273	54 J	2648	30	43	31
MS-07	LOC.2	OU4-SD-M07-201A	05	20010820	0 - 0.33	96	175	41	2165	25 J	59	22
MS-07	LOC.2	OU4-SD-M07-202A	06	20020810	0 - 0.33	102	215 J	44	2687	28	58	25 J
MS-07	LOC.2	OU4-SD-M07-203A	07	20030810	0 - 0.33	97	182	40	2181	38	66	27
MS-07	LOC.3	OU4-SD-M07-399A	01	19990908	0 - 0.33	116 J	280	73	4093	43	68 J	26 J
MS-07	LOC.3	OU4-SD-M07-300B	02	20000503	0 - 0.33	56 J	66	22 J	684	23	44	25
MS-07	LOC.3	OU4-SD-M07-300A	03	20000827	0 - 0.33	61	95 J	33 J	1423	20 J	53	16 J
MS-07	LOC.3	OU4-SD-M07-301B	04	20010507	0 - 0.33	71	215	44 J	2277	29	59	23
MS-07	LOC.3	OU4-SD-M07-301A	05	20010820	0 - 0.33	88	175	39	2027	23 J	53	22
MS-07	LOC.3	OU4-SD-M07-302A	06	20020810	0 - 0.33	73	151 J	27	1579	19	43	23
MS-07	LOC.3	OU4-SD-M07-303A	07	20030810	0 - 0.33	67	138	34	1837	28	67	22

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value

TABLE 1-7

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 8
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE
PAGE 1 OF 2

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-08	LOC.1	OU4-SD-M08-199A	01	19990908	0 - 0.33	54 J	233	72	3181	370	428 J	83 J
MS-08	LOC.1	OU4-SD-M08-100B	02	20000503	0 - 0.33	67	225	56	2434	455	245	93
MS-08	LOC.1	OU4-SD-M08-100A	03	20000828	0 - 0.33	83	214	48 J	2864	280	183	55 J
MS-08	LOC.1	OU4-SD-M08-100A-AVG	03	20000828	0 - 0.33	87	213	62 J	2923	311	201	77 J
MS-08	LOC.1	OU4-SD-M08-100A-D	03	20000828	0 - 0.33	91 J	212	76	2983	341 J	218 J	98 J
MS-08	LOC.1	OU4-SD-M08-101B	04	20010508	0 - 0.33	82 J	267 J	53 J	2809	420	254	85
MS-08	LOC.1	OU4-SD-M08-101B-AVG	04	20010508	0 - 0.33	66 J	243 J	46 J	2437	382	253	75
MS-08	LOC.1	OU4-SD-M08-101B-D	04	20010508	0 - 0.33	51	219 J	39 J	2066	343	252	66
MS-08	LOC.1	OU4-SD-M08-101A	05	20010819	0 - 0.33	52	227	61 J	2791	289	208	69
MS-08	LOC.1	OU4-SD-M08-101A-AVG	05	20010819	0 - 0.33	67	256	50 J	2823	311	249	72
MS-08	LOC.1	OU4-SD-M08-101A-D	05	20010819	0 - 0.33	81	284	39 J	2855	333	290	76
MS-08	LOC.1	OU4-SD-M08-102A	06	20020810	0 - 0.33	74	248 J	50 J	3516	365	295	114
MS-08	LOC.1	OU4-SD-M08-102A-AVG	06	20020810	0 - 0.33	51 J	217 J	56 J	3359	405	288 J	102
MS-08	LOC.1	OU4-SD-M08-102A-D	06	20020810	0 - 0.33	29 J	186 J	63	3203	444	280 J	90
MS-08	LOC.1	OU4-SD-M08-103A	07	20030810	0 - 0.33	**232 J**	1088 J	366	12955	**1958**	**2187**	**197**
MS-08	LOC.1	OU4-SD-M08-103A-AVG	07	20030810	0 - 0.33	172 J	853 J	293	10540	**1918**	**2082**	**194**
MS-08	LOC.1	OU4-SD-M08-103A-D	07	20030810	0 - 0.33	112 J	617 J	220	8125	**1878**	**1976**	**190**
MS-08	LOC.1	OU4-SD-M08-105A	08	20050823	0 - 0.33	3 U	2 J	3 U	43	13 J	20 J	8
MS-08	LOC.1	OU4-SD-M08-105A-AVG	08	20050823	0 - 0.33	3 U	2 J	3 U	42	13 J	20 J	8
MS-08	LOC.1	OU4-SD-M08-105A-D	08	20050823	0 - 0.33	3 U	3 U	3 U	42			
MS-08	LOC.1	OU4-SD-M08-107A	09	20071107	0 - 0.33	4 U	7	4 U	152	27 J	31 J	12 J
MS-08	LOC.1	OU4-SD-M08-108A	10	20081217	0 - 0.33	6	12	5 U	245	35	47	15
MS-08	LOC.2	OU4-SD-M08-299A	01	19990908	0 - 0.33	108 J	286	75	4518	95	178 J	36
MS-08	LOC.2	OU4-SD-M08-200B	02	20000503	0 - 0.33	89	276	77	2317	78	66	31
MS-08	LOC.2	OU4-SD-M08-200A	03	20000827	0 - 0.33	87	180 J	50 J	2173	118 J	78	25 J
MS-08	LOC.2	OU4-SD-M08-201B	04	20010507	0 - 0.33	102 J	410 J	92 J	4155	100	105	30
MS-08	LOC.2	OU4-SD-M08-201A	05	20010820	0 - 0.33	81	270	93	3218	57 J	75	28
MS-08	LOC.2	OU4-SD-M08-202A	06	20020810	0 - 0.33	100	464 J	71	6396	104	93	31
MS-08	LOC.2	OU4-SD-M08-203A	07	20030810	0 - 0.33	101	403	113	5337	446	**439**	64
MS-08	LOC.2	OU4-SD-M08-205A	08	20050820	0 - 0.33	25 J	370	75	5424	129 J	117 J	30
MS-08	LOC.2	OU4-SD-M08-205A-AVG	08	20050820	0 - 0.33	25 J	370	75	5424	129 J	117 J	30
MS-08	LOC.2	OU4-SD-M08-207A	09	20071106	0 - 0.33	45 J	100 J	37 J	1714	115 J	137 J	27 J
MS-08	LOC.2	OU4-SD-M08-208A	10	20081217	0 - 0.33	33	74	19	1284	97	96	26
MS-08	LOC.3	OU4-SD-M08-399A	01	19990909	0 - 0.33	80 J	285	62	3811	282	141 J	**174 J**
MS-08	LOC.3	OU4-SD-M08-300B	02	20000503	0 - 0.33	22 J	75 J	9 J	1050	441 J	207	124
MS-08	LOC.3	OU4-SD-M08-300B-AVG	02	20000503	0 - 0.33	60 J	231 J	24 J	2653	**756 J**	207	**131**
MS-08	LOC.3	OU4-SD-M08-300B-D	02	20000503	0 - 0.33	99 J	387 J	39 J	4256	**1070 J**	207	**137**
MS-08	LOC.3	OU4-SD-M08-300A	03	20000828	0 - 0.33	22	44	8	563	407	164	**130 J**
MS-08	LOC.3	OU4-SD-M08-301B	04	20010508	0 - 0.33	21 J	66 J	9	726	434	219	112
MS-08	LOC.3	OU4-SD-M08-301A	05	20010819	0 - 0.33	29	75	13	1344	**1207**	385	**130**
MS-08	LOC.3	OU4-SD-M08-302A	06	20020810	0 - 0.33	90	258 J	15	3772	354	265	119
MS-08	LOC.3	OU4-SD-M08-303A	07	20030809	0 - 0.33	56	309	93	3619	**666**	310	**160**
MS-08	LOC.3	OU4-SD-M08-307A	09	20071107	0 - 0.33	8	25	5	454	112 J	66 J	29 J
MS-08	LOC.3	OU4-SD-M08-308A	10	20081217	0 - 0.33	24	52	15	1028	179	163	37
MS-08	LOC.3A	OU4-SD-M08-305A	08	20050823	0 - 0.33	1 J	23	9	402	39 J	35 J	14
MS-08	LOC.4	OU4-SD-M08-400B	02	20000506	0 - 0.33	91 J	302 J	79 J	3480	157	104	53

TABLE 1-7

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 8
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value
U - Not detected at the indicated value.

TABLE 1-8

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 9
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)				
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER		LEAD	NICKEL	
										EPA METHOD	NOAA METHOD		EPA METHOD	NOAA METHOD
						IRG 210	IRG 1236	IRG 500	IRG 13057	-	IRG 486	2x ER-M 436	-	IRG 124
MS-09	LOC.1	OU4-SD-M09-199A	01	19990909	0 - 0.33	6 J	26	12	429	-	98	66 J	-	114 J
MS-09	LOC.1	OU4-SD-M09-100B	02	20000503	0 - 0.33	5	12	2	62	-	**511**	188	-	**160**
MS-09	LOC.1	OU4-SD-M09-100A	03	20000830	0 - 0.33	7 J	13	7	209	-	413 J	88 J	-	72 J
MS-09	LOC.1	OU4-SD-M09-101B	04	20010508	0 - 0.33	16 J	133 J	26	886	-	227	165	-	79
MS-09	LOC.1	OU4-SD-M09-101A	05	20010820	0 - 0.33	16	42	7	735	-	58 J	50	-	77
MS-09	LOC.1	OU4-SD-M09-102A	06	20020810	0 - 0.33	30 J	868 J	180 J	8083	-	128	85	-	107
MS-09	LOC.1	OU4-SD-M09-107A	09	20071106	0 - 0.33	57	220	96	3319	-	376 J	233 J	-	102 J
MS-09	LOC.1A	OU4-SD-M09-103A	07	20030811	0 - 0.33	146	1199	474	**15651**	-	**1145**	**762**	-	**228**
MS-09	LOC.1A	OU4-SD-M09-108A	10	20081217	0 - 0.33	70 J	210 J	59 J	3622	-	159	110	-	51
MS-09	LOC.1A	OU4-SD-M09-108A-AVG	10	20081217	0 - 0.33	70 J	210 J	59 J	3622	-	168 J	133 J	-	54 J
MS-09	LOC.1B	OU4-SD-M09-105A	08	20050820	0 - 0.33	42 J	1200	**530 J**	**19370**	-	**892 J**	**506 J**	-	**188**
MS-09	LOC.1B	OU4-SD-M09-105A-AVG	08	20050820	0 - 0.33	39 J	980	415 J	**17210**	-	**892 J**	**506 J**	-	**188**
MS-09	LOC.1B	OU4-SD-M09-105A-D	08	20050820	0 - 0.33	36 J	760	300 J	**15050**	-			-	
MS-09	LOC.2	OU4-SD-M09-299A	01	19990909	0 - 0.33	14 J	83	15	1601	-	119	190 J	-	41 J
MS-09	LOC.2	OU4-SD-M09-200B	02	20000503	0 - 0.33	9	79	15	709	-	207	142	-	62
MS-09	LOC.2	OU4-SD-M09-200A	03	20000829	0 - 0.33	55	128	36	1779	-	101	98	-	32 J
MS-09	LOC.2	OU4-SD-M09-201B	04	20010508	0 - 0.33	47 J	194 J	41	2047	-	132	109	-	62
MS-09	LOC.2	OU4-SD-M09-201A	05	20010820	0 - 0.33	64	194	67	2965	-	80 J	93	-	41
MS-09	LOC.2	OU4-SD-M09-202A	06	20020810	0 - 0.33	27	109 J	23	1861	-	211	121	-	43
MS-09	LOC.2A	OU4-SD-M09-203A	07	20030810	0 - 0.33	96	1009	**540**	11517	-	**526**	**519**	-	**140**
MS-09	LOC.2A	OU4-SD-M09-205A	08	20050820	0 - 0.33	31 J	200	66	5080	-	229 J	198 J	-	62
MS-09	LOC.2B	OU4-SD-M09-207A	09	20071106	0 - 0.33	59	280	86	4300	-	202 J	349 J	-	49 J
MS-09	LOC.2B	OU4-SD-M09-207A-AVG	09	20071106	0 - 0.33	61	265	78	4300	-	214 J	374 J	-	53 J
MS-09	LOC.2B	OU4-SD-M09-207A-D	09	20071106	0 - 0.33	63	250	70	4300	-	225 J	398 J	-	56 J
MS-09	LOC.2B	OU4-SD-M09-208A	10	20081217	0 - 0.33	89	250	61	4690	-	150	271	-	45
MS-09	LOC.3	OU4-SD-M09-399A	01	19990908	0 - 0.33	66 J	252	81	3065	-	106	102 J	-	42 J
MS-09	LOC.3	OU4-SD-M09-300B	02	20000503	0 - 0.33	61 J	208 J	69 J	2564	-	73	100	-	39
MS-09	LOC.3	OU4-SD-M09-300A	03	20000827	0 - 0.33	101 J	224 J	88 J	3210	-	77 J	100	-	32 J
MS-09	LOC.3	OU4-SD-M09-300A-AVG	03	20000827	0 - 0.33	113 J	258 J	101 J	3634	-	78 J	100	-	33 J
MS-09	LOC.3	OU4-SD-M09-300A-D	03	20000827	0 - 0.33	125	291	114	4057	-	79	99	-	34 J
MS-09	LOC.3	OU4-SD-M09-301B	04	20010507	0 - 0.33	97	395 J	116 J	4386	-	73	89	-	34
MS-09	LOC.3	OU4-SD-M09-301B-AVG	04	20010507	0 - 0.33	88 J	415 J	106 J	4117	-	77	92	-	35
MS-09	LOC.3	OU4-SD-M09-301B-D	04	20010507	0 - 0.33	80 J	435 J	95 J	3848	-	82	94	-	36
MS-09	LOC.3	OU4-SD-M09-301A	05	20010820	0 - 0.33	84 J	210 J	72 J	3080	-	88 J	92	-	33
MS-09	LOC.3	OU4-SD-M09-301A-AVG	05	20010820	0 - 0.33	93	293 J	93	4168	-	77	88 J	-	34 J
MS-09	LOC.3	OU4-SD-M09-301A-D	05	20010820	0 - 0.33	101	375 J	114	5255	-	66	84 J	-	35 J
MS-09	LOC.3	OU4-SD-M09-302A	06	20020810	0 - 0.33	118 J	536 J	113 J	6508	-	78	95	-	39
MS-09	LOC.3	OU4-SD-M09-302A-AVG	06	20020810	0 - 0.33	97 J	428 J	111 J	5846	-	73	91 J	-	36
MS-09	LOC.3	OU4-SD-M09-302A-D	06	20020810	0 - 0.33	77 J	320 J	109	5184	-	69	87 J	-	34
MS-09	LOC.3	OU4-SD-M09-303A	07	20030810	0 - 0.33	165	967	334	11946	-	**785**	**704**	-	**208**
MS-09	LOC.3	OU4-SD-M09-303A-AVG	07	20030810	0 - 0.33	156	915	311	11261	-	**761**	**707**	-	**202**
MS-09	LOC.3	OU4-SD-M09-303A-D	07	20030810	0 - 0.33	147	863	289	10575	-	**737**	**710**	-	**195**
MS-09	LOC.3	OU4-SD-M09-305A	08	20050820	0 - 0.33	55 J	600	180	**13640**	-	408 J	415 J	-	120 J
MS-09	LOC.3	OU4-SD-M09-307A	09	20071106	0 - 0.33	91	410	110	5660	-	232 J	225 J	-	62 J
MS-09	LOC.3	OU4-SD-M09-308A	10	20081217	0 - 0.33	82	550	270	9190	-	169	174	-	50
MS-09	LOC.4	OU4-SD-M09-400B	02	20000506	0 - 0.33	42 J	243 J	66 J	2620	-	152	162	-	50
MS-09	SD01	AS09-SD-SD01	ASP1	20050820	0 - 0.33	21 J	160 J	78 J	3875	161 J	183	-	41 J	59
MS-09	SD02	AS09-SD-SD02	ASP1	20050820	0 - 0.33	28 J	170	62	4094	81 J	85	-	27 J	47
MS-09	SD03	AS09-SD-SD03	ASP1	20050820	0 - 0.33	69 J	780	250	**16850**	180 J	206	-	39 J	58
MS-09	SD04	AS09-SD-SD04	ASP1	20050820	0 - 0.33	22	80	31	2334	40 J	36	-	23 J	44
MS-09	SD05	AS09-SD-SD05	ASP1	20050820	0 - 0.33	23 J	280	120	5570	57 J	56	-	23 J	43
MS-09	SD06	AS09-SD-SD06	ASP1	20050820	0 - 0.33	26	95	33	2754	38 J	34	-	21 J	42

