

N00181_001584
NORFOLK PORTS NSY
SSIC 5000-33b

**FINAL THIRD FIVE YEAR REVIEW NORFOLK NAVAL SHIPYARD
PORTSMOUTH VA**

05/01/2021
CH2M HILL

Approved for public release: distribution unlimited.



Navy Facilities Engineering Systems Command Mid-Atlantic
Norfolk, Virginia

Final

Third Five-Year Review

Norfolk Naval Shipyard
Portsmouth, Virginia

May 2021



Navy Facilities Engineering Systems Command Mid-Atlantic
Norfolk, Virginia

Final

Third Five-Year Review

Norfolk Naval Shipyard
Portsmouth, Virginia

May 2021

Prepared for NAVFAC Mid-Atlantic
by CH2M HILL, Inc.
Virginia Beach, Virginia
Contract N62470-16-D-9000
CTO 5883



Final

Third Five-Year Review

Norfolk Naval Shipyard
Portsmouth, Virginia

DATE: August 2021
06 AUG 2021

This report documents the Third Five-Year Review for Operable Unit (OU) 2 (Sites 3, 4, 5, and 6 Soils), OU4 (Site 17), and OU6 (Site 10) at Norfolk Naval Shipyard as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in accordance with CERCLA §121(c), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan, Part 300.430(f)(4)(ii) of the Code of Federal Regulations.

Approved by:

A handwritten signature in black ink that reads "Chitlyn T. Nichols CAPT (ACTING)". The signature is written in a cursive style and is positioned above a horizontal line.

C. T. Nichols
Commander, Norfolk Naval Shipyard
Acting

Executive Summary

The Department of the Navy conducted this Five-Year Review for Norfolk Naval Shipyard (NNSY) in Portsmouth, Virginia, as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Five-Year Review was conducted in accordance with CERCLA §121(c), as amended by the Superfund Amendments and Reauthorization Act, and the National Oil and Hazardous Substances Pollution Contingency Plan, Part 300.430(f)(4)(ii) of the Code of Federal Regulations. In addition, the Five-Year Review was conducted in accordance with the following documents:

- *Comprehensive Five-Year Review Guidance* (USEPA, 2001) and supplements (USEPA, 2012a, 2012b, 2016)
- *Navy/Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews* (Navy, 2011b)
- *Toolkit for Preparing Five-Year Reviews* (NAVFAC, 2013)
- *Defense Environmental Restoration Program (DERP) Management Manual* (DoD, 2012)
- 2014 Five-Year Review Procedures Update (DoD, 2014)

This report summarizes the evaluation of remedies and remedial actions that resulted in hazardous substances, pollutants, or contaminants remaining at sites above levels that allow for unlimited use and unrestricted exposure, and for which there is a final Record of Decision (ROD). A ROD requiring a Five-Year Review has been finalized for the following NNSY operable units (OUs):

- OU2 (Sites 3, 4, 5, and 6 Soils)—Paradise Creek Disposal Area, May 2010
 - Remedy: Soil cover with side-slope stabilization and land use controls (LUCs)
- OU4 (Site 17)—Building 195 Plating Shop, August 2006
 - Remedy: LUCs
- OU6 (Site 10)—1927 Landfill, September 2008
 - Remedy: LUCs

This is the third Five-Year Review at NNSY. The objective of this Five-Year Review was to evaluate the selected remedies at these sites and determine whether the remedies remain protective of human health and the environment in accordance with the requirements set forth in each of the RODs. The principal method used to evaluate the protectiveness of the remedies was a review of documents pertaining to site activities, analytical data, and findings. The methods, findings, and conclusions from the document reviews are presented in this Five-Year Review report. In addition, this report is intended to identify issues that may prevent a particular remedy from functioning as designed or appropriately, which could endanger the protection of human health and the environment. The overall evaluations of the effectiveness of each remedy are presented as protectiveness statements in the Five-Year Review Summary Form provided below. Based on this third Five-Year Review, the remedies have been found to be protective.

Five-Year Review Summary Form

SITE IDENTIFICATION				
Site name: Norfolk Naval Shipyard				
EPA ID: VA1170024813				
Region: 3	State: Virginia	City/County: Portsmouth		
SITE STATUS				
NPL status: Final				
Multiple OUs? Yes		Has the site achieved construction completion? No		
REVIEW STATUS				
Lead agency: Other Federal Agency If "Other Federal Agency" was selected above, enter Agency name: Department of the Navy				
Author name (Federal or State Project Manager): Naval Facilities Engineering Command, Mid-Atlantic				
Review period: September 4, 2019 through February 2021				
Date of site inspection: September 4, 2019				
Type of review: Statutory				
Review number: 3				
Triggering action date: 8/8/2016				
Due date (five years after triggering action date): 8/8/2021 (Navy) 8/16/21 (USEPA)				
ISSUES/RECOMMENDATIONS				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
OU2 (Sites 3, 4, 5, and 6 Soil) and OU6 (Site 10)				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 4 (Site 17)	Issue Category: Changed Site Conditions			
	Issue: OU4 (Site 17) was identified as a potential per- and polyfluoroalkyl substances (PFAS) release area based on historical site use as a plating facility. Presence of PFAS compounds has been identified in Site 17 groundwater at concentrations above risk-based screening levels.			
	Recommendation: Refine the extent of PFAS in site media at Site 17 and evaluate whether there is a potentially unacceptable risk to human health and/or a potential complete exposure pathway to drinking water receptors.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	Navy/Base	USEPA/State	12/31/2024

PROTECTIVENESS STATEMENT(S)		
<i>Operable Unit:</i> 2	<i>Protectiveness Determination:</i> Protective	<i>Addendum Due Date (if applicable):</i> Not applicable
<p>The remedy for OU2 is protective of human health and the environment. Exposure pathways that could result in unacceptable risk are controlled through maintenance of the soil cover, enforcement of land use controls (LUCs), and access restrictions. LUCs have been imposed to prevent residential land use at the site, and the Navy adheres to LUC-related procedures pertaining to ground-disturbing activity and changes in land use. LUC objectives are annotated in the Navy Geographical Information System database and real estate summary map for the installation.</p>		
<i>Operable Unit:</i> 4	<i>Protectiveness Determination:</i> Short-term Protective	<i>Addendum Due Date (if applicable):</i> Not applicable
<p>The remedy at OU4 is currently protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through enforcement of LUCs (soil) and Base master planning (groundwater), and groundwater is not currently used as a potable drinking water source. LUCs are in place to prevent unauthorized intrusive activities and prohibit development and use of the property for residential housing, elementary and secondary schools, child care facilities, or a playground.</p> <p>However, to ensure the remedy is protective over the long term, the Navy intends conduct a Remedial Investigation to refine the extent of PFAS in site media, evaluate the potential for unacceptable risks and/or a potential complete exposure pathway at Site 17, and prepare appropriate post-Record of Decision (ROD) documents to incorporate any additions to the remedy, if necessary.</p>		
<i>Operable Unit:</i> 6	<i>Protectiveness Determination:</i> Protective	<i>Addendum Due Date (if applicable):</i> Not applicable
<p>The remedy at OU6 is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk to receptors from exposure are being controlled through enforcement of LUCs (soil) and Base master planning (groundwater), and groundwater is not currently used as a potable drinking water source. LUCs are in place to prohibit development and use of the property for residential housing, elementary and secondary schools, child care facilities, or a playground.</p>		

Contents

Executive Summary	vii
Acronyms and Abbreviations	xiii
1 Introduction	2-1
1.1 Objectives and Approach.....	2-1
1.2 Installation Background.....	2-2
1.2.1 Physical Characteristics.....	2-3
1.2.2 Land and Resource Use	2-3
1.3 Environmental History.....	2-3
2 Five-Year Review Process	2-1
2.1 Document Review.....	2-1
2.1.1 Resilience Assessment.....	2-1
2.2 Site Inspections.....	2-1
2.3 Community Involvement	2-2
2.4 Interviews	2-2
2.5 Next Five-Year Review	2-2
3 Operable Unit 2 (Sites 3, 4, 5, and 6 Soils)	3-1
3.1 Site History and Background	3-1
3.2 Site Characterization.....	3-3
3.2.1 Physical Characteristics.....	3-3
3.2.2 Land Use	3-4
3.2.3 Basis for Taking Action.....	3-4
3.3 Remedial Action Objectives.....	3-5
3.4 Remedial Actions	3-5
3.4.1 Remedy Implementation.....	3-6
3.4.2 Remedy Operations and Maintenance.....	3-6
3.4.3 Progress since the 2016 Five-Year Review	3-6
3.5 Technical Assessment	3-7
3.6 Issues, Recommendations, and Follow-up Actions	3-8
3.7 Statement of Protectiveness	3-8
3.8 Next Review	3-8
4 Operable Unit 4 (Site 17)—Building 195 and Vicinity	4-1
4.1 Site History and Background	4-1
4.2 Site Characterization.....	4-1
4.2.1 Physical Characteristics.....	4-1
4.2.2 Land Use	4-2
4.2.3 Basis for Taking Action.....	4-2
4.3 Remedial Action Objectives.....	4-3
4.4 Remedial Actions	4-3
4.4.1 Remedy Implementation.....	4-3
4.4.2 Remedy Operations and Maintenance.....	4-3
4.4.3 Progress since the 2016 Five-Year Review	4-3
4.5 Technical Assessment	4-4
4.6 Issues, Recommendations, and Follow-up Actions	4-6
4.7 Statement of Protectiveness	4-6
4.8 Next Review	4-7

5	Operable Unit 6 (Site 10)—1927 Landfill.....	5-1
5.1	Site History and Background	5-1
5.2	Site Characterization.....	5-1
5.2.1	Physical Characteristics.....	5-2
5.2.2	Land Use	5-2
5.2.3	Basis for Taking Action.....	5-2
5.3	Remedial Action Objectives	5-3
5.4	Remedial Actions	5-3
5.4.1	Remedy Implementation	5-3
5.4.2	Remedy Operations and Maintenance.....	5-3
5.4.3	Progress since the 2016 Five-Year Review	5-3
5.5	Technical Assessment	5-4
5.6	Issues, Recommendations, and Follow-up Actions	5-6
5.7	Statement of Protectiveness	5-6
5.8	Next Review	5-6
6	References	6-1

Appendixes

- A Annual Land Use Control Inspection Reports
- B Public Notices
- C Interview Questionnaire
- D 2016 Five-Year Review Recommendations Preliminary Investigation Results
- E Groundwater Discharge to Surface Water Pathway Review for OU4 and OU6

Tables

- 1-1 Summary of Sites by Operable Unit
- 3-1 Five-Year Review of ARARs for OU2 (Sites 3, 4, 5, 6, and 7)
- 4-1 OU4 (Site 17) Progress since the 2016 Five-Year Review
- 4-2 Five-Year Review of ARARs for OU4 (Site 17)
- 4-3 OU4 (Site 17) Issues, Recommendations, and Follow-up Actions
- 5-1 OU6 (Site 10) Progress since the 2016 Five-Year Review
- 5-2 Five-Year Review of ARARs for OU6 (Site 10)

Figures

- 1-1 Regional Site Map
- 3-1 OU2 (Sites 3, 4, 5, 6, and 7) – Paradise Creek Disposal Area
- 4-1 OU4 (Site 17) – Building 195 and Vicinity
- 5-1 OU6 (Site 10) – 1927 Landfill

Acronyms and Abbreviations

°F	degrees Fahrenheit
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzodioxin
µg/L	microgram(s) per liter
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	constituent of concern
ERA	Ecological Risk Assessment
ERP	Environmental Restoration Program
FFA	Federal Facilities Agreement
FFS	Focused Feasibility Study
ft/day	feet per day
HHRA	Human Health Risk Assessment
HRS	Hazard Ranking System
IAS	Initial Assessment Study
IRI	Interim Remedial Investigation
LUC	land use control
MCL	maximum contaminant level
msl	mean sea level
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NCP	National Contingency Plan
NFA	no further action
NIRIS	Naval Installation Restoration Information Solution
NNSY	Norfolk Naval Shipyard
NPL	National Priorities List
NTCRA	Non-Time-Critical Removal Action
OU	Operable Unit
OWS	oil-water separator
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PFAS	per- and polyfluoroalkyl substances
PFC	perfluorinated compounds (superseded by PFAS)
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PP	Proposed Plan
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report
RAO	Remedial Action Objective
RBC	risk-based screening criteria
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFA	RCRA Facility Assessment

RFA-S	Supplement to Interim Final RFA
RI	Remedial Investigation
ROD	Record of Decision
RSL	regional screening level
SSP	Site Screening Process
TEQ	toxicity equivalent
USEPA	United States Environmental Protection Agency
UST	underground storage tank
UTL	upper tolerance limit
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound

Introduction

The Department of the Navy (Navy) conducted this Five-Year Review for Norfolk Naval Shipyard (NNSY) in Portsmouth, Virginia, as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121(c), as amended by the Superfund Amendments and Reauthorization Act, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Part 300.430(f)(4)(ii) of Title 40 of the Code of Federal Regulations.