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

NOAA - National Oceanic and Atmospheric Administration
EPA - Environmental protection Agency
MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value
U - Not detected at the indicated value.

TABLE 1-9

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 10
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-10	LOC.1	OU4-SD-M10-199A	01	19990907	0 - 0.33	3 J	14	4	252	21 J	31 J	42
MS-10	LOC.1	OU4-SD-M10-100B	02	20000503	0 - 0.33	16	119	30	1214	27	68	29
MS-10	LOC.1	OU4-SD-M10-100B-AVG	02	20000503	0 - 0.33	26	115	27	1086	28	57	29
MS-10	LOC.1	OU4-SD-M10-100B-D	02	20000503	0 - 0.33	36	111	24	958	28	47	29
MS-10	LOC.1	OU4-SD-M10-100A	03	20000829	0 - 0.33	24	43 J	12 J	646	19 J	65 J	24 J
MS-10	LOC.1	OU4-SD-M10-100A-AVG	03	20000829	0 - 0.33	27	60 J	17 J	1045	20 J	82 J	21 J
MS-10	LOC.1	OU4-SD-M10-100A-D	03	20000829	0 - 0.33	30 J	77 J	23 J	1444	21 J	99 J	18 J
MS-10	LOC.1	OU4-SD-M10-101B	04	20010508	0 - 0.33	20 J	60 J	15 J	824	23 J	47	29
MS-10	LOC.1	OU4-SD-M10-101B-AVG	04	20010508	0 - 0.33	16 J	63 J	15 J	850	32 J	42	33
MS-10	LOC.1	OU4-SD-M10-101B-D	04	20010508	0 - 0.33	11 J	65 J	16 J	875	40 J	37	36
MS-10	LOC.1	OU4-SD-M10-101A	05	20010820	0 - 0.33	51	353	54	3141	21 J	48	24
MS-10	LOC.1	OU4-SD-M10-101A-AVG	05	20010820	0 - 0.33	59	464	72	4811	26	60 J	29 J
MS-10	LOC.1	OU4-SD-M10-101A-D	05	20010820	0 - 0.33	68	574	89	6481	31	73 J	34 J
MS-10	LOC.1	OU4-SD-M10-102A	06	20020810	0 - 0.33	20	101 J	32	1078	22	102 J	29
MS-10	LOC.1	OU4-SD-M10-102A-AVG	06	20020810	0 - 0.33	23	130 J	30	1694	22	76 J	29
MS-10	LOC.1	OU4-SD-M10-102A-D	06	20020810	0 - 0.33	25	159 J	28	2311	23	50 J	29
MS-10	LOC.1	OU4-SD-M10-103A	07	20030812	0 - 0.33	22 J	90 J	34 J	1428	130 J	47	53 J
MS-10	LOC.1	OU4-SD-M10-103A-AVG	07	20030812	0 - 0.33	17 J	69 J	23 J	985	76 J	48	41 J
MS-10	LOC.1	OU4-SD-M10-103A-D	07	20030812	0 - 0.33	12 J	48 J	12 J	542	23 J	49	28 J
MS-10	LOC.1	OU4-SD-M10-105A	08	20050823	0 - 0.33	4	17	5	614			
MS-10	LOC.2	OU4-SD-M10-299A	01	19990907	0 - 0.33	157 J	806	163	7857	17 J	73 J	21
MS-10	LOC.2	OU4-SD-M10-200B	02	20000503	0 - 0.33	**237**	**1650**	386	9694	34	56	21
MS-10	LOC.2	OU4-SD-M10-200A	03	20000829	0 - 0.33	114	494	117	4861	20 J	79 J	19 J
MS-10	LOC.2	OU4-SD-M10-201B	04	20010507	0 - 0.33	129	**1541 J**	288 J	7494	18	99	16
MS-10	LOC.2	OU4-SD-M10-201A	05	20010820	0 - 0.33	160	668	135	7605	19 J	40	14
MS-10	LOC.2	OU4-SD-M10-202A	06	20020810	0 - 0.33	113 J	922 J	170 J	**23828**	15	46	16
MS-10	LOC.2	OU4-SD-M10-203A	07	20030810	0 - 0.33	94	839	131	5890	19	82	18
MS-10	LOC.2	OU4-SD-M10-205A	08	20050820	0 - 0.33	50	710	150	7710			
MS-10	LOC.3	OU4-SD-M10-399A	01	19990908	0 - 0.33	**217 J**	592	67	11462	105 J	116 J	28
MS-10	LOC.3	OU4-SD-M10-300B	02	20000503	0 - 0.33	94	1130	82	2465	31	55	29
MS-10	LOC.3	OU4-SD-M10-300A	03	20000829	0 - 0.33	135	251	39	2174	37 J	105 J	23 J
MS-10	LOC.3	OU4-SD-M10-301B	04	20010507	0 - 0.33	146 J	623 J	100 J	4182	27	56	25
MS-10	LOC.3	OU4-SD-M10-301A	05	20010820	0 - 0.33	45	101	23	1580	43 J	89	25
MS-10	LOC.3	OU4-SD-M10-302A	06	20020810	0 - 0.33	148	417 J	56	4597	32	71	27
MS-10	LOC.3	OU4-SD-M10-303A	07	20030810	0 - 0.33	122	374	68	3015	41	80	26
MS-10	LOC.3	OU4-SD-M10-305A	08	20050820	0 - 0.33	29	100	46	2817			

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value

TABLE 1-10

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 11
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-11	LOC.2	OU4-SD-M11-299A	01	19990909	0 - 0.33	20 J	52	11	688	17495 J	16250 J	5601
MS-11	LOC.3	OU4-SD-M11-399A	01	19990909	0 - 0.33	8	13	5	228	139 J	206 J	69
MS-11	LOC.3	OU4-SD-M11-300B	02	20000506	0 - 0.33	48 J	214 J	53 J	1980	541	554	76
MS-11	LOC.3	OU4-SD-M11-300A	03	20000830	0 - 0.33	21 J	67	17	1030	1479 J	1265 J	56 J
MS-11	LOC.3	OU4-SD-M11-301B	04	20010508	0 - 0.33	45 J	237 J	65 J	1478	747	1225	105
MS-11	LOC.3	OU4-SD-M11-301A	05	20010820	0 - 0.33	32	174	81	1137	461 J	1528	156
MS-11	LOC.3	OU4-SD-M11-302A	06	20020812	0 - 0.33	7	16 J	5	211	298	1239	70
MS-11	LOC.3	OU4-SD-M11-303A	07	20030809	0 - 0.33	85	335	166	2920	2628	1843	172