The Five-Year Review was conducted in accordance with the following:

- *Comprehensive Five-Year Review Guidance* (USEPA, 2001) and supplements (USEPA, 2012a, 2012b, 2016)
- *Navy/Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Five-Year Reviews* (Navy, 2011b)
- *Toolkit for Preparing Five-Year Reviews* (NAVFAC, 2013)
- *Defense Environmental Restoration Program (DERP) Management Manual* (DoD, 2012)
- 2014 Five-Year Review Procedures Update (DoD, 2014)

This document summarizes the evaluation of remedial actions that have been implemented at operable units (OUs) that resulted in hazardous substances, pollutants, or contaminants remaining at sites above levels that allow for unlimited use and unrestricted exposure (UU/UE), and for which there is a final Record of Decision (ROD) in place.

There are currently eight OUs within the Environmental Restoration Program (ERP) at NNSY. **Table 1-1** contains a summary of all OUs and the rationale for their inclusion in this Five-Year Review. The following OUs are included in this Five-Year Review:

- OU2 (Sites 3, 4, 5, and 6 Soils)—Paradise Creek Disposal Area
- OU4 (Site 17)—Building 195 Plating Shop
- OU6 (Site 10)—1927 Landfill

Tables and figures are provided following the respective sections.

1.1 Objectives and Approach

The objective of this Five-Year Review was to evaluate current remedies at OU2 (Sites 3, 4, 5, and 6 Soils), OU4 (Site 17), and OU6 (Site 10) and determine whether the remedies are protective of human health and the environment in accordance with the requirements established in the RODs and preceding Decision Documents (where applicable). The principal method used to evaluate the protectiveness of the remedies was a thorough review of reports, analytical data, and documents pertaining to site activities and findings. The methods, findings, and conclusions from the document reviews are presented in this Five-Year Review report. In addition, the objective of this report is to ensure all remedies are functioning as intended and identify any issues that may prevent a particular remedy from functioning as designed. As noted in this document, all remedies addressed in this Five-Year Review are functioning as intended and are protective.

This Five-Year Review was prepared pursuant to CERCLA 121 and the NCP. CERCLA 121 states the following:

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

which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The United States Environmental Protection Agency (USEPA) interpreted this requirement further in the NCP, 40 Code of Federal Regulations 300.430 (f)(4)(ii), which states the following:

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.

The triggering action of the statutory review process is the signature of the OU4 (Site 17) ROD in August 2006 by the Navy (Navy, 2006b). The first Five-Year Review Report was finalized in August 2011 (CH2M, 2011) and the second Five-Year Review Report was finalized in August 2016 (CH2M, 2016). This third Five-Year Review is required because hazardous contaminants remain at sites at NNSY at concentrations above levels that allow for UU/UE.

1.2 Installation Background

NNSY is located along the Southern Branch of the Elizabeth River in Portsmouth, Virginia (**Figure 1-1**). The NNSY is the oldest continuously operated shipyard in the United States, with origins dating back to 1767, when it was a merchant shipyard under British rule. During the American Revolution in 1775, the Shipyard was confiscated by the Commonwealth of Virginia. In 1801, the Shipyard was purchased by the federal government. Until the beginning of the Civil War, shipbuilding and repair facilities at the Shipyard were gradually expanded. Federal authorities burned the Shipyard when war was imminent in 1861. It was taken over by the Confederacy and burned twice more during the Civil War. Following the Civil War, the Shipyard was rebuilt, and activities of repair, service, and construction of ships continued. During the First and Second World Wars, the Shipyard was greatly expanded and modernized. After World War II, NNSY became primarily an overhaul and repair facility, and has remained such to this day. NNSY's primary mission is to repair, overhaul, dry-dock, convert, modernize, and inactivate ships, and to provide logistics services in support of the fleet.

The following official mission is assigned to this Shipyard by the Secretary of the Navy:

- Provide logistic support for assigned ships and service craft
- Perform authorized work in connection with construction, conversion, overhaul, repair, alteration, dry-docking, and outfitting of ships and craft, as assigned
- Perform manufacturing, research, development, and test work, as assigned
- Provide services and material to other activities and units, as directed by competent authority

The present NNSY and the nearby Navy-owned noncontiguous annexes and special areas (**Figure 1-1**) comprise the following elements:

- **Main Shipyard**—533 acres of waterfront ship repair facilities (dry docks, wet slips, berths, etc.), a Controlled Industrial Area, public works, administration and supply facilities, housing, medical facilities, and personnel and community support services.
- **Southgate Annex**—63 acres used primarily for storage.
- **Scott Center Annex**—a 63-acre recreational complex for NNSY personnel. The former Scott Center Landfill was remediated in 2005 with the removal of waste and the creation of sustainable tidal wetlands.
- **Paradise Creek Disposal Area**—a 91-acre hydraulic fill area formerly used for landfilling, solid waste disposal, and petroleum reclamation (storage of petroleum products and the maintenance and storage of waste-handling vehicles and equipment).

- **New Gosport**—a 57-acre military housing area; an area immediately to the north is the former New Gosport Landfill, which was remediated in 2001 with the removal of waste and the creation of sustainable tidal wetlands.

1.2.1 Physical Characteristics

NNSY lies within the Atlantic Coastal Plain Physiographic Province. The topography at NNSY is relatively flat, which is typical in the Tidewater Region of Virginia. Land surface elevations at NNSY range from sea level to approximately 20 feet above mean sea level (msl). Most of the high areas of the NNSY are manmade and underlain by a variety of fill materials used to reclaim land.

NNSY is situated on the outer part of the Atlantic Coastal Plain, which is characterized by unconsolidated sediments several thousand feet in thickness (Water and Air Research, Inc. 1983). The uppermost geologic formations consist of alluvial, colluvial, and marsh deposits, which are composed of silt, sand, and pebbles with some clay. The aquifers and confining/semi-confining units relevant to CERCLA investigations at NNSY are, from youngest to oldest, the Columbia aquifer, Yorktown confining unit, and the Yorktown-Eastover aquifer. Groundwater flow directions for the aquifers are controlled by topography and surface water bodies with the primary discharge direction being east and south towards the Southern Branch of the Elizabeth River and Paradise Creek.

The Tidewater Region is characterized by long, temperate summers and mild winters. The average annual temperature is 60.7 degrees Fahrenheit (°F), with average monthly high temperatures ranging from 48.1°F in January to 87.4°F in July. Precipitation averages 46.6 inches annually and is distributed evenly over the year. Winds are generally easterly and range from 8.2 to 12 miles per hour.

1.2.2 Land and Resource Use

The main portion of the Shipyard includes more than 100 buildings, 5 active dry docks, and 3 repair piers. Included within NNSY are the Controlled Industrial Area, public works, administration, supply facilities, housing, medical facilities, and personnel and community support facilities. Roadways and parking areas at the NNSY are primarily asphalt-paved with some outlying areas gravel-surfaced. Exposed ground surfaces are vegetated with introduced grasses, deciduous trees, and pine trees.

The current land use of the nearby Navy-owned noncontiguous areas are described in **Section 1.2** and are not expected to change in the foreseeable future.

In southeastern Virginia, the Columbia aquifer may be used as a potable water source of domestic supply for watering lawns or filling swimming pools. However, groundwater in the Columbia aquifer has poor yield and is of poorer quality than the underlying Yorktown aquifer and is generally not used in the area. Throughout the eastern portion of the Coastal Plain, the Yorktown aquifer is used extensively for domestic and public water supply, as well as for industrial purposes.

There are surface water bodies adjacent to the NNSY and its annexes and special areas. The main surface water drainage receptors for NNSY are the Southern Branch of the Elizabeth River and Paradise Creek, which are used for commercial, industrial, and recreational purposes.

1.3 Environmental History

NNSY initiated its environmental investigation efforts in 1983 under the Navy Assessment and Control of Installation Pollutants Program, termed the Installation Restoration Program in 1986 when changed to reflect the requirements of CERCLA as amended by the Superfund Amendments and Reauthorization Act. Various facility-wide studies and detailed investigations have been completed at the NNSY since 1983 in response to the Navy's ERP. The following preliminary assessments were conducted to identify and assess sites posing a potential threat to human health or the environment resulting from past or current operations or waste management activities:

- Initial Assessment Study (IAS) (Water and Air Research, Inc., 1983)
- Phase I Interim Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) (NUS Corporation, 1986)
- Supplement to Interim Final RFA (RFA-S) (A. T. Kearney, 1987)
- Aerial Photographic Site Analysis (EPIC Study) (USEPA, 1994)

Some of the investigations included multiple sites and were not focused on a specific site assessment. These major investigations included the following:

- Interim Remedial Investigation (IRI) (IT Corporation, 1989)
- Site Screening Assessment (Baker, 1999b)
- Basewide Background Investigation (CH2M, 2002b)
- Paradise Creek Ecological Risk Assessment (ERA) (CH2M, 2001)

On March 6, 1998, USEPA proposed that NNSY be added to the National Priorities List (NPL). USEPA evaluates industrial sites using the Hazard Ranking System (HRS), and those facilities with HRS scores exceeding 28.5 are proposed for the NPL. USEPA assigned NNSY an HRS score of 70. The proposed listing was followed by a 60-day review and comment period prior to NNSY's inclusion on the NPL on July 22, 1999. A Federal Facilities Agreement (FFA) between USEPA Region 3, Virginia Department of Environmental Quality (VDEQ), and NNSY was finalized in September 2004. The FFA identified nine sites for further investigation. Additionally, the NNSY FFA includes a list of 152 other previously investigated sites for which no further action (NFA) under CERCLA is required (USEPA/Navy, 2004).

This Five-Year Review report addresses the three OUs with remedies in place: OU2 (Sites 3, 4, 5, and 6), OU4 (Site 17), and OU6 (Site 10) (**Figure 1-1**). These sites are discussed in further detail in **Sections 3, 4, and 5**, respectively.