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value

TABLE 1-11

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 12
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-12	LOC.1	OU4-SD-M12-199A	01	19990909	0 - 0.33	217 J	2880	1393	39579	162 J	190 J	51
MS-12	LOC.1	OU4-SD-M12-100B	02	20000505	0 - 0.33	116	1220	680 J	13329	88	118	40
MS-12	LOC.1	OU4-SD-M12-100A	03	20000829	0 - 0.33	303 J	2205	2434	46931	375 J	330 J	73 J
MS-12	LOC.1	OU4-SD-M12-101B	04	20010508	0 - 0.33	168 U	2432 J	1246 J	22195	266	379	69
MS-12	LOC.1	OU4-SD-M12-101A	05	20010821	0 - 0.33	160	4036	1389	38253	166 J	240	47
MS-12	LOC.1	OU4-SD-M12-102A	06	20020812	0 - 0.33	513 J	9286 J	4011 J	106039	269	307	70
MS-12	LOC.1	OU4-SD-M12-103A	07	20030809	0 - 0.33	303	7419	4061	87938	421	410	101
MS-12	LOC.2	OU4-SD-M12-299A	01	19990909	0 - 0.33	69 J	355	146	5353	27 J	53 J	25
MS-12	LOC.2	OU4-SD-M12-200B	02	20000505	0 - 0.33	98	1140	666 J	13073	35	57	23
MS-12	LOC.2	OU4-SD-M12-200B-AVG	02	20000505	0 - 0.33	93	1078	650 J	12252	37	55	23
MS-12	LOC.2	OU4-SD-M12-200B-D	02	20000505	0 - 0.33	88 J	1016 J	634 J	11431	40	54	23
MS-12	LOC.2	OU4-SD-M12-200A	03	20000829	0 - 0.33	191 J	1031	1057	26371	128 J	142 J	28 J
MS-12	LOC.2	OU4-SD-M12-200A-AVG	03	20000829	0 - 0.33	217 J	1053	1056	26105	191 J	173 J	39 J
MS-12	LOC.2	OU4-SD-M12-200A-D	03	20000829	0 - 0.33	242 J	1075	1055	25839	254 J	204 J	50 J
MS-12	LOC.2	OU4-SD-M12-201B	04	20010508	0 - 0.33	167	2267 J	1513 J	23074	90	103	29
MS-12	LOC.2	OU4-SD-M12-201B-AVG	04	20010508	0 - 0.33	142	2500 J	1641 J	22950	85	98	28
MS-12	LOC.2	OU4-SD-M12-201B-D	04	20010508	0 - 0.33	117	2733 J	1769 J	22827	79	94	27
MS-12	LOC.2	OU4-SD-M12-201A	05	20010820	0 - 0.33	123 J	1778 J	835 J	19866	172 J	306	42
MS-12	LOC.2	OU4-SD-M12-201A-AVG	05	20010820	0 - 0.33	179 J	2213	1119 J	23823	213	254 J	52 J
MS-12	LOC.2	OU4-SD-M12-201A-D	05	20010820	0 - 0.33	236 J	2648	1403 J	27779	253	203 J	61 J
MS-12	LOC.2	OU4-SD-M12-202A	06	20020813	0 - 0.33	80 J	1608 J	585 J	15578	37	152	15
MS-12	LOC.2	OU4-SD-M12-202A-AVG	06	20020813	0 - 0.33	69 J	1233 J	488 J	12789	33	126	16
MS-12	LOC.2	OU4-SD-M12-202A-D	06	20020813	0 - 0.33	58	858 J	390	9999	30	100	16
MS-12	LOC.2	OU4-SD-M12-203A	07	20030809	0 - 0.33	138	2195	1105	25428	119	147	39
MS-12	LOC.2	OU4-SD-M12-203A-AVG	07	20030809	0 - 0.33	141	2039	1048	23440	121	135	44
MS-12	LOC.2	OU4-SD-M12-203A-D	07	20030809	0 - 0.33	143	1884	991	21452	123	122	48
MS-12	LOC.3	OU4-SD-M12-399A	01	19990909	0 - 0.33	79 J	479	151	6475	51 J	88 J	27
MS-12	LOC.3	OU4-SD-M12-399A-AVG	01	19990909	0 - 0.33	73 J	399	139	6135	47 J	85 J	27
MS-12	LOC.3	OU4-SD-M12-399A-D	01	19990909	0 - 0.33	68 J	318	126	5795	44 J	83 J	26
MS-12	LOC.3	OU4-SD-M12-300B	02	20000505	0 - 0.33	64 J	258 J	70 J	3916	111	124	40
MS-12	LOC.3	OU4-SD-M12-300B-AVG	02	20000505	0 - 0.33	80 J	420 J	96 J	5253	95	116	37
MS-12	LOC.3	OU4-SD-M12-300B-D	02	20000507	0 - 0.33	96	582	121	6589	80	107	35
MS-12	LOC.3	OU4-SD-M12-300A	03	20000829	0 - 0.33	85	196	117	3372	77 J	201 J	28 J
MS-12	LOC.3	OU4-SD-M12-301B	04	20010508	0 - 0.33	103 J	498 J	251 J	5605	83	126	33
MS-12	LOC.3	OU4-SD-M12-301A	05	20010820	0 - 0.33	83	762 J	424	8985	85 J	175	37
MS-12	LOC.3	OU4-SD-M12-302A	06	20020813	0 - 0.33	63 J	372 J	83 J	6497	99	148	34
MS-12	LOC.3	OU4-SD-M12-303A	07	20030809	0 - 0.33	77	1050	606	13206	689	555	91
MS-12	SD01	AS12-SD-SD01	ASP1	20050822	0 - 0.33	99	840	380	12100	-	409	-
MS-12	SD02	AS12-SD-SD02	ASP1	20050823	0 - 0.33	270	3200	1900	52030	-	128 J	-
MS-12	SD020	AS12-SD-SD20-00	ASP2	20080414	0 - 0.17	850 UJ	7700 J	4500 J	119200	-	422 J	-
MS-12	SD027	AS12-SD-SD27-00	ASP2	20080414	0 - 0.25	850 UJ	15000 J	8200 J	172700	-	369 J	-
MS-12	SD028	AS12-SD-SD28-00	ASP2	20080414	0 - 0.33	87 UJ	650 J	340 J	11060	-	608 J	-
MS-12	SD029	AS12-SD-SD29-00	ASP2	20080414	0 - 0.33	44 UJ	500 J	340 J	7190	-	761 J	-
MS-12	SD03	AS12-SD-SD03	ASP1	20050823	0 - 0.33	-	-	-	-	-	51 J	-
MS-12	SD030	AS12-SD-SD30-00	ASP2	20080414	0 - 0.33	100 UJ	1300 J	970 J	26940	-	278 J	-
MS-12	SD031	AS12-SD-SD31-00	ASP2	20080415	0 - 0.33	39 U	560	400	7400	-	41600 J	-
MS-12	SD032	AS12-SD-SD32-00	ASP2	20080415	0 - 0.33	320 U	3700	2500	48480	-	324 J	-
MS-12	SD032	AS12-SD-SD32-01	ASP2	20080415	0.67 - 1	180 U	2100	1600	36760	-	305 J	-
MS-12	SD033	AS12-SD-SD33-00	ASP2	20080415	0 - 0.33	93	420 J	210 J	11700	-	823 J	-
MS-12	SD033	AS12-SD-SD33-00-AVG	ASP2	20080415	0 - 0.33	94	1060 J	580 J	18895	-	805 J	-

TABLE 1-11

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 12
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-12	SD033	AS12-SD-SD33-00-D	ASP2	20080415	0 - 0.33	94	**1700 J**	**950 J**	**26090**	-	**786 J**	-
MS-12	SD033	AS12-SD-SD33-01	ASP2	20080415	0.75 - 1.25	49	230	130	3710	-	**719 J**	-
MS-12	SD034	AS12-SD-SD34-00	ASP2	20080415	0 - 0.33	40	92	51	1875	-	**1820 J**	-
MS-12	SD034	AS12-SD-SD34-01	ASP2	20080415	0.83 - 1.42	33	65	25	1008	-	**1270 J**	-
MS-12	SD035	AS12-SD-SD35-00	ASP2	20080415	0 - 0.33	1500 U	**16000**	**12000**	**249100**	-	230 J	-
MS-12	SD035	AS12-SD-SD35-01	ASP2	20080415	0.33 - 1	34	370	280	6660	-	261 J	-
MS-12	SD036	AS12-SD-SD36-00	ASP2	20080415	0 - 0.33	150	1100	**840**	**20150**	-	345 J	-
MS-12	SD037	AS12-SD-SD37-00	ASP2	20080416	0 - 0.33	430 U	**5900**	**4200**	**86400**	-	**3160 J**	-
MS-12	SD038	AS12-SD-SD38-00	ASP2	20080416	0 - 0.25	460 U	**5500**	**3900 J**	**99700**	-	**2530 J**	-
MS-12	SD038	AS12-SD-SD38-00-AVG	ASP2	20080416	0 - 0.25	335 U	**4050**	**2800 J**	**80250**	-	**2130 J**	-
MS-12	SD038	AS12-SD-SD38-00-D	ASP2	20080416	0 - 0.25	210 U	**2600**	**1700 J**	**60800**	-	**1730 J**	-
MS-12	SD039	AS12-SD-SD39-00	ASP2	20080416	0 - 0.33	25	190	130	4340	-	**690 J**	-
MS-12	SD04	AS12-SD-SD04	ASP1	20050823	0 - 0.33	-	-	-	-	-	116 J	-
MS-12	SD040	AS12-SD-SD40-00	ASP2	20080416	0 - 0.25	42 U	490	260	7850	-	**1090 J**	-
MS-12	SD041	AS12-SD-SD41-00	ASP2	20080416	0 - 0.33	67 J	200 J	100 J	4930	-	231 J	-
MS-12	SD042	AS12-SD-SD42-00	ASP2	20080416	0 - 0.25	79 U	760	480	**13500**	-	**777 J**	-
MS-12	SD05	AS12-SD-SD05	ASP1	20050823	0 - 0.33	-	-	-	-	-	63 J	-
MS-12	SD06	AS12-SD-SD06	ASP1	20050823	0 - 0.33	-	-	-	-	-	118 J	-
MS-12	SD06	AS12-SD-SD06-0004	ASP1	20050823	0 - 0.33	29 J	1200 J	**640 J**	**15870**	-		-
MS-12	SD06	AS12-SD-SD06-0412	ASP1	20050823	0.33 - 1	44 J	**1500 J**	**750 J**	**17940**	-	**610 J**	-
MS-12	SD06	AS12-SD-SD06-1220	ASP1	20050823	1 - 1.66	61 J	**1300 J**	500 J	**22270**	-	**544 J**	-
MS-12	SD06	AS12-SD-SD06-2031	ASP1	20050823	1.66 - 2.58	110 J	**3600 J**	**3000 J**	**54600**	-	**681 J**	-
MS-12	SD07	AS12-SD-SD07	ASP1	20050823	0 - 0.33	88	990	500	**16330**	-	297 J	-
MS-12	SD07	AS12-SD-SD07-0412	ASP1	20050823	0.33 - 1	47 J	**1700 J**	**950 J**	**24190**	-	**534 J**	-
MS-12	SD07	AS12-SD-SD07-1220	ASP1	20050823	1 - 1.66	39 J	1100 J	**640 J**	**13190**	-	**1350 J**	-
MS-12	SD07	AS12-SD-SD07-2028	ASP1	20050823	1.66 - 2.33	37 J	**1500 J**	**2100 J**	**21660**	-	**651 J**	-
MS-12	SD07	AS12-SD-SD07-AVG	ASP1	20050823	0 - 0.33	88	990	500	**16330**	-	**533 J**	-
MS-12	SD07	AS12-SD-SD07-D	ASP1	20050823	0 - 0.33	-	-	-	-	-	**768 J**	-
MS-12	SD08	AS12-SD-SD08	ASP1	20050823	0 - 0.33	-	-	-	-	-	**757 J**	-
MS-12	SD09	AS12-SD-SD09	ASP1	20050822	0 - 0.33	200	**2500**	**1500**	**47540**	-	144	-
MS-12	SD09	AS12-SD-SD09-AVG	ASP1	20050822	0 - 0.33	200	**2500**	**1500**	**47540**	-	154	-
MS-12	SD09	AS12-SD-SD09-D	ASP1	20050822	0 - 0.33	-	-	-	-	-	163	-
MS-12	SD10	AS12-SD-SD10	ASP1	20050823	0 - 0.33	-	-	-	-	-	290 J	-
MS-12	SD100	AS12-SD-SD100-00	ASP2	20080416	0 - 0.33	900 U	**13000**	**11000**	**172200**	-	**7810 J**	-
MS-12	SD100	AS12-SD-SD100-01	ASP2	20080416	0.67 - 0.83	930 U	**18000**	**14000**	**231800**	-	**6970 J**	-
MS-12	SD101	AS12-SD-SD101-00	ASP2	20080416	0 - 0.33	110	370	260	7660	-	**736 J**	-
MS-12	SD102	AS12-SD-SD102-00	ASP2	20080416	0 - 0.25	490 U	**5200**	**4100**	**85500**	-	**1110 J**	-
MS-12	SD103	AS12-SD-SD103-00	ASP2	20080416	0 - 0.33	12	42 J	39 J	2171	-	202 J	-
MS-12	SD103	AS12-SD-SD103-00-AVG	ASP2	20080416	0 - 0.33	12	671 J	370 J	9141	-	171 J	-
MS-12	SD103	AS12-SD-SD103-00-D	ASP2	20080416	0 - 0.33	77 U	**1300 J**	**700 J**	**16110**	-	140 J	-
MS-12	SD103	AS12-SD-SD103-01	ASP2	20080416	0.67 - 1.25	44 U	670	**570**	9300	-	114 J	-
MS-12	SD104	AS12-SD-SD104-00	ASP2	20080416	0 - 0.33	190 U	**2100**	**1600**	**41220**	-	**874 J**	-
MS-12	SD105	AS12-SD-SD105-00	ASP2	20080416	0 - 0.33	170 U	**1900**	**1500**	**34340**	-	**608 J**	-
MS-12	SD106	AS12-SD-SD106-00	ASP2	20080416	0 - 0.33	44 U	390	330	10920	-	288 J	-
MS-12	SD107	AS12-SD-SD10700	ASP1	20081217	0 - 0.33	-	-	-	-	-	417	-
MS-12	SD108	AS12-SD-SD10800	ASP1	20081217	0 - 0.33	-	-	-	-	-	**647**	-
MS-12	SD109	AS12-SD-SD10900	ASP1	20081217	0 - 0.33	-	-	-	-	-	**598**	-
MS-12	SD11	AS12-SD-SD11	ASP1	20050823	0 - 0.33	-	-	-	-	-	155 J	-
MS-12	SD12	AS12-SD-SD12	ASP1	20050822	0 - 0.33	-	-	-	-	-	**3120**	-
MS-12	SD13	AS12-SD-SD13	ASP1	20050822	0 - 0.33	-	-	-	-	-	148	-

TABLE 1-11

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 12
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-12	SD14	AS12-SD-SD14	ASP1	20050822	0 - 0.33	-	-	-	-	-	42	-
MS-12	SD15	AS12-SD-SD15	ASP1	20050824	0 - 0.33	**670**	**11000**	**6400**	**157600**		**643 J**	-
MS-12	SD16	AS12-SD-SD16	ASP1	20050824	0 - 0.33	120	**1500**	**880**	**24410**	-	423 J	-
MS-12	SD16	AS12-SD-SD16-AVG	ASP1	20050824	0 - 0.33	110	**1350**	**785**	**21870**	-	423 J	-
MS-12	SD16	AS12-SD-SD16-D	ASP1	20050824	0 - 0.33	100	1200	**690**	**19330**	-	-	-
MS-12	SD21	AS12-SD-SD21-00	ASP2	20071108	0 - 0.33	24	280	160	3485	-	58 J	-
MS-12	SD21	AS12-SD-SD21-01	ASP2	20071108	0.33 - 0.67	17	110	63	1504	-	68 J	-
MS-12	SD22	AS12-SD-SD22-00	ASP2	20071108	0 - 0.33	84 J	270 J	150 J	4698	-	70 J	-
MS-12	SD22	AS12-SD-SD22-00-AVG	ASP2	20071108	0 - 0.33	80 J	220 J	108 J	3850	-	73 J	-
MS-12	SD22	AS12-SD-SD22-00-D	ASP2	20071108	0 - 0.33	76 J	170 J	66 J	3002	-	75 J	-
MS-12	SD23	AS12-SD-SD23-00	ASP2	20071107	0 - 0.33	100 J	420 J	220 J	7440	-	100 J	-
MS-12	SD23	AS12-SD-SD23-01	ASP2	20071107	0.33 - 0.83	23	130	73	2782	-	124 J	-
MS-12	SD24	AS12-SD-SD24-00	ASP2	20071105	0 - 0.33	43	460	290	5570	-	240	-
MS-12	SD24	AS12-SD-SD24-01	ASP2	20071105	0.33 - 1	74	**1900**	**1300**	**21770**	-	340	-
MS-12	SD25	AS12-SD-SD25-00	ASP2	20071108	0 - 0.33	77 J	850 J	**620 J**	10420	-	236 J	-
MS-12	SD25	AS12-SD-SD25-01	ASP2	20071108	0.33 - 1	65	510	260	8680	-	327 J	-
MS-12	SD26	AS12-SD-SD26-00	ASP2	20071108	0 - 0.33	14 J	170 J	98 J	2114	-	104 J	-
MS-12	SD43	AS12-SD-SD43-00	ASP2	20071105	0 - 0.33	35	250	160	3808	-	58	-
MS-12	SD44	AS12-SD-SD44-00	ASP2	20071109	0 - 0.33	51	640	360	12710	-	54 J	-
MS-12	SD45	AS12-SD-SD45-00	ASP2	20071105	0 - 0.33	27	190	100	3117	-	45	-
MS-12	SD46	AS12-SD-SD46-00	ASP2	20071105	0 - 0.33	46	260	140	3287	-	55	-
MS-12	SD49	AS12-SD-SD49-00	ASP2	20071106	0 - 0.33	59	220	74	2632	-	280	-
MS-12	SD50	AS12-SD-SD50-00	ASP2	20071106	0 - 0.33	75	520	200	4845	-	86	-

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value
U - Not detected at the indicated value.

TABLE 1-12

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 13
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-13	LOC.1	OU4-SD-M13-199A	01	19990911	0 - 0.33	85 J	453	160	6094	47	60 J	32 J
MS-13	LOC.1	OU4-SD-M13-100B	02	20000506	0 - 0.33	**212 J**	**2269 J**	**3752 J**	**16634**	54	51	33
MS-13	LOC.1	OU4-SD-M13-100A	03	20000828	0 - 0.33	**215 J**	**1283 J**	**834 J**	**19342**	45 J	71 J	25 J
MS-13	LOC.1	OU4-SD-M13-101B	04	20010507	0 - 0.33	162	**1237 J**	197 J	10331	45	61	25
MS-13	LOC.1	OU4-SD-M13-101A	05	20010820	0 - 0.33	**222**	1041 J	388	12386	40 J	73	24
MS-13	LOC.1	OU4-SD-M13-102A	06	20020813	0 - 0.33	81	332 J	99	5386	67	109	33
MS-13	LOC.1	OU4-SD-M13-103A	07	20030813	0 - 0.33	66	202	104	2232	111 J	98 J	28
MS-13	LOC.1	OU4-SD-M13-105A	08	20050822	0 - 0.33	26 J	83	36 J	4518	-	-	-
MS-13	LOC.1	OU4-SD-M13-105A-AVG	08	20050822	0 - 0.33	32 J	162 J	98 J	11243	-	-	-
MS-13	LOC.1	OU4-SD-M13-105A-D	08	20050822	0 - 0.33	37 J	240 J	160 J	**17968**	-	-	-
MS-13	LOC.2	OU4-SD-M13-299A	01	19990911	0 - 0.33	123 J	463	87	5271	46	56 J	38
MS-13	LOC.2	OU4-SD-M13-200B	02	20000506	0 - 0.33	188	625	156	5894	52	49	31
MS-13	LOC.2	OU4-SD-M13-200A	03	20000828	0 - 0.33	150	340	65	3778	36 J	64 J	23 J
MS-13	LOC.2	OU4-SD-M13-201B	04	20010507	0 - 0.33	133 J	560 J	97 J	4896	42	77	24
MS-13	LOC.2	OU4-SD-M13-201A	05	20010820	0 - 0.33	107	298 J	63	3038	43 J	164	28
MS-13	LOC.2	OU4-SD-M13-202A	06	20020813	0 - 0.33	121 J	**1597 J**	334	8006	357	**469**	56
MS-13	LOC.2	OU4-SD-M13-203A	07	20030813	0 - 0.33	111	584	222	2900	115 J	77 J	32
MS-13	LOC.2	OU4-SD-M13-205A	08	20050822	0 - 0.33	35	150	52	3660	-	-	-
MS-13	LOC.2	OU4-SD-M13-205A-AVG	08	20050822	0 - 0.33	37	135	65	3427	-	-	-
MS-13	LOC.2	OU4-SD-M13-205A-D	08	20050822	0 - 0.33	39	120	78	3194	-	-	-
MS-13	LOC.3	OU4-SD-M13-399A	01	19990911	0 - 0.33	109 J	348	94	4609	62	70 J	31
MS-13	LOC.3	OU4-SD-M13-300B	02	20000506	0 - 0.33	119	749	287	6556	119	85	35
MS-13	LOC.3	OU4-SD-M13-300A	03	20000828	0 - 0.33	131	359	116	3964	87 J	88 J	29 J
MS-13	LOC.3	OU4-SD-M13-301B	04	20010507	0 - 0.33	103 J	384 J	111 J	3969	63	89	29
MS-13	LOC.3	OU4-SD-M13-301A	05	20010820	0 - 0.33	125	428 J	101	5061	63 J	74	38
MS-13	LOC.3	OU4-SD-M13-302A	06	20020813	0 - 0.33	121	380 J	66	4018	57	82	25
MS-13	LOC.3	OU4-SD-M13-303A	07	20030813	0 - 0.33	79 J	277 J	86	2893	153 J	70 J	26
MS-13	LOC.3	OU4-SD-M13-305A	08	20050822	0 - 0.33	25 J	200 J	110 J	4080	-	-	-

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value

TABLE 1-13

SUMMARY OF COCs DETECTED IN SEDIMENT AT MONITORING STATION 14
FEASIBILITY STUDY FOR OPERABLE UNIT 4
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

MS Number	Sample Location	Sample ID	Round	Sample Date	Depth Interval (Feet)	Semivolatile Organics (ug/kg)				Inorganics (mg/kg)		
						ACENAPHTHYLENE	ANTHRACENE	FLUORENE	HIGH MOLECULAR WEIGHT PAHS	COPPER	LEAD	NICKEL
						IRG 210	IRG 1236	IRG 500	IRG 13057	IRG 486	2x ER-M 436	IRG 124
MS-14	LOC.1	OU4-SD-M14-199A	01	19990911	0 - 0.33	42 J	90	23	1515	27	57 J	27
MS-14	LOC.1	OU4-SD-M14-100B	02	20000504	0 - 0.33	115 J	197 J	44 J	2226	60	185	30
MS-14	LOC.1	OU4-SD-M14-100A	03	20000828	0 - 0.33	117	166	35	1926	44 J	94 J	23 J
MS-14	LOC.1	OU4-SD-M14-101B	04	20010507	0 - 0.33	179 J	416 J	65 J	4391	37	82	20
MS-14	LOC.1	OU4-SD-M14-101A	05	20010821	0 - 0.33	**245**	408 J	57	4020	34 J	85	23
MS-14	LOC.1	OU4-SD-M14-102A	06	20020811	0 - 0.33	159	276 J	44	4165	30	119	22
MS-14	LOC.1	OU4-SD-M14-103A	07	20030811	0 - 0.33	43	78	17	993	86 J	65 J	28
MS-14	LOC.1	OU4-SD-M14-105A	08	20050821	0 - 0.33	14	44	16	1508	-	-	-
MS-14	LOC.2	OU4-SD-M14-299A	01	19990911	0 - 0.33	120 J	307	74	4465	25	65 J	19
MS-14	LOC.2	OU4-SD-M14-200B	02	20000505	0 - 0.33	103	409	107	5209	29	53	20
MS-14	LOC.2	OU4-SD-M14-200A	03	20000828	0 - 0.33	189	433	142	4206	16 J	54 J	17 J
MS-14	LOC.2	OU4-SD-M14-201B	04	20010508	0 - 0.33	164 J	549 J	113 J	4061	29	66	19
MS-14	LOC.2	OU4-SD-M14-201A	05	20010821	0 - 0.33	172	674 J	163	5310	25	71 J	17 J
MS-14	LOC.2	OU4-SD-M14-202A	06	20020811	0 - 0.33	**230 J**	**1838 J**	205 J	11688	21	65	17
MS-14	LOC.2	OU4-SD-M14-203A	07	20030811	0 - 0.33	72 J	180 J	39 J	2502	68	51	24 J
MS-14	LOC.2	OU4-SD-M14-205A	08	20050821	0 - 0.33	41	400	120	5930	-	-	-
MS-14	LOC.3	OU4-SD-M14-399A	01	19990911	0 - 0.33	77 J	145	30	2140	38	58 J	27
MS-14	LOC.3	OU4-SD-M14-300B	02	20000505	0 - 0.33	173	396	99	4669	31	44	27
MS-14	LOC.3	OU4-SD-M14-300A	03	20000828	0 - 0.33	130 J	353	85	3631	29 J	67 J	25 J
MS-14	LOC.3	OU4-SD-M14-301B	04	20010508	0 - 0.33	113 J	373 J	108 J	2785	27	60	22
MS-14	LOC.3	OU4-SD-M14-301A	05	20010821	0 - 0.33	165	437 J	93	4387	24 J	57	25
MS-14	LOC.3	OU4-SD-M14-302A	06	20020810	0 - 0.33	151 J	570 J	93	4882	26	88	20
MS-14	LOC.3	OU4-SD-M14-303A	07	20030811	0 - 0.33	101	254	51	2332	82 J	56 J	30
MS-14	LOC.3	OU4-SD-M14-305A	08	20050821	0 - 0.33	43	680	74	3867			

Shaded values exceed their IRG or 2 times the ER-M (for lead only).

MS - Monitoring station
COC - Chemical of concern
IRG - Interim remediation goal
ER-M - Effects-range median
ug/kg - Micrograms/kilogram
mg/kg - Milligrams/kilogram
J - Estimated value

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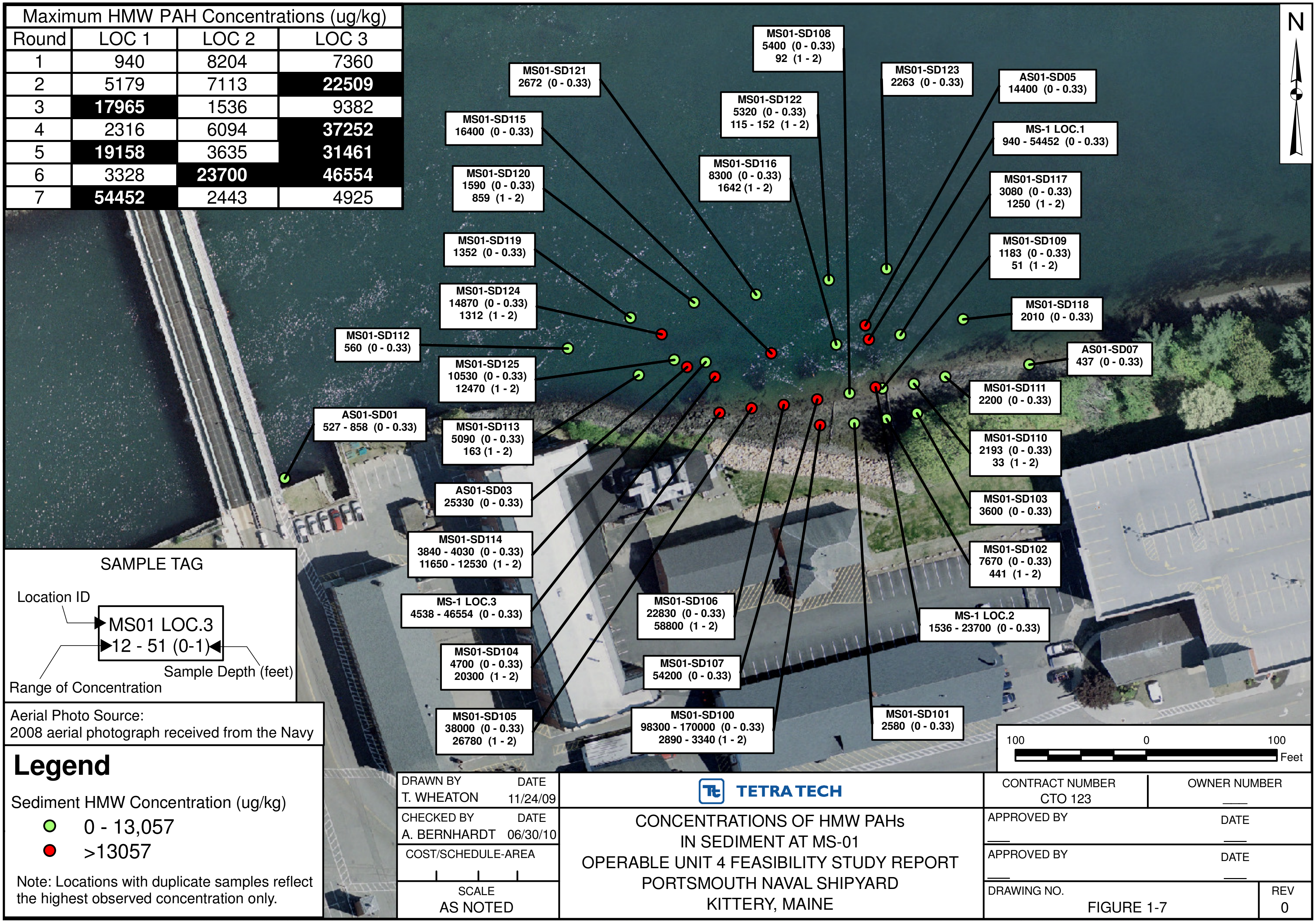
Maximum HMW PAH Concentrations (ug/kg)			
Round	LOC 1	LOC 2	LOC 3
1	940	8204	7360
2	5179	7113	**22509**
3	**17965**	1536	9382
4	2316	6094	**37252**
5	**19158**	3635	**31461**
6	3328	**23700**	**46554**
7	**54452**	2443	4925