Table 1-1. Summary of Sites by Operable Unit*Third Five-Year Review**Norfolk Naval Shipyard, Portsmouth, Virginia*

OU	Site No.	Site Description	Inclusion in the Five-Year Review
1	2	Scott Center Landfill	Not Included – NFA ROD – Signed 2005 (Navy, 2005)
2	3	Sanitary Landfill (High Dump)	Included – ROD Signed 2010 (Navy, 2010)
	4	Chemical Holding Ponds	Included – ROD Signed 2010 (Navy, 2010)
	5	Oil Reclamation Area	Included – ROD Signed 2010 (Navy, 2010)
	6	East Dump	Included – ROD Signed 2010 (Navy, 2010)
	7	Bermed Chemical Pits	Not Included – NFA ROD – Signed 2010 (Navy, 2010)
3	9	Former Acetylene Waste Lagoon	Not Included – NTCRA 2003 and DD – 2004 (CH2M, 2004a)
4	17	Building 195 Plating Shop	Included – ROD Signed 2006 (Navy, 2006)
5	1	Former New Gosport Landfill	Not Included – NTCRA 2001 and DD 2004 (CH2M, 2004b)
6	10	1927 Landfill	Included – ROD Signed 2008 (Navy, 2008)
7	3, 4, 5, 6	Paradise Creek Disposal Area Groundwater	Not Included – OU Currently in RI/FS Phase
8	Not Applicable	Basewide	Not Included – OU is for Basewide progress tracking only

Notes:

DD = Decision Document

FS = Feasibility Study

NFA = no further action

NTCRA = Non-Time-Critical Removal Action

OU = operable unit



RI = Remedial Investigation

ROD = Record of Decision

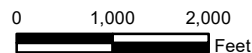
Table ReferencesCH2M HILL, Inc. (CH2M). 2004a. *Decision Document Site 9 Impoundment and Calcium Hydroxide Lagoon, Norfolk Naval Shipyard, Portsmouth, Virginia*. Final. May.CH2M. 2004b. *Decision Document Former New Gosport Landfill, Norfolk Naval Shipyard, Portsmouth, Virginia*. Final. July.Department of the Navy (Navy). 2005. *Record of Decision, Operable Unit 1, Site 2, Scott Center Landfill, Norfolk Naval Shipyard, Portsmouth, Virginia*. October.Navy. 2006. *Record of Decision, Site 17: Building 195-Plating Shop, Norfolk Naval Shipyard, Portsmouth, Virginia*. Final. August.Navy. 2008. *Record of Decision, Site 10: 1927 Landfill, Norfolk Naval Shipyard, Portsmouth, Virginia*. Final. September.Navy. 2010. *Record of Decision, OU2, Paradise Creek Disposal Area (Soil), Norfolk Naval Shipyard, Portsmouth, Virginia*. May.



Legend

-  Land Use Control Boundary
-  Installation Boundary

Note:
Operable unit boundary is the land use control boundary.



Imagery Source: Esri 2017

Figure 1-1
Regional Site Map
Norfolk Naval Shipyard
Portsmouth, Virginia



Five-Year Review Process

The Five-Year Review process for the sites at NNSY is described in **Sections 2.1** through **2.5**. This process includes reviewing all relevant documents, conducting site inspections, notifying and presenting the findings to the community, and conducting interviews to evaluate remedy effectiveness.

2.1 Document Review

The Five-Year Review included a review of site-specific documentation for each site. First, the ROD for each site was reviewed to identify the potential risks to human health and the environment, remedial action objectives (RAOs), selected remedies, and applicable or relevant and appropriate requirements (ARARs). Additional review of relevant documents, including operations and maintenance records, monitoring data, and other pertinent documents and data, was also completed to assess remedy performance and continued protection of human health and the environment.

Copies of Administrative Record documents are available by searching the online Administrative Record located on the NNSY public website at:

https://www.navfac.navy.mil/products_and_services/ev/products_and_services/env_restoration/installation_map/navfac_atlantic/midlant/norfolk_nsy.html

Copies of documents are also available by contacting the Public Affairs Officer or the Navy Remedial Project Manager. In addition, more detailed information regarding site backgrounds (presented in **Sections 3** through **5**) can be found in the Site Management Plan located on the public website (CH2M, 2020).

2.1.1 Resilience Assessment

As part of the technical assessment Question C: Has any other information come to light that could affect protectiveness, the 2016 Recommended Five-Year Review Template provides the following guidance (USEPA, 2016a):

This question may address site changes or vulnerabilities that may be related to climate change impacts not apparent during remedy selection, remedy implementation or O&M (e.g., sea level rise, changes in precipitation, increasing risk of floods, changes in temperature, increasing intensity of hurricanes and increasing wildfires, melting permafrost in northern regions, etc.).

Relative sea level rose along much of the U.S. coastline between 1960 and 2015, particularly the Mid-Atlantic coast, where Norfolk Naval Shipyard is located. The Atlantic coast is particularly vulnerable to rising sea level because of its low elevations and sinking shorelines. Rising sea level increases the likelihood of flooding at high tide and during storm surges and erodes shorelines and coastal infrastructure (USEPA, 2016b).

Because of these potential direct and indirect impacts of sea level rise a qualitative assessment of resilience is provided in each of the respective OU sections.

2.2 Site Inspections

A site visit was conducted on September 4, 2019 with representatives from the Navy, USEPA, VDEQ, and CH2M. A thorough inspection of all Five-Year Review sites was completed concurrent with the November 14, 2019 land use control (LUC) inspection to assess current conditions relevant to the protectiveness of the remedies. Annual LUC inspections conducted at the sites are summarized in the respective site-specific sections of this document and provided in **Appendix A**. No issues were identified during the Five-Year Review site inspections. Any maintenance issues are addressed as part of ongoing Basewide ERP site maintenance.

2.3 Community Involvement

In 1995, NNSY established a Restoration Advisory Board (RAB) for the Navy installation, consisting of community members and representatives of the VDEQ and USEPA. RAB meetings were held annually until 2007 and as needed based on public involvement requirements until 2011 (CH2M, 2019a). The RAB has not met since 2011. The Navy plans to re-establish the NNSY RAB based on recommendations in the Community Involvement Plan to promote open communication between the Navy, USEPA, VDEQ, and concerned citizens. A RAB meeting may be conducted in 2021 pending COVID-19 pandemic protocols for in-person meetings.

Members of the community were notified of the initiation of the Five-Year Review on February 16, 2020 via an announcement in *The Virginian Pilot* (**Appendix B**). No comments or questions were received from the public related to the Five-Year Review. When the Five-Year Review has been finalized, a notice will be sent to the newspaper indicating the results and that the final report is available to the public.

2.4 Interviews

Interviews were conducted with members of NNSY Facility Planning on March 23, 2020 as part of the Five-Year Review process. The interview questionnaire and consolidated responses are provided in **Appendix C**. In general, no significant concerns with the ERP were expressed. It was also noted that there was no effect on Base day-to-day operations. Interviewees suggested that the LUC boundaries be advertised to on-Base personnel via links on the NNSY intranet and/or with physical markers, such as signs and fences for Site 10, because this would raise awareness of the program to prevent accidental exposure or LUC infractions.

2.5 Next Five-Year Review

The next Five-Year Review is due to be finalized in 2026.

Operable Unit 2 (Sites 3, 4, 5, and 6 Soils)

3.1 Site History and Background

OU2, Paradise Creek Disposal Area, encompasses approximately 91 acres and lies adjacent to Paradise Creek at the southern boundary of NNSY (**Figure 1-1**). OU2 is bounded to the northwest, across Victory Boulevard, by a refuse-derived fuel processing plant operated by the Southeastern Public Service Authority; to the east by Atlantic Wood Industries, Inc. (a former wood-treatment facility currently on the USEPA Region 3 NPL), the Portsmouth School Board vehicle maintenance and refueling yard, and the Vane Brothers Marine Terminal property formerly used for petroleum bulk-storage (former British Petroleum Parcel); and to the south and southwest by Paradise Creek, a tributary to the Southern Branch of the Elizabeth River (**Figure 3-1**). The land on the opposite bank of Paradise Creek (the south bank) is also industrial. Some of these properties that surround OU2 have had documented releases of contaminants to groundwater (e.g., Atlantic Wood Industries, Inc. to the east of OU2 has released the wood-preserving chemicals pentachlorophenol and creosote to the groundwater). Investigations and actions at OU2 or sites within OU2 began in 1983, as shown in the following chronology.

OU2 (Sites 3, 4, 5, 6, and 7) Chronology	
Date	Investigation/Action
1983	IAS (Water and Air Research, 1983)
1983	NNSY Landfill Management Plan (Talbot and Associates, 1983)
1986	RFA (NUS Corporation, 1986)
1989	IRI (IT Corporation, 1989)
1989	Site 3 deemed closed
1994	EPIC Study (USEPA, 1994)
1995	Remedial Investigation (RI)/Feasibility Study (FWEI, 1995)
1996	Site Characterization and Conceptual Design (OHM, 1997)
1999	NNSY on NPL
2002	Phase II RI (CH2M, 2002a)
2004	Site 7 Engineering Evaluation/Cost Analysis (CH2M, 2004)
2005 – 2006	Site 7 Non-Time-Critical Removal Action (NTCRA) (FSSI, 2007)
2007	Construction Completion Report, Site 7 (Shaw, 2007)
2009	OU2 Soils ^a Focused Feasibility Study (FFS) (CH2M, 2009)
2009	OU2 Soils Proposed Plan (PP) (Navy, 2009)
2010	OU2 Soils ROD (Navy, 2010a)
2010	Post-Closure Monitoring Plan (Navy, 2010b)
2011	Closeout Report (Soil Cover) (Shaw, 2011)
2011	LUC Remedial Design (RD) (Navy, 2011a)
2011	Remedial Action Completion Report (RACR) (Navy, 2011c)
2011-Ongoing	Annual LUC and soil cover inspections (2016 to 2019 provided in Appendix A) and post-closure care (mowing, maintenance)

^a During preparation of the OU2 FFS, a new OU, OU7, was created to address groundwater beneath Sites 3, 4, 5, and 6. OU7 is in the RI/FS phase of CERCLA.

OU2 consists of five individual sites (Sites 3, 4, 5, 6, and 7) as shown on **Figure 3-1**. Site 3 was used as a permitted landfill and for dredge spoil disposal and encompasses approximately 70 acres on the northern bank of Paradise Creek. Sites 4, 5, 6, and 7 are located within the boundaries of Site 3. In 2009, the Project Management Team agreed to address OU2 soil separately from groundwater, sediment, and surface water. The PP and ROD referenced in this Five-Year Review only pertain to soil at OU2. Groundwater, sediment, and surface water (OU7) continue to be under investigation and will be addressed in a future ROD.

The NTCRA conducted at Site 7 from 2005 to 2006 removed the waste and contaminated soils from the site, backfilled the area with clean soil, and created a tidal wetland (FSSI, 2007) adjacent to the site along the banks of Paradise Creek. There were no unacceptable human health or ecological risk remaining at Site 7 that would prevent UU/UE, and the NFA determination was documented in the OU2 Soils ROD (Navy, 2010a). The following is a summary of the individual sites addressed by the OU2 Soils ROD.

Site 3

From 1954 through 1983, Site 3 reportedly served as a disposal area for dredge fill, abrasive blast material, paint residues, sanitary wastes, solvents, and other industrial residues. According to the IAS (Water and Air Research, 1983), the average rates of disposal of the primary wastes were estimated as follows:

- Salvage waste, including fluorescent tubes, mercury-contaminated rags, and construction/demolition debris: 1,200 tons per month
- Sandblasting grit: 1,500 tons per month
- Oil-fired power plant fly ash: 180 tons per month
- Coal-fired power plant fly ash: 1,800 tons per month
- Salvage waste, fuel-boiler-plant bottom ash: 1,700 tons per month up through 1977, 400 tons per month after 1977
- Asbestos waste: 320 cubic yards per month

Building 431, formerly located on the eastern side of the Western Landfill, was an incinerator used for burning liquid and solid waste until the late 1960s.

According to the NNSY Landfill Management Plan (Talbot and Associates, 1983), solid waste disposal operations continued until approximately 1983, when the landfill's permit expired. An application for a state permit to vertically expand both the Eastern and Western Landfills was denied. Between 1983 and 1985, an unspecified final cover material was applied to the Eastern Landfill. A letter from the Commonwealth of Virginia Department of Waste Management to the Environmental Programs Division of NNSY indicated the closure procedure for the facility had been accomplished, and the site was deemed to be properly closed (Commonwealth of Virginia, 1989).

Site 4

Site 4, Liquid Waste Holding Ponds, was an area north of the Western Landfill that consisted of five former chemical waste holding ponds constructed between 1963 and 1972 on top of and within the fill material composed of brick fragments, wood chips, crushed rock fragments, and construction debris mixed with silts and sands (as noted by boring logs from the site). These ponds received liquid wastes between 1963 and 1980. According to the historical information provided in the Phase II RI (CH2M, 2002a), four of the five ponds were lined with either a clay liner or asphalt. As documented by Navy records, the types of waste held in the ponds at Site 4 included cyanides, acids, degreasers, solvents, alkali, and other materials. When the ponds were full, the liquids were pumped into tanker trucks for offsite disposal. Prior to covering the pits with soil in 1981 (1 foot of clay and 6 inches of topsoil), remaining liquids were pumped out and disposed of offsite (NNSY, 1981). Site 4 was not operated within a regulatory program and, as such, the covering/closure of the holding ponds was not completed in accordance with any specific regulations.

Site 5

Site 5, Oil Reclamation Area, was an area north of the Site 3 Western Landfill used to store and consolidate used petroleum, oil, and lubricants from 1963 to the early 2000s before contract sale to Craney Island for reclamation. Two underground storage tanks (USTs) were used at the site for this purpose. The first tank was a 10,000-gallon tank in use from 1968 until the early 1980s. Because of suspected leaks, this tank was replaced in the 1980s by a new used-oil storage system. Navy record drawings indicate that the initial UST was abandoned in place by filling it with sand and capping the pipes.

The new system consisted of a second 10,000-gallon UST, four bermed concrete pads used as staging areas for drums and tanker trucks, and an in-ground concrete oil-water separator (OWS) used to treat oily water collected in the four staging areas. An underground sewer pipe ran from floor drains in the four bermed staging areas to the OWS. A diversion box was installed on this line to manually divert oily water to the OWS and clean water to a 72-inch-diameter storm sewer beneath the access road dividing the landfill areas. Treated water from the OWS was discharged through an underground pipe to the sanitary sewer. Petroleum, oil, and lubricants storage or handling has not been conducted at the site since 2005. A concrete area adjacent to the eastern side of Site 5 was reportedly used in the mid-1980s for storing containers of waste material (including oil, hydraulic fluid, and Freon) in 55-gallon drums (NUS Corporation, 1986). All former oil-handling structures (e.g., sumps, pipes) have been abandoned and taken out of service.

Site 6

Site 6, former Liquid Waste Disposal Area, was an area north of the western portion of Site 3 where spent abrasive blast material was disposed of between the mid-1960s and 1977. Liquids such as acetone and alcohol were placed on top of the abrasive blast material and allowed to evaporate (White, 1998). Information about any completed closeout or cleanup activities that are specific to Site 6 is limited. The 1983 IAS indicated the exact location of the site could not be determined (Water and Air Research, Inc. 1983).

3.2 Site Characterization

The findings from various investigations at OU2 that are pertinent to the Five-Year Review are summarized in this section.

3.2.1 Physical Characteristics

Surface Features. With the exception of the Site 7 area, a soil cover remedy was constructed over the historical ground surface of OU2 (Navy, 2010a, 2011c). The soil cover was not constructed over Site 7 because the ROD concluded that no response action was necessary for Site 7. Currently, OU2 forms a local topographic high (approximately 20 feet above msl) and encompasses the entire area of Sites 3, 4, 5, and 6. The soil cover was extended over Sites 4, 5, and 6 to provide for appropriate stormwater drainage for the site. Surface water runoff flows into catch basins that connect to the NNSY stormwater system or onsite ditches, which ultimately discharges into Paradise Creek.

Geology and Hydrogeology. Geology beneath the soil cover is made up of imperfectly connected sandy bodies or lenses that also may contain appreciable amounts of silt or clay. The confining units separating the sitewide aquifers consist of clay and silt layers containing varying amounts of sand. The layers may be thin and/or interlayered throughout the unit. In some cases, the confining units may be considered leaky confining units and/or may not be laterally continuous across all of OU2.

OU2 is underlain by two aquifers: the Columbia (surficial) aquifer and the Yorktown aquifer. The Yorktown confining unit separates the Columbia and the Yorktown aquifers. Hydraulic fill material has been identified in the upper portion of the surficial soils to depths ranging from 5 to 25 feet below ground surface (bgs) (prior to placement of the soil cover). The fill makes up part of the upper portion of the Columbia aquifer. Prior to installation of the soil cover, groundwater flow was generally towards the 72-inch stormwater culvert (shallow groundwater) or southeast towards Paradise Creek and the Southern Branch of the Elizabeth River.

3.2.2 Land Use

Current Land Use. Because OU2 is a former disposal area managed under CERCLA, the site is currently vacant because LUCs restrict its use.

Future Land Use. There are no anticipated changes in land use.

3.2.3 Basis for Taking Action

This section describes the results of site investigations and risk assessments that provide the basis for taking action at OU2. Details are provided in the Phase II RI report (CH2M, 2002a) and the ROD (Navy, 2010a).

Site Investigations

Soil, groundwater, surface water, and sediment were investigated during previous investigations. Groundwater surface water, and sediment are currently under investigation as OU7 and are not discussed in this Five-Year Review report.

Prior to the placement of the OU2 soil cover remedy, the surface soil at OU2 contained elevated concentrations (i.e., above background upper tolerance limits [UTLs]) of the following metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, and zinc. The surface soil also contained various polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Surface soil contamination was detected, particularly in the following locations:

- Along the southern border of Site 4 (PAHs and phenols)
- In drainage ditches that collect runoff from Sites 4 and 5, and the remainder of the Western Landfill (PAHs and phenols)
- Along the northern part of the access road between Site 3 and the Atlantic Wood Industries, Inc. facility (PAHs, phenols, and arsenic), in the drainage ditch running along the southern side of the access road (pesticides), and in the eastern part of the Western Landfill on the embankment leading down to the access road (PAHs and phenols)
- In the western and central parts of the Western Landfill (pesticides, PCBs, and metals)
- In the northwestern corner of the Eastern Landfill (metals)
- Near the intersection of the service roads across the landfills and the access road (PAHs)
- Where the access road meets Paradise Creek (PAHs)
- At Site 5 (PAHs, PCBs, and several metals)

The fill material and subsurface soil contained volatile organic compounds (VOCs), PAHs, PCBs, and metals. Maximum concentrations of most analytes in the subsurface soil were higher than in the surface soil. In general, the highest concentrations were detected in samples from depths greater than 2 to 3 feet bgs. While there are no background UTLs for subsurface soil, concentrations of PAHs and several metals exceeded background UTLs for surface soil. Subsurface contamination was detected in the following areas:

- In the western portion of the Site 3 Western Landfill (VOCs, PAHs, and PCBs)
- In and near Site 4 (VOCs, PAHs, phenols, PCBs, and metals)
- At Site 7 (metals, removed during the 2005-2006 NTCRA)
- On the southeastern corner of the Eastern Landfill (VOCs, PAHs, and metals, which were removed during the 2005-2006 NTCRA)
- At Site 6 (PAHs and metals)
- At Site 5 (total petroleum hydrocarbons, and benzene, toluene, ethylbenzene, and xylene)

Human Health Risks

The risks for Sites 3, 4, and 6 were evaluated together as one unit, while Site 5 was addressed separately in the Phase II RI (CH2M, 2002a).

Sites 3, 4, and 6: Based on the Human Health Risk Assessment (HHRA) completed in the Phase II RI (CH2M, 2002a), noncancer hazards and cancer risks did not exceed USEPA's acceptable levels for an industrial worker or future adult recreational user exposed to soil at Sites 3, 4, and 6, as evaluated as a combined data set in the Phase II RI. Under a reasonable maximum exposure analysis, ingestion of and/or dermal contact with soil by a future adult or child resident, future construction worker, and future child recreational user would result in a noncancer hazard and/or cancer risk above USEPA's acceptable levels associated with metals in soil. Additionally, future residential use of the site would result in potential unacceptable risks associated with exposure to lead in soil.

Site 5: Human health risks at Site 5, which was used primarily for the handling and storage of petroleum, were addressed separately from the remaining OU2 sites during the Phase II RI. Based on the HHRA, there are no noncancer hazards or cancer risks that exceed USEPA's acceptable levels for an industrial worker, future construction worker, future resident, or future recreational user exposed to Site 5 soil. Although the reasonable maximum exposure cumulative noncancer hazard for a future child resident (hazard index = 2.5) from exposure to soil exceeds USEPA's target threshold of 1, no individual compounds or target organs contributed to a risk greater than 1. Therefore, there were no unacceptable risks or hazards for the future child resident from exposure to soil at Site 5.

Ecological Risk

An ERA (CH2M, 2001) was completed to evaluate potential risks to ecological receptors in Paradise Creek from chemicals potentially originating from OU2 (Sites 3, 4, 5, 6, and 7)—Paradise Creek Disposal Area.

The ERA identified a potential for inorganic chemicals in sediment to adversely affect benthic organisms at several isolated locations in the reach of Paradise Creek (Lower Paradise Creek) adjacent to OU2. However, sediment is currently being addressed separately from the OU2 ROD. In addition to the evaluation of Paradise Creek, the ERA further evaluated ecological risks in adjacent upland area (soil on the OU2 landfill) based on consideration of the presumptive remedy proposed for OU2 (Site 3, 4, 5, 6, and 7). The ERA concluded that the proposed soil cover over the OU2 landfill areas and removal action at Site 7 would eliminate the identified potential ecological risk from landfill soils.

Based on the results of the HHRA and ERA, metals and PAHs are present in soil at levels presenting unacceptable human health risks and waste remains in place at the site that may also pose a hazard if exposed. Therefore, a response action was determined to be necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

3.3 Remedial Action Objectives

The ROD for OU2 was signed in May 2010 (Navy, 2010a). The selected remedy for OU 2 was installation of a soil cover with side-slope stabilization and LUCs to meet the following RAO:

- Prevent receptors from direct contact with contaminated soil posing unacceptable risk and reduce the potential for further erosion while being compatible with future actions that may be taken for groundwater at the site.

3.4 Remedial Actions

The selected remedy for contaminated soil and landfilled waste at OU2 was a soil cover with side-slope stabilization and LUCs.

3.4.1 Remedy Implementation

The installation of the soil cover with side-slope stabilization was documented in the final *Completion Report, NTCRA – Phase 2 and Phase 3, OU2 –Paradise Creek Disposal Area, NNSY, Portsmouth, Virginia* (Shaw, 2011). The soil cover was emplaced over the Eastern and Western Landfills and coincides with the fenceline as shown on **Figure 3-1**. The following LUC objectives for OU2 (soils) were presented in the ROD:

- Prevent receptor exposure to contaminated soils and waste remaining in place.
- Prohibit residential development or any other land use inconsistent with the RAO and selected soil remedy.
- Prevent unauthorized access to the site with fencing, secured and locked gates, No-Trespassing signs, and limited site access.
- Prevent activities that negatively affect the integrity of the soil cover and side slopes.
- Comply with the Post-Closure Monitoring Plan.

The LUCs will be maintained on all land within the OU2 LUC boundary (**Figure 3-1**) until site conditions allow for UU/UE.

3.4.2 Remedy Operations and Maintenance

The Post Closure Monitoring Plan (Navy, 2010b) was created to define the objectives for landfill inspections and gas monitoring. The monitoring plan specified that the final cover was to be inspected for settling, subsidence, displacement, and erosion at least monthly for the first year following construction; additional visual inspections were to be conducted during and after major rain or storm events. The soil cover is inspected for the following:

- The final cover drainage system is inspected for ponding of water, erosion, and obstruction of culverts.
- Drainage structures, including ditches, swales, culverts, and channels, are inspected for sedimentation, blockage, obstructions, and erosion, and to ensure proper drainage.
- Permanent survey benchmarks are protected and maintained.
- Signs are inspected for damage, fading, and obstructions to viewing.
- Roadways are inspected for erosion, rutting, physical damage, and obstructions.
- The Paradise Creek shoreline is inspected for instability, erosion, and raveling.
- The landfill gas venting system and landfill gas probes are inspected for damage and tampering.

Landfill gas monitoring was conducted quarterly at all landfill gas vents and probes for the first year following construction completion of the soil cover remedy. Based on the first year gas monitoring results, which indicated gases were not being generated at levels to pose any potential hazard, a determination was made that no further gas monitoring was required.

LUCs are implemented, maintained, monitored, inspected, enforced, and reported on as stated in the LUC RD (Navy, 2011a). Currently, access to OU2 is controlled by a locked perimeter fence. To ensure continued implementation, a Base Master Plan for NNSY accounts for land use restrictions across the facility, and the LUC boundaries for OU2 are annotated in the Navy's Geographical Information System (GIS). As a result of annual LUC site inspections (**Appendix A**), a portion of the Eastern Landfill cover was repaired in 2019 to address a 3-foot by 3-foot by 6-foot sinkhole at the southeastern portion of OU2. In addition, approximately 1,130 feet of chain-link fence along Victory Boulevard were replaced.