SAMPLE TAG

Location ID

MS01 LOC.3
12 - 51 (0-1)

Sample Depth (feet)

Range of Concentration

Aerial Photo Source:
2008 aerial photograph received from the Navy

Legend

Sediment HMW Concentration (ug/kg)

- 0 - 13,057
- >13057

Note: Locations with duplicate samples reflect the highest observed concentration only.

DRAWN BY	DATE
T. WHEATON	11/24/09
CHECKED BY	DATE
A. BERNHARDT	06/30/10
COST/SCHEDULE-AREA	
SCALE	
AS NOTED	

TETRA TECH

CONCENTRATIONS OF HMW PAHs
IN SEDIMENT AT MS-01
OPERABLE UNIT 4 FEASIBILITY STUDY REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

CONTRACT NUMBER	OWNER NUMBER
CTO 123	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO.	REV
FIGURE 1-7	0

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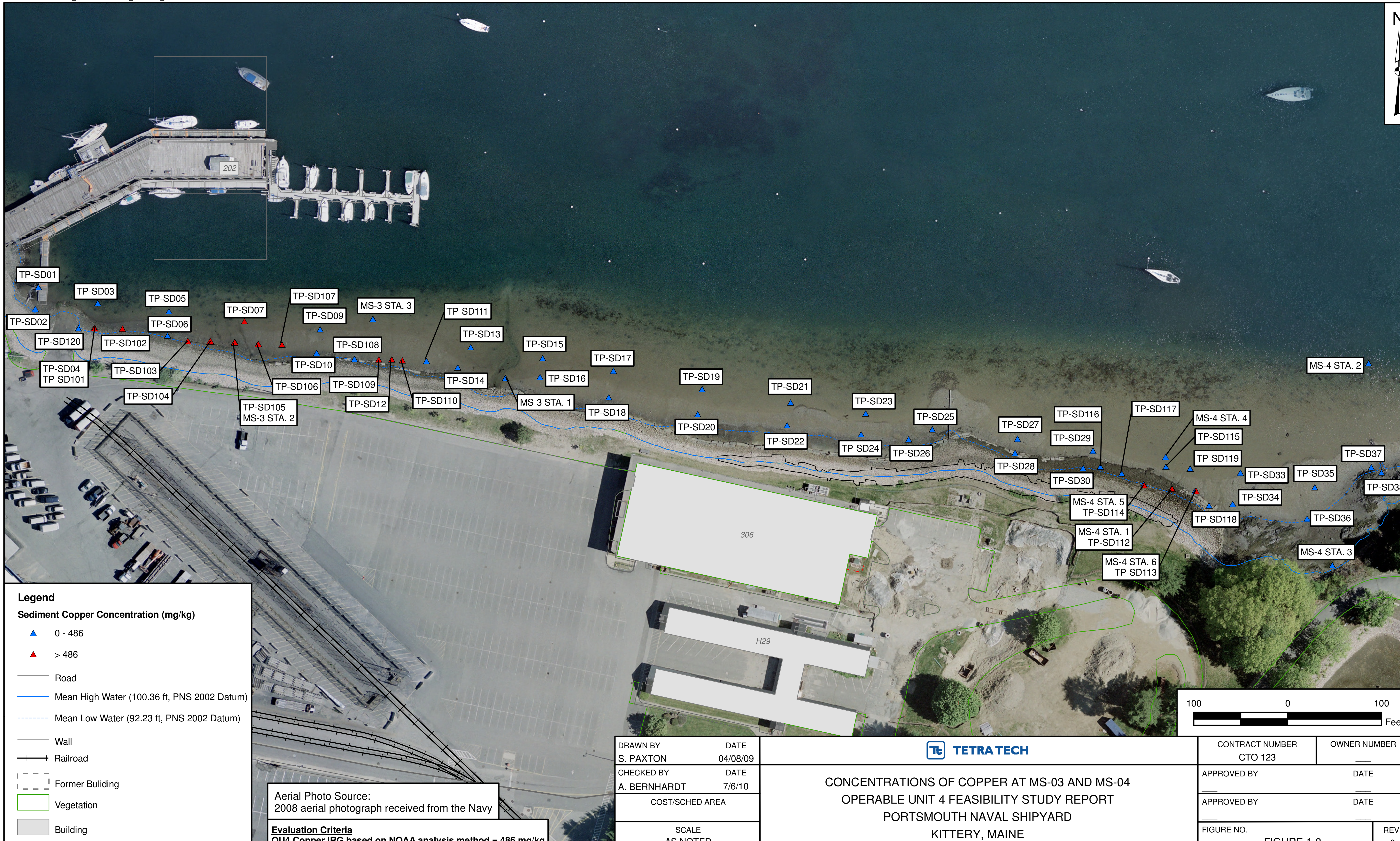

Legend

Sediment Copper Concentration (mg/kg)

- ▲ 0 - 486
- ▲ > 486
- Road
- Mean High Water (100.36 ft, PNS 2002 Datum)
- Mean Low Water (92.23 ft, PNS 2002 Datum)
- Wall
- Railroad
- Former Buliding
- Vegetation
- Building

Aerial Photo Source:
2008 aerial photograph received from the Navy

Evaluation Criteria
OU4 Copper IRG based on NOAA analysis method = 486 mg/kg

DRAWN BY	DATE
S. PAXTON	04/08/09
CHECKED BY	DATE
A. BERNHARDT	7/6/10
COST/SCHED AREA	
SCALE	
AS NOTED	

TETRA TECH

CONCENTRATIONS OF COPPER AT MS-03 AND MS-04
OPERABLE UNIT 4 FEASIBILITY STUDY REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

CONTRACT NUMBER	OWNER NUMBER
CTO 123	___
APPROVED BY ___	DATE ___
APPROVED BY ___	DATE ___
FIGURE NO. FIGURE 1-8	REV 0

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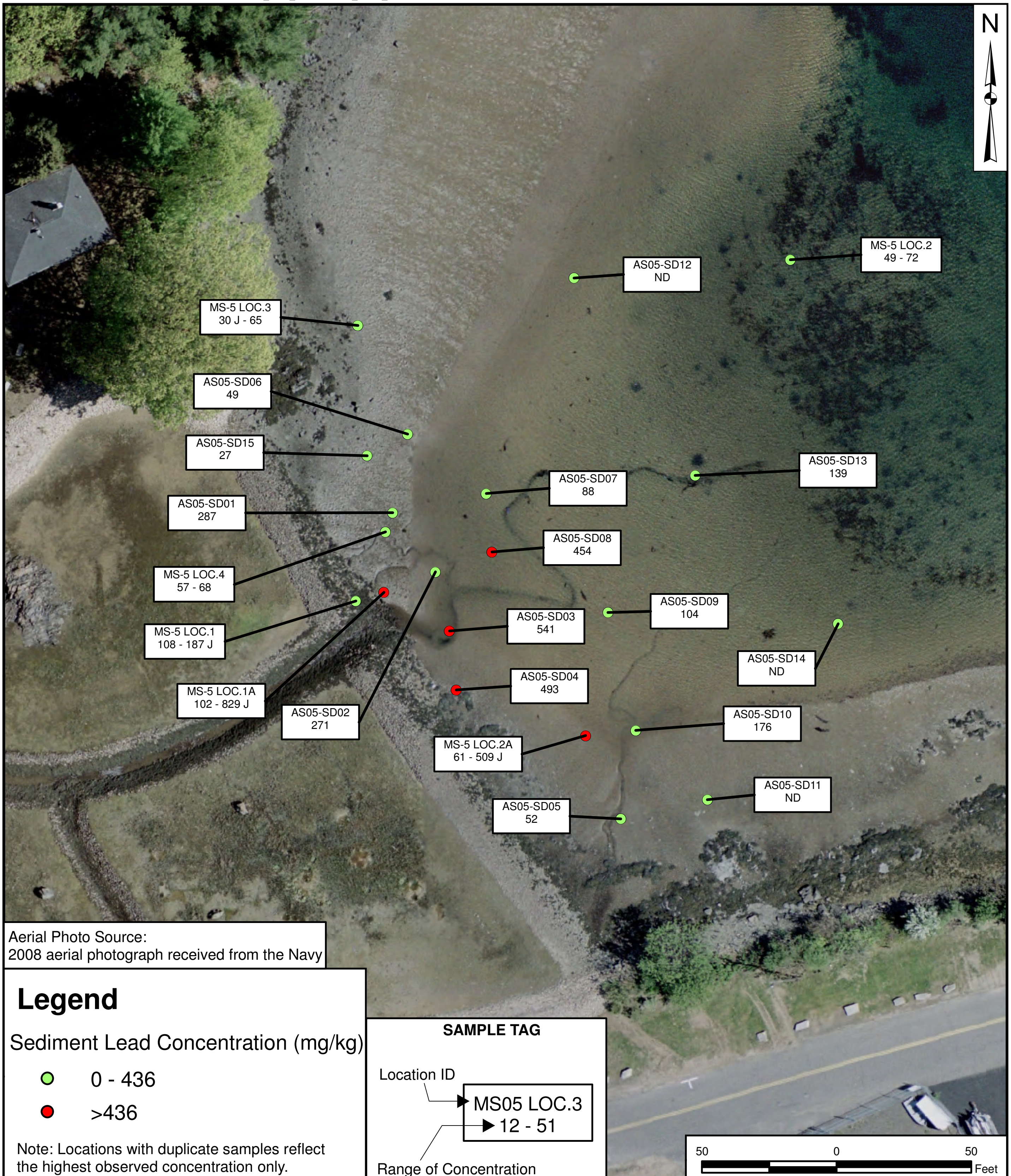

DRAWN BY: T. WHEATON; DATE: 11/24/09	TETRA TECH	CONTRACT NUMBER: CTO 123	OWNER NUMBER:
CHECKED BY: A. BERNHARDT; DATE: 06/30/10	CONCENTRATIONS OF LEAD IN SEDIMENT AT MS-05 OPERABLE UNIT 4 FEASIBILITY STUDY REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY	DATE
COST/SCHEDULE-AREA		APPROVED BY	DATE
SCALE: AS NOTED		DRAWING NO.: FIGURE 1-9	REV: 0

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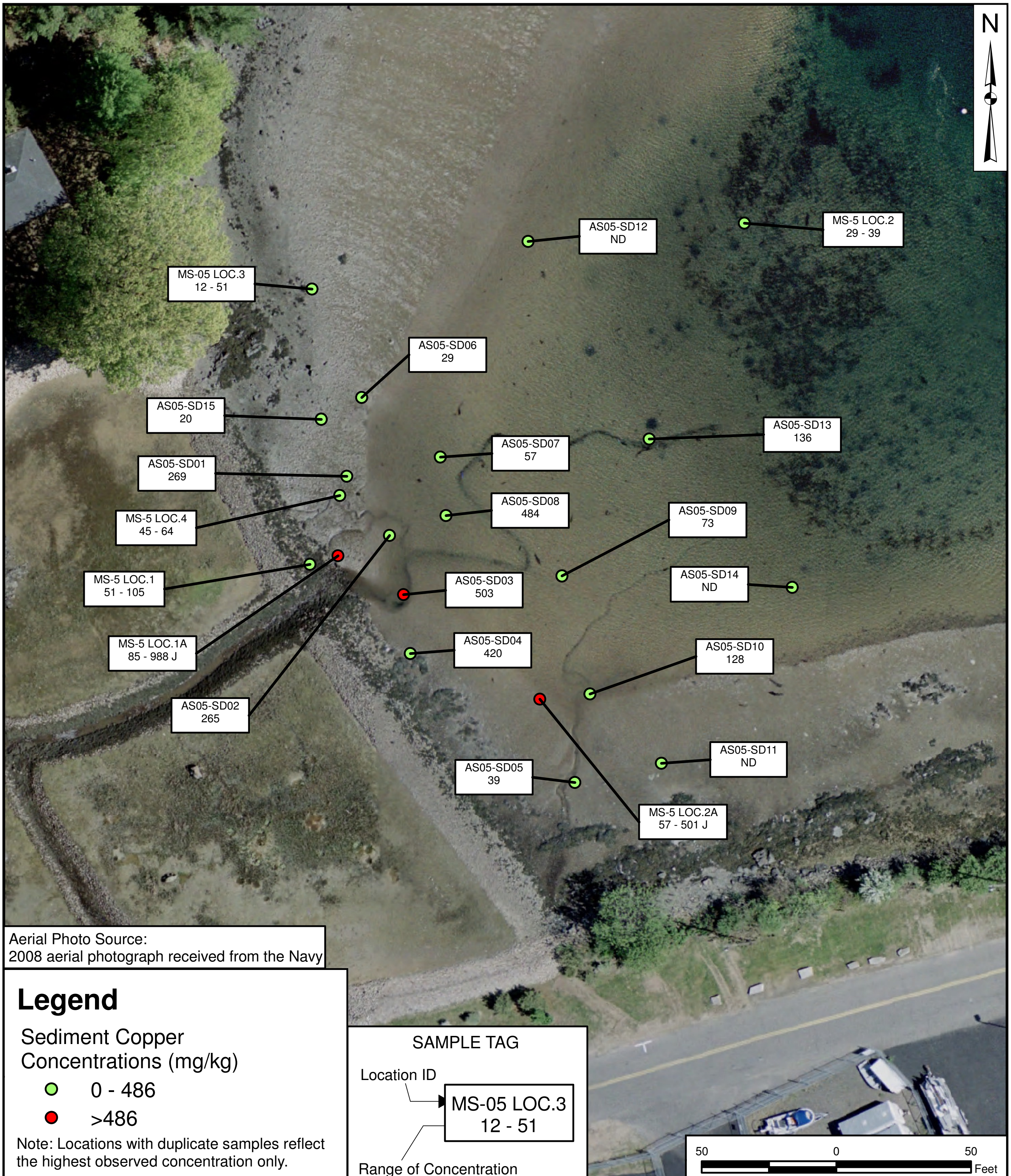

Aerial Photo Source:
2008 aerial photograph received from the Navy

Legend

Sediment Copper Concentrations (mg/kg)

- 0 - 486 (green)
- >486 (red)

Note: Locations with duplicate samples reflect the highest observed concentration only.

SAMPLE TAG

Location ID → MS-05 LOC.3

Range of Concentration → 12 - 51

DRAWN BY T. WHEATON	DATE 11/11/09	TETRA TECH	CONTRACT NUMBER CTO 123 / OWNER NUMBER
CHECKED BY A. BERNHARDT	DATE 06/30/10	CONCENTRATIONS OF COPPER IN SEDIMENT AT MS-05 OPERABLE UNIT 4 FEASIBILITY STUDY REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-10 / REV 0

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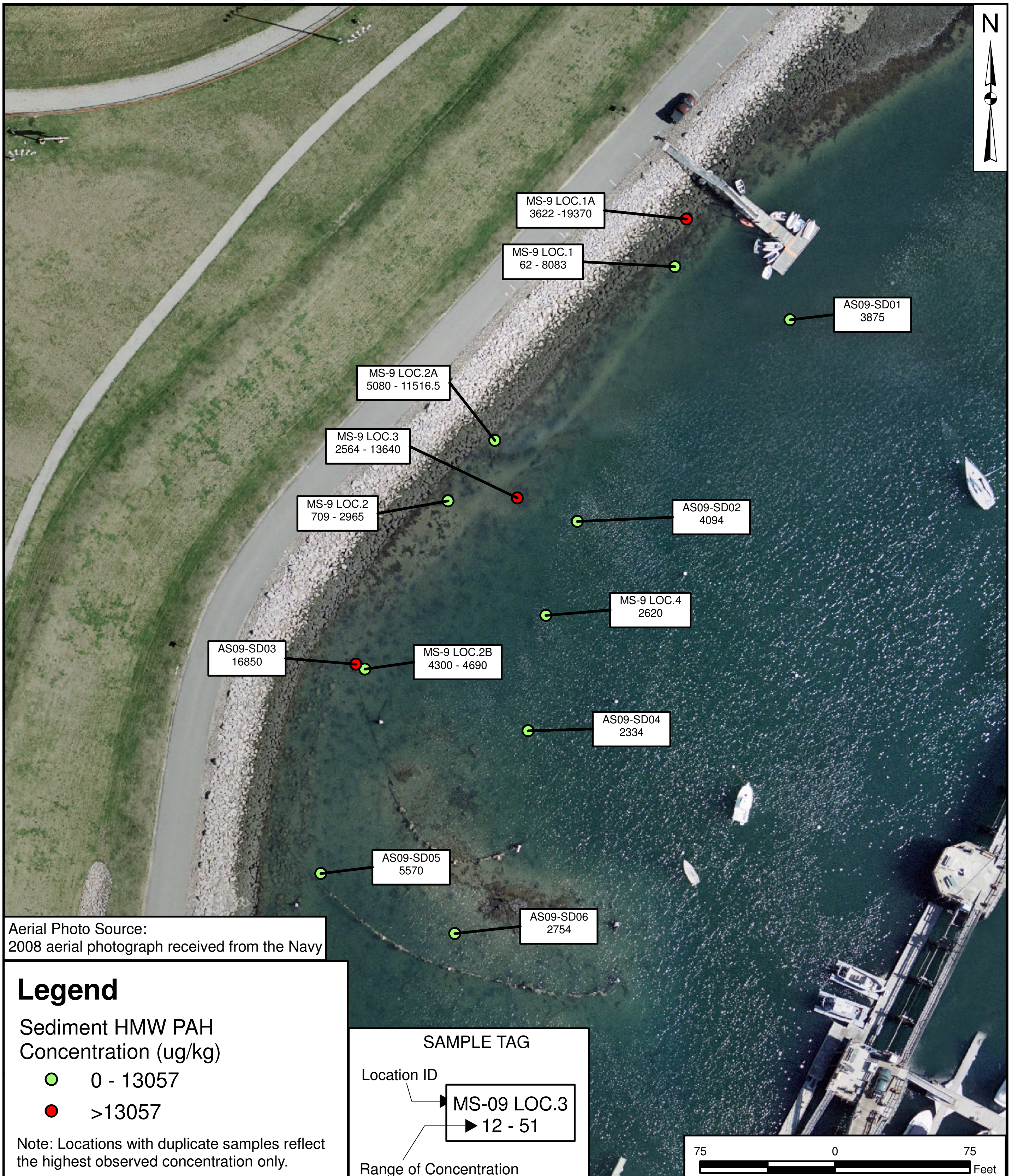

DRAWN BY T. WHEATON	DATE 11/11/09	TETRA TECH	CONTRACT NUMBER CTO 123	OWNER NUMBER
CHECKED BY A. BERNHARDT	DATE 06/30/10	CONCENTRATIONS OF HMW PAHs IN SEDIMENT AT MS-09 OPERABLE UNIT 4 FEASIBILITY STUDY REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY	DATE
COST/SCHEDULE-AREA			APPROVED BY	DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-11	REV 0

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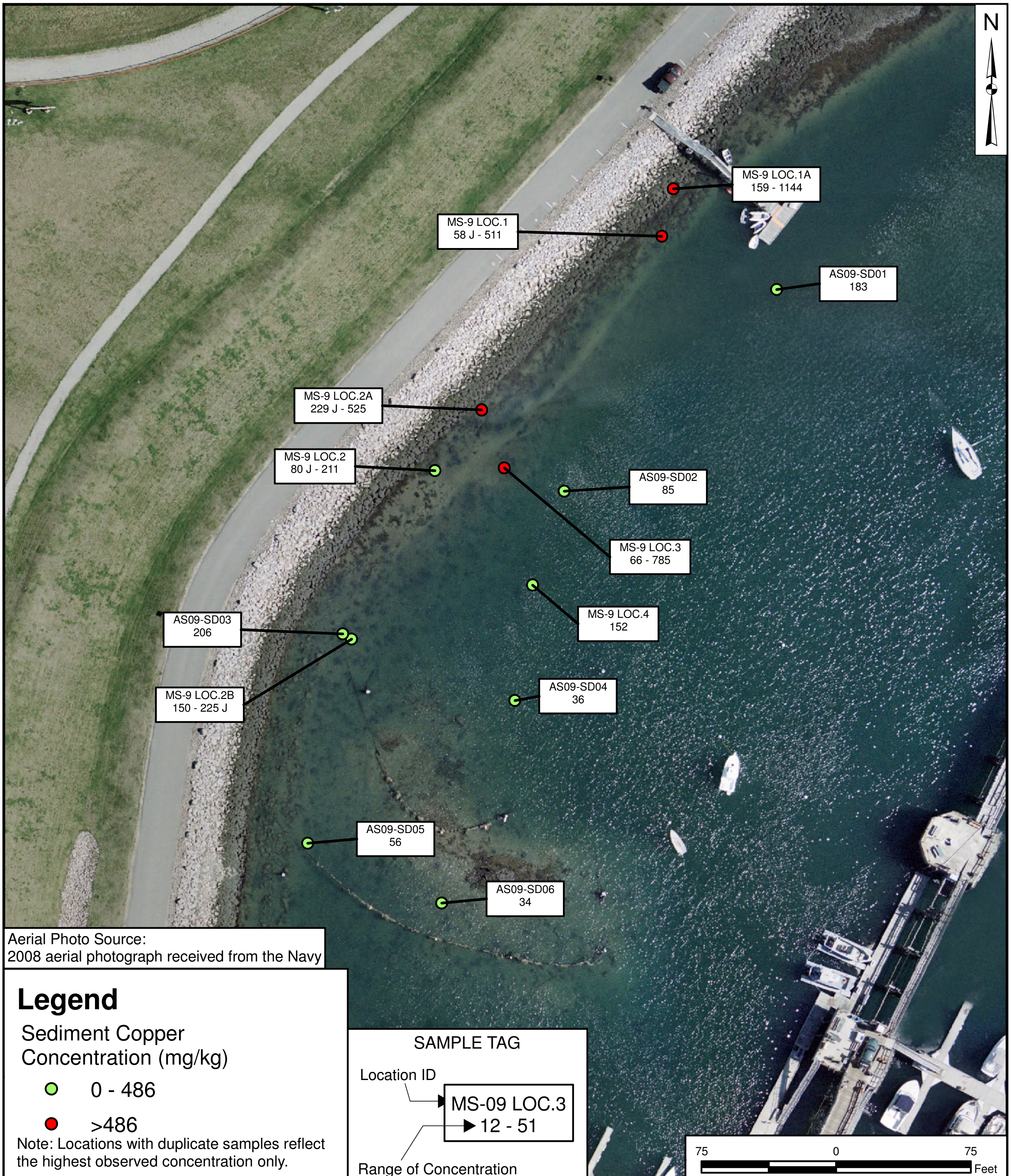
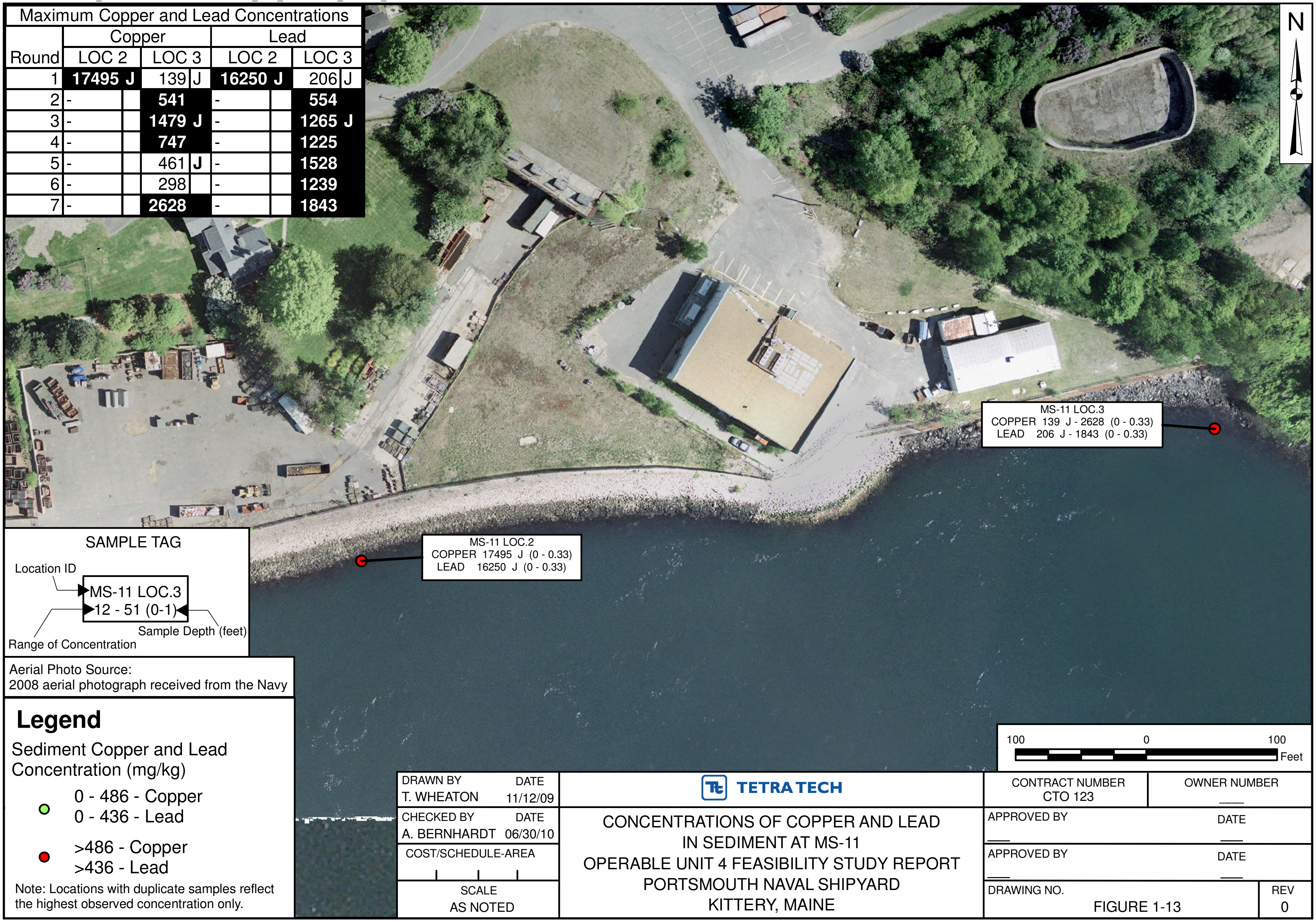


DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	OWNER NUMBER
T. WHEATON	11/11/09		CTO 123	___
CHECKED BY	DATE	CONCENTRATIONS OF COPPER IN SEDIMENT AT MS-09 OPERABLE UNIT 4 FEASIBILITY STUDY REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY ___	DATE ___
A. BERNHARDT	06/30/10		APPROVED BY ___	DATE ___
COST/SCHEDULE-AREA				
SCALE			DRAWING NO. FIGURE 1-12	REV 0
AS NOTED				

Maximum Copper and Lead Concentrations

Round	Copper LOC 2	Copper LOC 3	Lead LOC 2	Lead LOC 3
1	17495 J	139 J	16250 J	206 J
2	-	541	-	554
3	-	1479 J	-	1265 J
4	-	747	-	1225
5	-	461 J	-	1528
6	-	298	-	1239
7	-	2628	-	1843



SAMPLE TAG

Location ID
MS-11 LOC.3
12 - 51 (0-1)
Sample Depth (feet)
Range of Concentration

Aerial Photo Source:
2008 aerial photograph received from the Navy

Legend

Sediment Copper and Lead Concentration (mg/kg)

- (green) 0 - 486 - Copper; 0 - 436 - Lead
- (red) >486 - Copper; >436 - Lead

Note: Locations with duplicate samples reflect the highest observed concentration only.

DRAWN BY: T. WHEATON	DATE: 11/12/09	TETRA TECH
CHECKED BY: A. BERNHARDT	DATE: 06/30/10	
COST/SCHEDULE-AREA		
SCALE: AS NOTED		

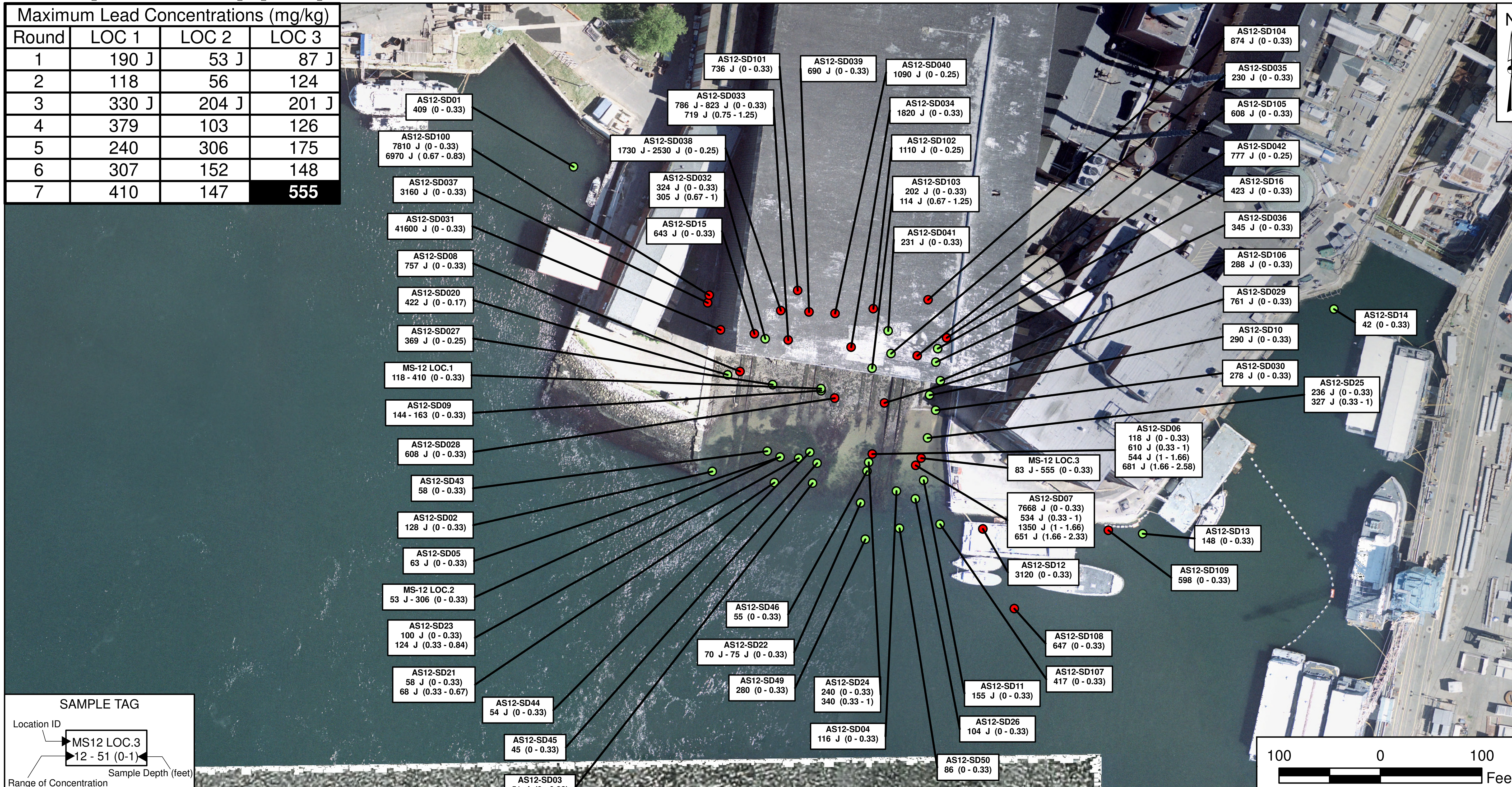
CONCENTRATIONS OF COPPER AND LEAD
IN SEDIMENT AT MS-11
OPERABLE UNIT 4 FEASIBILITY STUDY REPORT
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

CONTRACT NUMBER: CTO 123	OWNER NUMBER: ___
APPROVED BY: ___	DATE: ___
APPROVED BY: ___	DATE: ___
DRAWING NO.: FIGURE 1-13	REV: 0

P:\GIS\PORTSMOUTH_NSY\MAPDOCS\MXD\MONITORING_SITE_MAPS\MS-12_LEAD.MXD 06/30/10 TW

Maximum Lead Concentrations (mg/kg)

Round	LOC 1	LOC 2	LOC 3
1	190 J	53 J	87 J
2	118	56	124
3	330 J	204 J	201 J
4	379	103	126
5	240	306	175
6	307	152	148
7	410	147	555



SAMPLE TAG

Location ID — MS12 LOC.3 — 12 - 51 (0-1) — Range of Concentration — Sample Depth (feet)

Legend

Sediment Lead Concentration (mg/kg)

- ● 0 - 436
- ● >436

Note: Locations with duplicate samples reflect the highest observed concentration only.

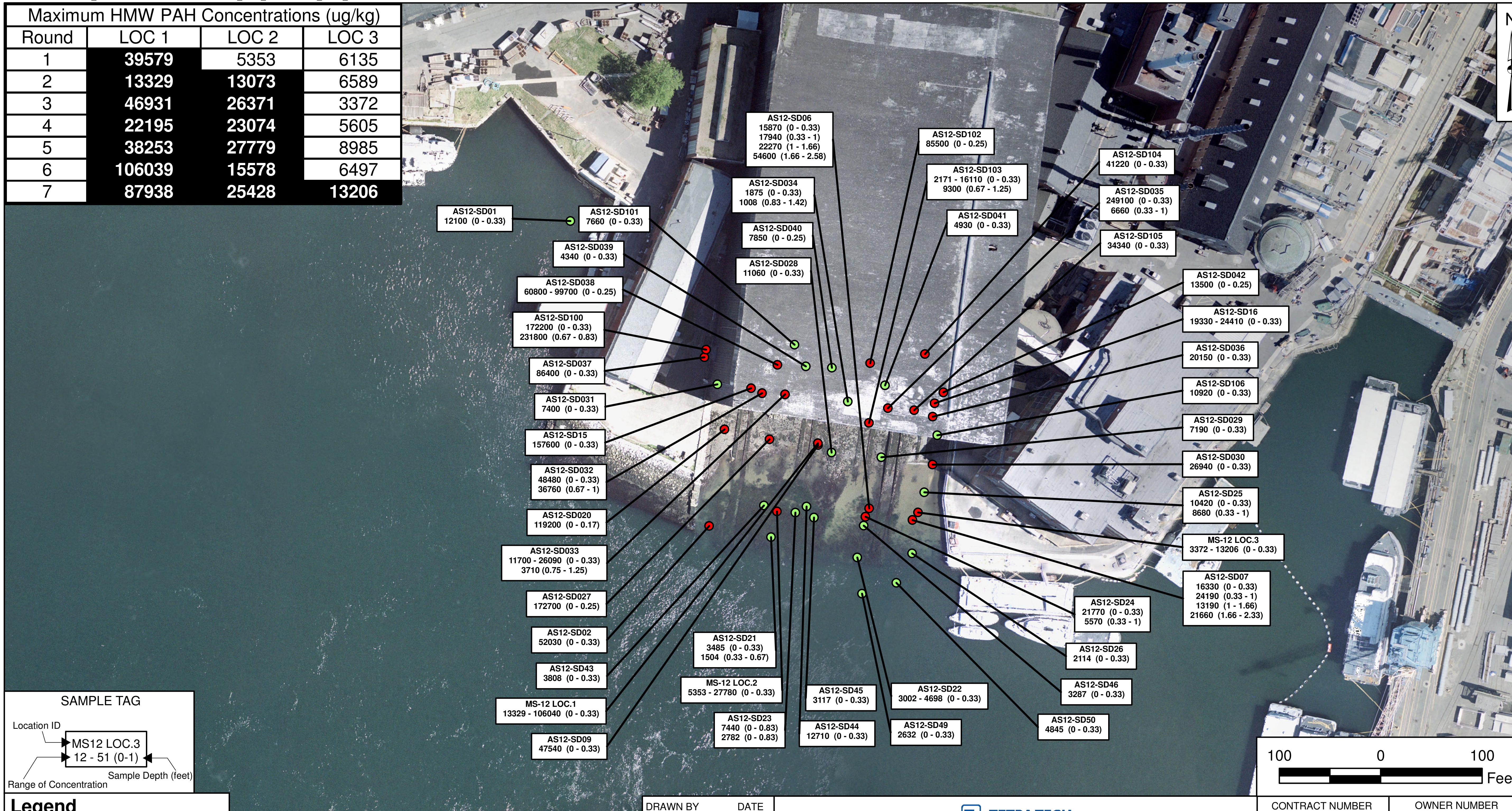
Aerial Photo Source:
2008 aerial photograph received from the Navy

DRAWN BY	DATE	TETRA TECH	CONTRACT NUMBER	OWNER NUMBER
T. WHEATON	11/24/09		CTO 0123	--
CHECKED BY	DATE	CONCENTRATION OF LEAD IN SEDIMENT AT MS-12 OPERABLE UNIT 4 FEASIBILITY STUDY REPORT PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	APPROVED BY	DATE
A. BERNHARDT	06/30/10		APPROVED BY	DATE
COST/SCHEDULE-AREA			FIGURE NO.	REV
SCALE AS NOTED			FIGURE 1-14	0

P:\GIS\PORTSMOUTH_NSY\MAPDOCS\MXD\MONITORING_SITE_MAPS\MS-12_HMW_PAHs.MXD 06/30/10 TW

Maximum HMW PAH Concentrations (ug/kg)

Round	LOC 1	LOC 2	LOC 3
1	39579	5353	6135
2	13329	13073	6589
3	46931	26371	3372
4	22195	23074	5605
5	38253	27779	8985
6	106039	15578	6497
7	87938	25428	13206



SAMPLE TAG

Location ID

MS12 LOC.3
12 - 51 (0-1)

Range of Concentration

Sample Depth (feet)

Legend

Sediment HMW PAH Concentration (ug/kg)

- 0 - 13057
- >13057

Note: Locations with duplicate samples reflect the highest observed concentration only.