3.4.3 Progress since the 2016 Five-Year Review

During the 2016 Five-Year Review, it was found that the selected remedy for OU2 was protective of human health and the environment. Exposure pathways that could result in unacceptable risk were controlled through

maintenance of the soil cover (as warranted), enforcement of LUCs, and access restrictions (locked fence). As a result, no recommendations for future investigations or follow-up actions were required.

3.5 Technical Assessment

Question A: Is the remedy functioning as intended by the decision document? Yes

- **Remedial Action Performance:** Based on the review of historical documents, ARARs, risk assumptions, and site inspection reports, the OU2 soils remedy is functioning as intended by the ROD.
- **Implementation of LUCs and Cover Maintenance:** The Navy adheres to the requirements of the LUC RD for OU 2, which are as follows:
 - Conduct five-year reviews of the remedy and prepare a report that provides the results to USEPA and VDEQ.
 - Conduct annual inspections of the LUCs, in accordance with approved checklists, and provide a yearly report to USEPA and VDEQ. Yearly reports identify implementation actions that have been taken to maintain LUCs according to the ROD, and incorrect actions, including inconsistent land use activity at the site, any LUC failures, and the corrective action taken or proposed for each (**Appendix A**).
 - Indicate where LUCs have been imposed and annotate LUC objectives in the Navy GIS database and real estate summary maps for the installation, and follow LUC-related procedures pertaining to ground-disturbing activity and changes in land use, according to *Commander, Navy Region, Mid-Atlantic Instruction 5090.2, Installation Restoration; Land Use Controls at Navy Region, Mid-Atlantic Installations; Establishment and Maintenance*, as amended.
 - Post and maintain No-Trespassing signs.

Based on the above, implementation of the Basewide site approval and dig-permitting process prohibits unauthorized ground disturbance and protects the remedy.

Implementation of LUCs and soil cover inspections has ensured that the facility land use remains consistent (former disposal area managed under CERCLA) and access is restricted at the site. LUCs at NNSY are also tracked in the Naval Installation Restoration Information Solution (NIRIS) LUC tracker.

- **Opportunities for Optimization:**
 - Maintenance activities to the soil cover (erosion, localized settlement, bare vegetation areas, etc.) are conducted as necessary. No optimization opportunities are identified for the remedy.

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

- **Changes in Exposure Pathways:** No changes in the site conditions that would affect soil exposure pathways have been identified during the Five-Year Review (groundwater, sediment, and surface water are currently being investigated as part of OU7 [CH2M, 2017]). No new contaminants, sources, or routes of exposure have been identified as part of this Five-Year Review.
- **Changes in Toxicity and Other Contaminant Characteristics:** Although there have been some changes in toxicity values (including the toxicity values for the PAHs that are now less conservative), regulatory levels, and risk characteristics of some contaminants detected in OU2 soil since the ROD was signed, these changes would not affect the protectiveness of the selected remedy because they would not substantially change the results of the risk assessment. The remedy is a soil cover with LUCs. The soil cover combined with LUCs restrict access, site activities, and land uses that may result in receptor exposure to elevated concentrations of contaminants in soil. Toxicity changes were noted, but no additional use restrictions were required, and the remedy remains protective of human health and the environment. Changes in toxicity values that may affect groundwater or sediment will be addressed as part of the OU7 investigation (CH2M, 2017).

- **Changes in Risk Assessment Methodologies:** Although there have been some procedural changes as to how HHRAs are conducted, including how exposure point concentrations are calculated and the exposure parameter values (such as exposed skin surface area and body weight), none of these changes affect the protectiveness of the remedy.

The ERA completed for this site indicated the potential for adverse effects on ecological receptors from the presence of organic and inorganic chemicals in the landfill surface soils/sediments. As part of the selected remedial alternative, a soil cover, side-slope stabilization, and re-vegetation were completed for this site. These remedial actions created a physical barrier, eliminating ecological exposure pathways. Recent site inspections indicate the site remains vegetated and the soil cover and stabilized slopes remain intact, and there are no complete ecological exposure pathways to contaminants in soil.

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

No. The following information is relevant to the OU but does not affect the protectiveness of the remedy:

- A facility-wide PFAS Preliminary Assessment/Site Investigation (PA/SI) is scheduled for completion in Fiscal Year 2021/2022 and, as part of the PA/SI, a facility-wide conceptual site model (CSM) will be developed to identify potential PFAS source areas and set priorities for investigation of potential PFAS source areas. The findings of any PFAS data within OU2 resulting from the PFAS PA/SI will be addressed in subsequent monitoring reports and Five-Year Reviews.
- Sea level rise, increased flooding, and stronger or more frequent storm surges were identified as likely future events for the region. These could result in erosion or damage to the soil cover exposing impacted soil or waste material; however, annual inspections and routine maintenance are conducted to ensure the soil cover is intact and to ensure continued protectiveness. The rip-rap emplaced along Paradise Creek in the Western Landfill and the manmade berm along the Eastern Landfill as well as wetlands created during the Site 7 removal action also provide a storm surge buffer and the elevation of the landfill is currently between 15 and 20 feet above mean sea level.

3.6 Issues, Recommendations, and Follow-up Actions

No issues, recommendations, or follow-up actions were identified during this Five-Year Review for OU2 soils (groundwater, surface water, and sediment are currently being investigated as part of OU7). Minor areas of erosion and wash out are being addressed in a timely manner.

3.7 Statement of Protectiveness

The remedy for OU2 is protective of human health and the environment. Exposure pathways that could result in unacceptable risk are controlled through maintenance of the soil cover, enforcement of LUCs, and access restrictions. LUCs have been imposed to prevent residential land use at the site, and the Navy adheres to LUC-related procedures pertaining to ground-disturbing activity and changes in land use. LUC objectives are annotated in the Navy GIS database and real estate summary map for the installation.

3.8 Next Review

The next Five-Year Review for OU2 will be in 2026.

Table 3-1. Five-Year Review of ARARs for OU2 (Sites 3, 4, 5, 6 and 7)

Third Five-Year Review

Norfolk Naval Shipyard, Portsmouth, Virginia

Summary of ARARs - Record of Decision for OU2 (Sites 3, 4, 5, 6, and 7)			
Requirement	Citation	ARAR Determination	Five-year Review Comments
Chemical-Specific ARARs – There are no chemical-specific ARARs.			
Location-Specific ARARs			
Avoid adverse effects, minimize potential harm, and preserve and enhance wetlands, to the extent possible.	40 CFR 230.2, .10-.12, .20-.32, .41-.42, .53, .60-.77, .93, .94(a), .94(c), .95-.98 33 CFR 320.4, 328.2, 330.1(c), 330.4, 332.3, 332.4(a), 332.4(c), 332.5-8	Applicable	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Federal activities must be consistent with, to the maximum extent practicable, state coastal zone management programs.	<i>Coastal Zone Management Act</i> ; 6 USC 1456(c), 15 CFR 930.30 - .33, .36(a), .39(b-d)	Relevant and Appropriate	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Compensation or mitigation for permanent loss of wetlands will be determined on a case-by-case basis.	<i>Wetlands Mitigation Compensation Policy, 4 VAC 20-390-10 to 50</i>	Applicable	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Activities performed in a wetland will comply with these requirements.	<i>Virginia Water Protection Permit Program</i> , 9 VAC 25-210-50	Applicable	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Action-Specific ARARs			
No discharge of dredged or fill material will be allowed unless appropriate and practicable steps are taken that minimize potential adverse impacts of the discharge on the aquatic ecosystem.	40 CFR 230.2(b), .10-.12, .20-.32, .41-.42, .53, .60 .77 33 CFR 320.4, 328.2, 330.1(c), 330.4	Relevant and Appropriate	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.

Table 3-1. Five-Year Review of ARARs for OU2 (Sites 3, 4, 5, 6 and 7)

Third Five-Year Review

Norfolk Naval Shipyard, Portsmouth, Virginia

Summary of ARARs - Record of Decision for OU2 (Sites 3, 4, 5, 6, and 7)			
Requirement	Citation	ARAR Determination	Five-year Review Comments
Procedures, requirements, and Best Management Practices to be followed in connection with construction activities.	<i>Stormwater Management Regulations, 4VAC 50-60- 10 to 80, 380.A&B., 420, 430, 1100 to 1140, 1160, 1170, 1182, 1186</i>	Applicable	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Regulations for the effective control of soil erosion, sediment deposition and nonagricultural runoff which must be met in any control program to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources.	<i>Erosion and Sediment Control Regulations, 4 VAC 50-30-40, 60.A</i>	Applicable	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Wastes to be managed must be sampled for appropriate waste characterization, storage, and disposal requirements.	<i>Solid and Hazardous Waste Regulations 9 VAC 20-60-261 (incorporating 40 CFR Part 261) (hazardous waste identification) 9 VAC 20-62-262 (incorporating 40 CFR Parts 262.11 and 262.34) (generator requirements) 9 VAC 20-80-140, 150, 240.C</i>	Applicable	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Reasonable precautions will be taken to prevent particulate matter from becoming airborne.	<i>Standard for Fugitive Dust/Emissions, 9 VAC 5-50-90</i>	Applicable	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.

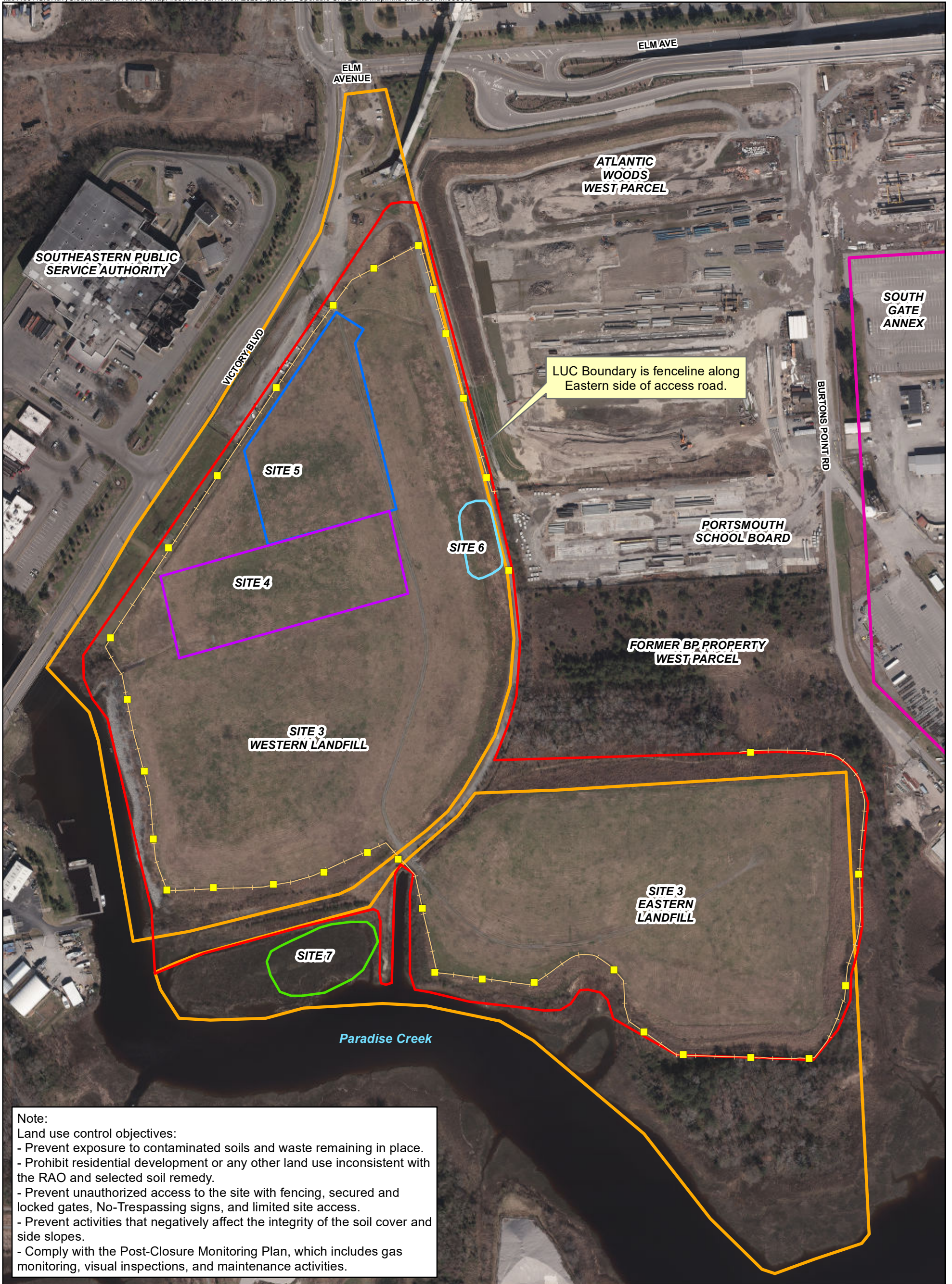
Notes:

ARAR = Applicable or Relevant and Appropriate Requirement

CFR = Code of Federal Regulations

USC = United States Code

VAC = Virginia Administrative Code



Note:
 Land use control objectives:
 - Prevent exposure to contaminated soils and waste remaining in place.
 - Prohibit residential development or any other land use inconsistent with the RAO and selected soil remedy.
 - Prevent unauthorized access to the site with fencing, secured and locked gates, No-Trespassing signs, and limited site access.
 - Prevent activities that negatively affect the integrity of the soil cover and side slopes.
 - Comply with the Post-Closure Monitoring Plan, which includes gas monitoring, visual inspections, and maintenance activities.

- Legend**
- Sign Location
 - Fence Line
 - ▭ OU2 Soils LUC Boundary
 - ▭ Site 4 Boundary
 - ▭ Site 5 Boundary
 - ▭ Site 6 Boundary
 - ▭ Site 7 Boundary (No Further Action)
 - ▭ Navy Annexes
 - ▭ OU2 Boundary

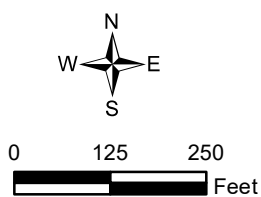


Figure 3-1
OU2 (Sites 3, 4, 5, 6, and 7) - Paradise Creek Disposal Area
 Norfolk Naval Shipyard
 Portsmouth, Virginia

Operable Unit 4 (Site 17)—Building 195 and Vicinity

4.1 Site History and Background

OU4 (Site 17), Building 195, covers approximately 2 acres within the central portion of the main Shipyard (**Figure 1-1**). Building 195 is a brick building that housed the main plating shop at NNSY from the early 1900s to the mid-1980s and is currently unoccupied. The building is located off of Stevens Street (**Figure 4-1**). Spills onto the concrete floor of the building and the land surface adjacent to the building may have occurred from the early 1970s to mid-1980s and may have involved metals and cyanide (Water and Air Research, Inc., 1983). The formerly unpaved area to the north of Building 195 was used for coal storage from the 1920s until approximately 1966. Investigations and actions at OU4 began in 1983, as shown in the following chronology.

OU4 (Site 17) Chronology	
Date	Investigation/Action
1983	IAS (Water and Air Research, Inc., 1983)
1986	RFA (NUS Corporation, 1986)
1987	RFA-S (A. T. Kearney, 1987)
1989	IRI (IT Corporation, 1989)
1994	EPIC Study (USEPA, 1994)
1995	Phase I RI/Feasibility Study (Baker, 1995)
1999	Phase II RI (Baker, 1999a)
1999	NNSY on NPL
2005	Revised FFS/HHRA (CH2M, 2005)
2006	PP (Navy, 2006a)
2006	ROD (Navy, 2006b)
2007 – Ongoing	Annual LUC Inspections (2016 to 2019 provided in Appendix A)
2010	RD for LUCs (Navy, 2010c)
2011	RACR (Navy, 2011d)
2019	Site 10 (OU6) and Site 17 (OU 4) Five-Year Review Recommendations Investigation (CH2M, 2019b)

4.2 Site Characterization

The findings from various investigations at OU4 that are pertinent to the Five-Year Review are summarized in this section.

4.2.1 Physical Characteristics

Surface Features. Site 17 is relatively flat with a gentle slope towards the south/southwest. The ground surface surrounding Building 195 is completely paved with asphalt, and the site is surrounded by a chain-link fence west and north of Building 195. North of Building 195 is a small parking lot, also paved with asphalt. Surface water runoff flows into catch basins that connect to the NNSY stormwater system, which discharges into the Southern Branch of the Elizabeth River.

Geology and Hydrogeology. Beneath the asphalt and stone surface at Building 195 is a sand and clayey silt fill, ranging in thickness from 1 to 3 feet. Beneath the fill material, Site 17 is underlain by silty-clayey sands and sandy silt and clay. Limited lithological data from Site 17 indicate that a silt and clay layer is present beneath the silty/clayey sand at 11 to 17 feet bgs (Baker, 1999a). However, not enough lithological data are available from the site to determine the thickness or extent of this semi-confining/confining unit. Groundwater in the water table aquifer (Columbia aquifer) is encountered at depths ranging from 3 to 5 feet bgs. Groundwater flows east toward the Southern Branch of the Elizabeth River. The Columbia aquifer has a hydraulic gradient of 0.004 feet per foot from northwest to southeast at the site. The average estimated hydraulic conductivity is 2.80 feet per day (ft/day), and the estimated average linear groundwater velocity is 0.032 ft/day (Baker, 1999a).

4.2.2 Land Use

Current Land Use. The land use at OU4 is currently industrial; however, the site and Building 195 are currently vacant.

Future Land Use. The Navy plans to demolish Building 195 in the future; however, the land use will remain industrial.

4.2.3 Basis for Taking Action

This section describes the results of site investigations and risk assessments that provide the basis for taking action at Site 17. Details are provided in the Phase II RI report (Baker, 1999a), FFS (CH2M, 2005), and the ROD (Navy, 2006b).

Site Investigations

Soil and Columbia (surficial) aquifer groundwater were investigated. Metals, PAHs, and pesticides were present in surface and subsurface soil at concentrations above background UTLs. Arsenic and benzo(a)pyrene exceeded the industrial risk-based screening criteria (RBCs). VOCs, one semivolatile organic compound (naphthalene), and metals were identified in groundwater at concentrations above the federal maximum contaminant level (MCL) and/or RBC.

Human Health Risk

The potential human health risks associated with receptor exposure to soil within Site 17 were quantitatively evaluated for industrial land use and construction worker exposure scenarios as part of the Phase II RI Report, and subsequent 2001 and 2004 supplemental data collection efforts. The HHRA completed as part of the Revised FFS (CH2M, 2005) evaluated the data from the 2004 Supplemental Investigation and the Phase I RI data set. The HHRA concluded that there is no unacceptable risk to current/future onsite industrial workers or future construction workers exposed to Site 17 soils; hence, there are no constituents of concern (COCs) for these receptors in the soils. Potential human health risks associated with residential soil exposure scenarios were qualitatively evaluated and assumed to be unacceptable for Site 17.

The human health risk associated with potable use of the groundwater was based on comparison of the groundwater data to available MCLs and NNSY background UTLs (for metals). Upon evaluation of this data, the NNSY PMT agreed only to further quantify risks posed by arsenic, the only constituent to exceed both the MCL and background UTL. The Navy, in partnership with the EPA (project manager, toxicologist, and hydrogeologist) and VDEQ determined that the human health risks were acceptable based on the following findings: (1) although maximum concentrations of aluminum, iron, and manganese exceeded the secondary MCLs, mean concentrations were below background UTLs established for NNSY groundwater; (2) exposure point concentrations for arsenic in groundwater at the MCL (10 µg/L) and background maximum (12.1 µg/L) present similar risk when compared with the site maximum concentration (20.8 µg/L); (3) the 95 percent upper confidence limit concentration of arsenic in Site 17 groundwater was 9.2 µg/L, below the MCL and background maximum for NNSY; and (4) there is no discernible plume of arsenic in groundwater (Navy, 2006b). Further, the groundwater is currently not used as a water supply, and there is no current receptor exposure to groundwater.

Ecological Risk

A qualitative ERA was completed as part of the Revised FFS to evaluate the potential for ecological risk. Site 17 is an industrial site. Because the site is entirely paved, it provides no viable ecological habitat. As such, there is no exposure pathway for ecological receptors at Site 17. In addition, the Revised FFS concluded that ecological receptors are not adversely affected by groundwater through chemical exposure routes from groundwater to surface water and/or sediment. Therefore, Site 17 poses no unacceptable ecological risk (CH2M, 2005).

4.3 Remedial Action Objectives

The ROD for OU4 (Site 17) was signed in August 2006 (Navy, 2006b). The selected remedy is LUCs to meet the following RAO:

- Prevent unrestricted receptor exposure to contaminated soil.

4.4 Remedial Actions

The LUC boundary for OU4 (Site 17) is shown on **Figure 4-1**.

4.4.1 Remedy Implementation

The LUC objectives for OU4 (Site 17) as stated in the ROD are as follows:

- Prohibit unrestricted access to the site.
- Prohibit the development and use of the property for residential housing, elementary and secondary schools, child care facilities, or a playground.

4.4.2 Remedy Operations and Maintenance

LUCs are implemented, maintained, monitored, inspected, enforced, and reported on as stated in the LUC RD (Navy, 2010c). The LUCs will be maintained on all land within the boundaries of Site 17 until additional actions are taken under CERCLA that allow for UU/UE to surface and subsurface soil. To ensure continued implementation, a Base Master Plan for NNSY accounts for land use restrictions across the facility, and the LUC boundaries for OU4 are annotated in the Navy's GIS. LUCs are inspected annually (**Appendix A**) and no deficiencies or inconsistent uses were observed during the review.

4.4.3 Progress since the 2016 Five-Year Review

The 2016 FYR found that the remedy at Site 17, consisting of LUCs for soil, were protective in the short term. Exposure pathways that could result in unacceptable risk were being controlled through the enforcement of LUCs. Issues identified during the 2016 Five-Year Review and follow-up actions are summarized in **Table 4-1**.

Table 4-1. OU4 (Site 17) Progress since the 2016 Five-Year Review

Issue	Recommendation (Milestone)	Date Completed/Current Status
<p>Perfluorinated compounds (PFCs)^a have been identified by USEPA as an emerging contaminant. Based on site history, these constituents have the potential to be present in site groundwater.</p>	<p>Although there is no direct receptor exposure, determine the presence or absence of PFCs^a in site groundwater. (2019)</p>	<p>Completed in February 2020.</p> <p>A per- and polyfluoroalkyl substances (PFAS) investigation in the Columbia (surficial) aquifer was initiated in 2019 (CH2M, 2019b). Monitoring wells were installed and sampled for PFAS analysis in February 2020. Concentrations of perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) were detected in the Columbia aquifer groundwater at maximum concentrations of 976 and 1,134 nanograms per liter (ng/L), respectively. These exceeded the screening level^b (SL) of 40 ng/L.</p> <p>The concentrations of PFOS and PFOA in the groundwater indicate historical activities have resulted in a release of PFAS to the groundwater in the surficial aquifer. Groundwater data are provided in Appendix D, and a summary technical memorandum is currently in preparation.</p>
<p>The potential impacts of groundwater discharge to surface water have not been evaluated for this site.</p>	<p>The Navy, at the request of USEPA, will initiate an evaluation of the groundwater discharge to surface water pathway through an assessment of available groundwater data and refinement of the conceptual site model. (2019)</p>	<p>In progress.</p> <p>An evaluation of the groundwater discharge to surface water pathway was initiated in 2019 as part of the Five-Year Review recommendations Sampling and Analysis Plan (CH2M, 2019b). The monitoring wells were installed in February 2020, and a tidal study was conducted in August 2020. Results of this evaluation will be summarized in a technical memorandum.</p> <p>A desktop audit was completed in 2020 for the groundwater discharge to Elizabeth River pathway at Sites 10 and 17 (Appendix E). The audit identified previous assessments completed in 2003 (Site 10) and 2006 (Site 17) that concluded potential risks from groundwater discharging to surface water were minimal. Additionally, a 2016 investigation of nearshore sediments conducted in the Elizabeth River along the NNSY boundary identified minimal aquatic habitat, likely due to routine dredging and disturbing activities that support the conclusion of minimal risk to receptors from contaminants in groundwater.</p>

^a The present terminology for PFCs is per- and polyfluoroalkyl substances (PFAS).
^b SLs for PFOA and PFOS listed above were calculated using the RSL calculator and a hazard quotient (HQ) of 0.1 in accordance with the process described in the Assistant Secretary of Defense memo, dated October 15, 2019 (DoD, 2019).

4.5 Technical Assessment

Question A: Is the remedy functioning as intended by the decision document? Yes.

- **Remedial Action Performance:** Based on the review of historical documents, ARARs (**Table 4-2**), risk assumptions, and site inspection reports, the remedy at Site 17, consisting of LUCs, is functioning as intended and is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through LUCs (to prohibit development and use of the property for residential housing, elementary and secondary schools, childcare facilities, or a playground).
- **Implementation of LUCs:** The Navy adheres to the requirements of the LUC RD for Site 17, which are the following:
 - Conduct five-year reviews of the remedy and prepare a report that provides the results to USEPA and VDEQ.

- Conduct annual inspections of the LUCs, in accordance with approved checklists, and provide a yearly report to USEPA and VDEQ. Yearly reports identify all implementation actions that have been taken to maintain LUCs according to the ROD, and incorrect actions, including inconsistent land use activity at the site, any LUC failures, and the corrective action taken or proposed for each (**Appendix A**).
- Indicate where LUCs have been imposed and annotate LUC objectives in the Navy GIS database and real estate summary maps for the installation, and follow LUC-related procedures pertaining to ground-disturbing activity and changes in land use, according to *Commander, Navy Region, Mid-Atlantic Instruction 5090.2, Installation Restoration; Land Use Controls at Navy Region, Mid-Atlantic Installations; Establishment and Maintenance*, as amended.

Based on the above items, implementation of the Basewide site approval and dig-permitting process prohibits unauthorized ground disturbance and protects the remedy. LUCs at NNSY are also tracked in the NIRIS LUC tracker.

- **Opportunities for Optimization:** LUC implementation is effectively being implemented and requires no additional optimization.

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

- **Changes in Exposure Pathways:** No changes in the site conditions that would affect exposure pathways have been identified during the Five-Year Review. Vapor intrusion is not a significant exposure pathway because the COCs present at Site 17 are not volatile.
- **Changes in Toxicity and Other Contaminant Characteristics:** Although there have been some changes in toxicity values, regulatory levels, and risk characteristics of some contaminants detected in Site 17 media since the ROD was signed, these changes do not affect the protectiveness of the selected remedy for soil because they do not change the results of the risk assessment. These changes also do not affect closed out groundwater media. LUCs restrict residential land use, which may result in receptor exposure to soil. Toxicity changes were noted, but no additional use restrictions were required, and the remedy remains protective of human health and the environment.

PFAS compounds PFOS and PFOA were reported in groundwater samples at concentrations above risk-based screening levels (**Table 4-1**). The extent of PFAS compounds in groundwater has not been fully delineated and risk has not been quantified to determine if a CERCLA action is warranted. However, the likelihood of exposure is low because:

- In accordance with Base master planning, all construction projects within the installation boundary go through environmental review to determine what protective measures need to be followed to prevent potential exposure from occurring.
- Groundwater on Base is not currently used as a potable water supply.
- Based on available information, groundwater within 1 mile of the Base is not used as a source of public or private drinking water.
- A complete exposure pathway is unlikely between potential source areas within the Columbia/surficial aquifer and offsite drinking water wells because developed properties are located upgradient of NNSY and groundwater use immediately downgradient from each site is controlled by the Navy.
- The Southern Branch of the Elizabeth River is adjacent to the NNSY boundary and would likely act as a discharge point/groundwater divide in the Columbia/surficial aquifer.
- **Changes in Risk Assessment Methodologies:** Although there have been some procedural changes as to how HHRAs are conducted, including how exposure point concentrations are calculated and exposure parameter values (such as exposed skin surface area and body weight and inputs to the dermal exposure estimates from groundwater), none of these changes affect the protectiveness of the remedy.

The ERA originally completed for Site 17 concluded there were no ecological receptors and/or ecological exposure pathways associated with this site based on its highly industrialized nature. These investigations also indicate that stormwater is managed onsite, and there is no potential for the transport of chemicals to offsite locations. Land use activities and habitats on these sites have not changed over the past 5 years. It is therefore concluded there are still no complete terrestrial ecological exposure pathways for this site. Additionally, the groundwater to surface water pathway was qualitatively assessed with respect to potential ecological receptors, and the conclusions were that effects from Site 17 groundwater would be minimal (**Appendix E**).

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

No. The following information is relevant to the OU but does not affect the protectiveness of the remedy:

- Sea level rise, increased flooding, and stronger or more frequent storm surges were identified as likely future events for the region. However, protectiveness at Site 17 would not be affected because the only potential risk is to residential receptors and unrestricted exposure to soils. Any work conducted at the site in response to or in preparation for these events would be conducted in accordance with the LUCs and Base Master Planning.

4.6 Issues, Recommendations, and Follow-up Actions

Table 4-3 outlines the issues identified during this Five-Year Review and presents recommendations and follow-up actions.

Table 4-3. OU4 (Site 17) Issues, Recommendations, and Follow-up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current	Future
OU4 (Site 17) was identified as a potential PFAS release area based on historical site use as a plating facility. Presence of PFAS compounds has been identified in groundwater at Site 17 at concentrations above risk-based screening levels.	Conduct an RI to refine the extent of PFAS in site media at Site 17 and evaluate whether there is a potentially unacceptable risk to human health and/or a potential complete exposure pathway to drinking water receptors.	Navy, USEPA, and VDEQ	Navy	12/31/2024	No	Yes

4.7 Statement of Protectiveness

The remedy at OU4 is currently protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through enforcement of LUCs (soil) and Base master planning (groundwater). Groundwater is not currently used as a potable drinking water source. LUCs are in place to prohibit development and use of the property for residential housing, elementary and secondary schools, childcare facilities, or a playground.

However, to ensure the remedy is protective over the long term, the Navy intends conduct a Remedial Investigation to refine the extent of PFAS in site media, evaluate the potential for unacceptable risks and/or a potential complete exposure pathway at Site 17, and prepare appropriate post-ROD documents to incorporate any additions to the remedy, if necessary.

4.8 Next Review

The next Five-Year Review for OU4 (Site 17) will be in 2026.

Table 4-2. Five-Year Review of ARARs for OU4 (Site 17)

Third Five-Year Review

Norfolk Naval Shipyard, Portsmouth, Virginia

Summary of ARARs- Record of Decision for OU4 (Site 17)			
Requirement	Citation	ARAR Determination	Five-year Review Comments
<i>Chemical-Specific ARARs</i>			
Chemical concentrations corresponding to fixed levels of human health risk (i.e., a hazard quotient of 1, or lifetime cancer risk of 10 ⁻⁶ , whichever occurs at a lower concentration).	EPA Region III RBC Tables	TBC	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
<i>Location-Specific ARARs</i>			
Facility must be designed, constructed, operated, and maintained to avoid washout.	40 CFR 264.18(b)	Relevant and Appropriate	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Actions taken should expand and strengthen cooperative efforts to restore and protect the Chesapeake Bay and to achieve the goals established in the Chesapeake Bay Agreement.	<i>Chesapeake Restoration Act of 2000</i>	Relevant and Appropriate	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Avoid impacts on cultural resources; recover and preserve artifacts and historic properties. Where impacts are unavoidable mitigate through design and data recovery. Plan action to minimize harm to National Historic Landmarks.	<i>National Historic Preservation Act</i> , 16 USC 469 to 470; 36 CFR 65; 36 CFR 800	Relevant and Appropriate	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Federal activities must be consistent with, to the area that will affect maximum extent practicable, State coastal zone management programs. Federal agencies must supply the State with a consistency determination.	<i>Coastal Zone Management Act</i> , 16 USC 1451 et. seq.; 15 CFR 930.30; 15 CFR 930.34	Relevant and Appropriate	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Protects almost all species of native birds in the U.S. from unregulated taking which can include poisoning at hazardous waste sites.	16 USC 703	Relevant and Appropriate	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.

Table 4-2. Five-Year Review of ARARs for OU4 (Site 17)

Third Five-Year Review

Norfolk Naval Shipyard, Portsmouth, Virginia

Summary of ARARs- Record of Decision for OU4 (Site 17)

Requirement	Citation	ARAR Determination	Five-year Review Comments
Criteria that provide for the protection of water quality of the Chesapeake Bay and its tributaries, that will also accommodate economic development in Tidewater Virginia. Under these requirements, certain locally designated tidal and nontidal wetlands, as well as other sensitive land areas, may be subject to limitations regarding land-disturbing activities, removal of vegetation, use of impervious cover, erosion and sediment control, stormwater management, and other aspects of land use that may have effects on water quality.	<i>Chesapeake Bay Preservation Area Designation and Management Regulations,</i> 9 VAC 10-20-10 to 260	Relevant and Appropriate	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Regulates groundwater withdrawals in Groundwater Management Areas. Any person or entity wishing to withdraw 300,000 gallons per month or more in a declared management area must obtain a permit.	<i>Groundwater Management Act of 1992,</i> VA Code Ann. §§ 62.1-254 to 62.1-279	Relevant and Appropriate	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.

Action-Specific ARARs – There are no action-specific ARARs.

Notes:

ARAR = Applicable or Relevant and Appropriate Requirement



CFR = Code of Federal Regulations

USC = United States Code

VAC = Virginia Administrative Code



Legend

-  Columbia Aquifer Monitoring Well Location
-  OU4 (Site 17) Land Use Control Boundary

Note:

Land Use Control objectives:

- Prohibit unrestricted access to the site.
- Prohibit the development and use of the property for residential housing, elementary and secondary schools, childcare facilities, or a playground.

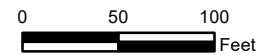


Figure 4-1
OU4 (Site 17) - Building 195 and Vicinity
Norfolk Naval Shipyard
Portsmouth, Virginia

Operable Unit 6 (Site 10)—1927 Landfill

5.1 Site History and Background

OU6 (Site 10), known as the 1927 Landfill in historical documents, is a 36-acre industrial area located in the southern portion of the Main Shipyard (**Figure 1-1**). The areas to the north and west of the site are industrial. The NNSY boundary is located to the south of the site, while the eastern side of the site encompasses Dry Dock 8 and is adjacent to Slip 5 along the Southern Branch of the Elizabeth River (**Figure 5-1**).

The 1927 Landfill was reportedly created by filling a tidal tributary (Back Creek) to the Southern Branch of the Elizabeth River, reportedly used from before 1927 to 1941. There is no specific design or information on materials used as fill. Basewide investigations and assessments have indicated that, based on the activities at NNSY, salvage waste, sandblast grit, fly ash, and asbestos may be found at the site, and no release controls such as clay liners, leachate collection systems, or compacted cover material are in place. However, results from debris delineation activities completed in 2001 and a historical photograph review indicate that the site consists primarily of dredge fill material and a small amount of construction debris rather than waste consistent with an industrial landfill (CH2M, 2006). Therefore, the Navy, in partnership USEPA and VDEQ, agree that Site 10 is more likely to have been a “filling operation to reclaim land” than a “landfill.” Investigations and actions at OU6 began in 1983, as shown in the following chronology.