Aerial Photo Source:
2008 aerial photograph received from the Navy

DRAWN BY: T. WHEATON	DATE: 11/24/09	TETRA TECH	CONTRACT NUMBER: CTO 0123	OWNER NUMBER: --
CHECKED BY: A. BERNHARDT	DATE: 06/30/10	CONCENTRATION OF HMW PAH's IN SEDIMENT AT MS-12	APPROVED BY: —	DATE: —
COST/SCHEDULE-AREA		OPERABLE UNIT 4 FEASIBILITY STUDY REPORT	APPROVED BY: —	DATE: —
SCALE: AS NOTED		PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE	FIGURE NO.: FIGURE 1-15	REV: 0

APPENDIX E

RESPONSES TO COMMENTS

RESPONSES TO MEDEP COMMENTS DATED MARCH 19, 2012
DRAFT SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

1. **Comment:** 1.0. 1-3. Please provide a reference for the Site Management Plan.

   Response: The reference for the Final FY12 Site Management Plan (Navy, February 2012) will be included as recommended.

2. **Comment:** 2.2. p. 2-3. In the History section indicate that there is also lead-contaminated soil outside the building.

   Response: It is already stated in this section that there were releases to soil outside the building in the second to last sentence of the section, on Page 2-4. Therefore, the Navy disagrees with the need to add this information.

3. **Comment:** 3.3, p. 3-9. Change “section” to “selection”.

   Response: This change will be made as recommended.

4. **Comment:** 3.3.1, p. 3-10. Please indicate that excavation in debris area is surface soil only.

   Response: The bullet will be updated to clarify the depth of the excavation, and will be revised to read as follows: *“Excavation from 0 to 2 feet bgs and off-yard disposal of soil and waste material in the debris area adjacent to the waste disposal area.”*

5. **Comment:** 3.4, p.3-13. The first five-year review report recommended that the wells be checked and repaired as needed as part of the additional investigation for OU2. The Status column of the table indicates that the wells will be inspected after the remedy is implemented. Were the wells inspected as part of the additional investigation for OU2 as the Navy recommended? Were they inspected at any other time? If not, why not?

   Response: The wells were inspected and necessary repairs were conducted as part of the OU2 Additional Investigation. The table will be updated to say the following:
   - *“Wells were inspected and necessary repairs were made as part of the OU2 Additional Investigation in 2007, as discussed in the OU2 Additional Investigation Data Package (Tetra Tech, August 2008).”*

6. **Comment:** Table 3-1, p. 2/5. Remove “are assumed” from the last sentence under Expected Outcomes as there is no question that CoC concentrations will exceed cleanup levels for the foreseeable future.

   Response: The Navy proposes deleting the full sentence in question, as it is not adding pertinent information.

7. **Comment:** 4.4, internal pipe outlet status, Section 4.7 and Section 4.8. The fact that the pipes are damaged in at least one place and the outlets could not be located indicates the cap may not be installed as designed. Inspection of this area should be included in the

recommendations in Section 4.8 and Section 6.1. These observations are of particular concern if they are related to the potential slumping near the gas vents on the east side of the landfill.

Response: Inspection of the pipes and surrounding area will be included as an Issue and in the recommendations in Section 4.8 and 6.1, as requested. The recommendation will include inspection of the area as part of the operation and maintenance program, with no further evaluation unless there is ponding in that area for an extended period of time or unstable soil. Topographic survey data collected in April 2011 have been reviewed and do not indicate cap settlement. Also, the pipes of interest are greater than 800 feet from the tilted gas vents near the east road; therefore, the pipe and gas vent issues are not related.

8. **Comment:** 4.5.2.1, Monitoring Data Review, last paragraph and Table 4-5. The table is missing detections from the April 2011 sampling round, including 1-1—dichloroethylene, dichlorodifluoromethane, and vinyl chloride. Please add the data from JW-13B and these detections to the table. In addition, 1,1-dichloroethane, 1,1-dichloroethylene, 1,1,2-trichlorotrifluoromethane and dichlorodifluoromethane need to be retained in the VOC analysis for the next 5-year review sampling round. Total 1,2-dichloroethylene may be dropped from the analytical list as the data show that the cis- isomer is the primary constituent in the total value. (This comment also applies to the Appendix D-1).

   Response: Data from well JW-13B will be added to Table 4-5 as requested. The Navy agrees with the recommendation to also drop total 1,2-dichloroethylene from the analytical list.

   To optimize the analytical program for five-year reviews for OU3, the Navy is proposing removal of VOCs from the five-year sampling round, with the exception of cis-1,2-dichloroethylene, trichloroethylene, and vinyl chloride. These were identified as representative VOCs that were detected at both JW-13D and JW-13B. The other VOCs were not detected in JW-13D.

   VOCs were analyzed at OU3 monitoring wells during Rounds 1 through 5 and there were no exceedances of human health or ecological screening levels. Therefore, in accordance with the OM&M Plan (Revision 0), VOC analysis was discontinued in Rounds 6 to 9. To address MEDEP concern that VOC were detected at greater concentrations in JW-13B (bedrock well) than JW-13D (overburden well), the Navy agreed to include analysis of VOCs in the five-year sampling events to support the five-year reviews. VOC analysis was conducted for the second five-year review (Round 10) and the entire VOC dataset evaluated. Review of the data shows that cis-1,2-dichloroethylene, total 1,2-dichloroethene, and trichloroethylene were detected in both JW-13D and JW-13B. The detections were generally an order of magnitude less than screening levels. Vinyl chloride was only detected in JW-13B; however, the concentrations were approximately 2 times less than the screening level. Therefore, this VOC was also recommended as a representative VOC for the next five-year review sampling. Review of the the results for 1,1-dichloroethane, 1,1-dichloroethene, 1,1,2-trichlorotrifluoromethane and dichlorodifluoromethane show that these VOCs were not detected in JW-13D and the detected concentrations were much less than the human health and ecological screening criteria. Specific detections compared to screening levels are provided in the table below. In addition, 1,1,2-trichlorotrifluoromethan was not detected in JW-13B. Therefore, the Navy believes that additional analysis for these four VOCs are not representative VOCs for this well cluster and will not provide additional information to address MEDEP's concern for JW-13 well cluster.

Parameter	Range of Detections Rounds 1 to 5 (ug/L)	Location of Maximum Detection	Range of Detections Round 10 (ug/L)	Location of Maximum Detection	Human Health Screening Criteria (ug/L)	Ecological Screening Criteria (ug/L)
1,1-dichloroethane	0.5 to 17	JW-13B	0.62 to 10	JW-13B	830	17,625
1,1-dichloroethene	1.6 to 3	JW-13B	1.6	JW-13B	3,400	9,375
1,1,2-trichlorotrifluoromethane	18 to 170	JW-9	16 to 32	JW-9	1,300,000	NA
Dichlorodifluoromethane	0.37 to 16	JW-9	1.3	JW-13B	15,000	NA

9. **Comment:** 4.5.3, p. 4-17. The text indicates that changes to action levels and screening levels are provided in Tables 4-2 and 4-4. Please add to these tables or provide new ones information indicating the actual changes – what were the original levels and what are the new levels.

   Response: New tables will be created providing the previous action levels and screening levels compared to the new action levels and screening levels. These new tables will be included in an Appendix, and will be referenced in Section 4.

10. **Comment:** 4.6, p. 4-18. "The covers also reduces infiltration of water…" Please change "water" to "precipitation/runoff" or something similar. The cover does not reduce infiltration of river water.

    Response: The change will be made as recommended.

11. **Comment:** 4.6, p. 4-21. Opportunities for optimization. See comment above regarding the VOC list.

    Response: As provided in the Navy's response to MEDEP Comment No. 8, the Navy continues to recommend the removal of 1,1-dichloroethane, 1,1-dichloroethylene, 1,1,2-trichlorotrifluoromethane and dichlorodifluoromethane. Any detections of these compounds during the monitoring events were infrequent and extremely low compared to both human health and ecological values, therefore further monitoring is unnecessary. Please see the Navy's response to MEDEP Comment No. 8 for specific values.

12. **Comment:** 4.6, p. 4-22. Please indicate the numbers of the tilted gas vents and show their locations on a figure.

    Response: The number and location of tilted gas vents will be indicated on a figure as suggested.

13. **Comment:** 4.6, p. 4-23, fifth bullet. "There was only one change to a standard in an ARAR that affected an action level (PAHs and metals)." What as the ARAR and what was the change?

    Response: The text will be revised to include the specific changes in ARARs, TBCs, or standards that could affect the action levels. For OU3, human health actions levels are calculated using toxicity criteria (Reference Doses and Cancer Slope Factors), that are identified as TBC for OU3. There were updates to the toxicity criteria, as noted in Table 4-2, which directly affected certain action levels due to the updated RfDs/CSFs being used in calculation. For chemicals that do not have water quality criteria (ARARs), ecological action levels were developed as part of the OM&M program using other sources as shown in Table 4-2. There was an update to one of these sources that affected the ecological action levels. This explanation was added to the fifth bullet in Question B, page 4-23.

14. **Comment:** OU1 Site Inspection Checklist, Implementation of the remedy, p. 4/4. Strike the reference to the Long Term Groundwater Monitoring Plan as there is no such plan for OU1.

    Response: The reference to the Long Term Groundwater Monitoring Plan was removed, and the reference was revised to "*The Groundwater Sampling and Analysis Plan, as part of a proposed Long-Term Management Plan".*

15. **Comment:** App. B.2 Photographs. Please provide a photo of the constructed wetland from the other side of the trees so they do not block the view of the wetland.

    Response: Two photographs showing the OU3 wetlands from the OU3 Round 9 Data Package for Post-Remedial Operation, Maintenance and Monitoring Program will be added to Appendix B.2.

RESPONSE TO MEDEP COMMENT DATED MAY 15, 2012
DRAFT FINAL SECOND FIVE-YEAR REVIEW REPORT
PORTSMOUTH NAVAL SHIPYARD, KITTERY, MAINE

Comment: In an email dated May 15, 2012, Maine Department of Environmental Protection (MEDEP) requested that the Navy keep 1,1-dichloroethane in the OU3 monitoring program.

Response: Based on discussion between the Navy and MEDEP, the Navy agreed to include 1,1-dichloroethane in the volatile organic compound (VOC) analysis that will be conducted for OU3 to support the next five-year review. The four VOCs that will be analyzed for the next five-year sampling round will be trichloroethene, cis-1,2-dichloroethene, vinyl chloride, and 1,1-dichloroethane. Section 4.0 will be revised as provided below.

Page 4-30, Section 4.5.2.1 – Monitoring Data Review:

"The main VOCs detected at this well are vinyl chloride, cis-1,2-dichloroethene, total 1,2-dichloroethene, and trichloroethene. The Navy recommended that the analytical program for VOCs for the next 5-year sampling round be reduced to these four VOCs. Based on MEDEP comments on the ~~draft~~ Second Five-Year Review Report (provided in Appendix E), the cis-isomer of 1,2-dichloroethene was found to be the primary constituent of the total value, and therefore, analysis for total 1,2-dichloroethene is not necessary for the next 5-year sampling round. ***However, 1,1-dichloroethane will be analyzed for the next 5-year sampling round.*** The removal of VOCs from the analytical program should be considered after the next 5-year sampling round."

Page 4-35, Section 4.6 – Technical Assessment, Bullet on Opportunities for Optimization:

"The OM&M Plan indicated that after the first four rounds, if concentrations of organic chemicals in JW-13B exceed action levels and are greater than concentrations in JW-13D, the well will be retained in the monitoring program. Concentrations of organics did not exceed action levels, and JW-13B was not retained in the OM&M program. However, VOC concentrations in JW-13B were greater than in JW-13D, and to address MEDEP concerns regarding VOC concentrations in JW-13B, JW-13B will be analyzed for VOCs during the 5-year sampling events to support the five-year reviews. Evaluation of VOC data, as provided in Appendix D.1, recommends reduction of the VOC analyte list to four VOCs. Based on the responses to the MEDEP comments on the draft document (provided in Appendix E), continued total 1,2-dichloroethene analysis is not required***. Instead 1,1-dichloroethane will be included and four***~~; therefore, three~~ representative VOCs will be analyzed for during the next five-year sampling round (vinyl chloride, cis-1,2-dichloroethene, ~~and~~ trichloroethene***, and 1,1-dichloroethane***)."