OU6 (Site 10) Chronology	
Date	Investigation/Action
1983	IAS (Water and Air Research, 1983)
1986	RFA (NUS Corporation, 1986)
1987	RFA-S (A. T. Kearney, 1987)
1994	EPIC Study (USEPA, 1994)
1999	NNSY on NPL
2000	Site Screening Assessment (Baker, 1999b)
2003	Site Screening Process (SSP) (CH2M, 2003)
2005	Supplemental Site Investigation Activities
2006	RI/HHRA/FFS (CH2M, 2006)
2006	PP (Navy, 2006c)
2008	ROD (Navy, 2008)
2008 – Ongoing	Annual LUC Inspections (2016 to 2019 provided in Appendix A)
2010	RD for LUCs (Navy, 2010c)
2011	RACR (Navy, 2011c)
2019	Site 10 (OU6) and Site 17 (OU4) Five-Year Review Recommendations Investigation (CH2M, 2019b)

5.2 Site Characterization

The findings from various investigations at OU6 that are pertinent to the Five-Year Review are summarized in this section.

5.2.1 Physical Characteristics

Surface Features. The surface of Site 10 is relatively flat and consists of paved roads, parking lots, and large industrial buildings. Quay walls, or earth-retaining structures at which ships can berth, are present along the perimeters of Slip 5 and Dry Dock 8 located east of Site 10. Surface water runoff flows into catch basins that connect to the NNSY stormwater system.

Geology and Hydrogeology. The ground surface to approximately 2 feet bgs consists of concrete and asphalt with gravel in some areas. Buried debris, consisting of concrete, wood, glass, ceramic fragments, brick, and slag, is present generally to 6 feet bgs, with some areas extending to 12 feet bgs (CH2M, 2006). Unconfined deposits below the fill and debris material and part of the Columbia aquifer consist predominantly of sand and gravelly sands and are present to a depth of approximately 16 to 18 feet bgs. The Yorktown Confining Unit was encountered at a depth of approximately 13 to 16 feet bgs (CH2M, 2006).

Columbia (surficial) aquifer groundwater elevations at Site 10 range from 2.4 to 5.5 feet above msl, and the primary flow directions are to the east and northeast toward Slip 5 and Dry Dock 8 (CH2M, 2006). The groundwater gradient is variable, with a range of 0.025 to 0.0007 feet per foot across the site. While site-specific hydraulic conductivity testing has not been performed at Site 10, hydraulic testing has been performed at nearby Site 17, where the hydraulic conductivity of the Columbia aquifer is 2.8 ft/day.

5.2.2 Land Use

Current Land Use. The Site 10 area is currently used to support the industrial operations of the Shipyard, primarily the overhaul and repair of Navy ships.

Future Land Use. There are no other foreseeable future land uses.

5.2.3 Basis for Taking Action

This section describes the results of site investigations and risk assessments that provide the basis for taking action at Site 10. Details are in the SSP (CH2M, 2003), RI report (CH2M, 2006), and the ROD (Navy, 2008).

Site Investigations

Soil and Columbia (surficial) aquifer groundwater were investigated. PAHs and metals (arsenic and lead) were detected at concentrations above background UTLs and RBCs in soil. Metals (antimony, arsenic, and cadmium) were detected in groundwater above the MCLs.

Human Health Risk

The HHRA was conducted to assess potential human health risks to construction workers, future industrial workers, and future residents that may be affected by a CERCLA release from Site 10. The results indicated that exposure to soil would not pose unacceptable risks to construction workers or industrial workers at the site. However, future residential use of the site would result in unacceptable risks because of potential receptor exposure to lead in soil.

A potential risk from arsenic in groundwater (maximum detected concentration of 65.2 micrograms per liter [$\mu\text{g/L}$] [total] and 52.9 $\mu\text{g/L}$ [dissolved] compared to the MCL of 10 $\mu\text{g/L}$) was identified in the HHRA. A risk management determination was made recommending no action for groundwater based upon statistical analysis of the monitoring well data and the sitewide distribution of arsenic in soil versus arsenic in groundwater. A separate technical memorandum summarizing the potential groundwater risks associated with arsenic and the rationale for risk management was completed for Site 10. The recommendation of the technical memorandum was no action for groundwater, which was summarized and documented in the ROD for Site 10. Consequently, arsenic was not retained as a COC. The remaining metals that exceeded the MCLs were not retained as COCs because they did not individually pose risk to any future receptor.

Ecological Risk

For ecological risk, there are limited exposure routes because of the industrial nature of Site 10, and any minimal receptor exposure would not pose unacceptable risk. The ERA concluded NFA is necessary to be protective of ecological receptors. As part of the ERA conducted during the SSP (CH2M, 2003), an evaluation of the groundwater intrusion to surface water and sediment of the Elizabeth River pathway was conducted through comparison of concentrations of dissolved inorganics in the groundwater to adjusted Biological Technical Assistance Group marine surface water benchmarks and background UTLs. Iron and manganese were detected at groundwater concentrations exceeding the surface water benchmark and the background UTL. The SSP concluded that these potential risks were acceptable because no source area or discernable plume of groundwater contamination was identified, and there was no statistical difference in groundwater concentrations upgradient or downgradient of Site 10.

5.3 Remedial Action Objectives

The ROD for OU6 (Site 10) was signed in September 2008 (Navy, 2008). The selected remedy is LUCs to meet the following RAO:

- Prevent residential or childcare use until site conditions allow for UU/UE to surface and subsurface soil.

5.4 Remedial Actions

The LUC boundary for OU6 (Site 10) is shown on **Figure 5-1**.

5.4.1 Remedy Implementation

The LUC objective for OU6 (Site 10) as stated in the ROD is as follows:

- Prohibit use of the property for residential housing, childcare, elementary and secondary schools, or playground facilities.

5.4.2 Remedy Operations and Maintenance

LUCs are implemented, maintained, monitored, inspected, enforced, and reported on as stated in the LUC RD (Navy, 2010c). The LUCs will be maintained on all land within the boundaries of Site 10 until additional actions are taken under CERCLA that allow for UU/UE to surface and subsurface soil. To ensure continued implementation, a Base Master Plan for NNSY accounts for land use restrictions across the facility, and the LUC boundaries for Site 10 are annotated in the Navy's GIS. Remedy operations and maintenance consist of annual site inspections and maintenance of LUC boundaries (**Appendix A**) and no deficiencies or inconsistent uses were observed during the review.

5.4.3 Progress since the 2016 Five-Year Review

The 2016 FYR found that the remedy at Site 10, consisting of LUCs for surface and subsurface soil, was protective in the short term. Exposure pathways that could result in unacceptable risk were being controlled through the enforcement of LUCs. Issues identified during the 2016 Five-Year Review and follow-up actions are summarized in **Table 5-1**. LUCs continue to be monitored to ensure they remain properly implemented.

Table 5-1. OU6 (Site 10) Progress since the 2016 Five-Year Review

Issue	Recommendation (Milestone)	Date Completed/Current Status
<p>Dioxins and furans have been identified by USEPA as an emerging contaminant. Based on site history, these constituents have the potential to be present in site groundwater.</p>	<p>Although there is no direct receptor exposure, determine the presence or absence of dioxins and furans in site soil and groundwater. (2018)</p>	<p>Completed in January 2020.</p> <p>An investigation of dioxins and furans in the Columbia aquifer was initiated in 2019 (CH2M, 2019b). Soil and groundwater samples were collected in January 2020 using direct-push technology for screening purposes. The 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD) toxicity equivalent (TEQ) was calculated for soil and groundwater samples and was detected in soil at concentrations above soil-to-groundwater screening levels but below industrial soil RSLs. The maximum 2,3,7,8-TCDD TEQ concentration in Columbia aquifer groundwater samples was 0.78 ng/L which exceeded the tapwater RSL based on a hazard quotient of 0.1 (0.00012 ng/L) and MCL (0.03 ng/L). An additional phase of investigation is planned for summer 2020 to install permanent groundwater monitoring wells and collect groundwater samples for use in a human health risk screening. Preliminary data are provided in Appendix D, and a summary technical memorandum is currently in preparation.</p>
<p>The potential impacts of groundwater discharge to surface water has not been evaluated for this site.</p>	<p>The Navy, at the request of USEPA, will initiate an evaluation of the groundwater discharge to surface water pathway through an assessment of available groundwater data and refinement of the conceptual site model. (2018)</p>	<p>In Progress.</p> <p>An evaluation of the groundwater discharge to surface water pathway was initiated in 2019 as part of the Five-Year Review recommendations Sampling and Analysis Plan (CH2M, 2019b). The monitoring wells were installed in February 2020, and a tidal study was completed in August 2020. Results of this evaluation will be summarized in a technical memorandum.</p> <p>A desktop audit was completed in 2020 for the groundwater discharge to Elizabeth River pathway at Sites 10 and 17 (Appendix E). The audit identified previous assessments completed in 2003 (Site 10) and 2006 (Site 17) that concluded potential risks from groundwater discharging to surface water were minimal. Additionally, a 2016 investigation of nearshore sediments conducted in the Elizabeth River along the NNSY boundary identified minimal aquatic habitat, likely from routine dredging and disturbing activities that support the conclusion of minimal risk to receptors from contaminants in groundwater.</p>

5.5 Technical Assessment

Question A: Is the remedy functioning as intended by the decision document? Yes.

- **Remedial Action Performance:** Based on the review of historical documents, ARARs (**Table 5-2**), risk assumptions, and site inspection reports, the remedy at Site 10, consisting of LUCs, is functioning as intended and is protective of human health and the environment. Exposure pathways that could result in unacceptable risk are being controlled through LUCs (to prohibit development and use of the property for residential housing, elementary and secondary schools, childcare facilities, or a playground).
- **Implementation of LUCs:** The Navy adheres to the requirements of the LUC RD for Site 10, which are as follows:
 - Conduct five-year reviews of the remedy and prepare a report that provides the results to USEPA and VDEQ.

- Conduct annual inspections of the LUCs, in accordance with approved checklists, and provide a yearly report to USEPA and VDEQ. Yearly reports identify all implementation actions that have been taken to maintain LUCs according to the ROD, and incorrect actions, including inconsistent land use activity at the site, any LUC failures, and the corrective action taken or proposed for each (**Appendix A**).
- Indicate where LUCs have been imposed and annotate LUC objectives in the Navy GIS database and real estate summary maps for the installation, and follow LUC-related procedures pertaining to ground-disturbing activity and changes in land use, according to *Commander, Navy Region, Mid-Atlantic Instruction 5090.2, Installation Restoration; Land Use Controls at Navy Region, Mid-Atlantic Installations; Establishment and Maintenance*, as amended.

Based on the above items, implementation of the Basewide site approval and dig-permitting process prohibits unauthorized ground disturbance and protects the remedy. LUCs at NNSY are also tracked in the NIRIS LUC tracker.

- **Opportunities for Optimization:** LUC implementation is effectively being implemented and requires no additional optimization.

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

- **Changes in Exposure Pathways:** No changes in the site conditions that would affect exposure pathways have been identified during this Five-Year Review. No new contaminants, sources, or routes of exposure have been identified as part of this Five-Year Review. Vapor intrusion is not an exposure pathway because the contaminants present at Site 10 are not volatile.
- **Changes in Toxicity and Other Contaminant Characteristics:** Although there have been some changes in toxicity values, regulatory levels, and risk characteristics of some contaminants detected in Site 10 media since the ROD was signed, these changes do not affect the protectiveness of the selected remedy because they do not substantially change the results of the risk assessment. LUCs restrict residential land use, which may result in receptor exposure to elevated concentrations of lead in soil. Toxicity changes were noted since the ROD was signed, but no additional use restrictions were required, and the remedy remains protective of human health and the environment.

Dioxin/furans (2,3,7,8-TCDD TEQ) were reported in groundwater samples at concentrations above risk-based screening levels (**Table 5-1**). The nature and extent of dioxin/furans in groundwater has not been fully delineated and risk has not been quantified to determine if a CERCLA action is warranted. However, the likelihood of exposure is low because:

- In accordance with Base master planning, all construction projects within the installation boundary go through environmental review to determine what protective measures need to be followed to prevent potential exposure from occurring.
- Groundwater on Base is not currently used as a potable water supply.
- Based on available information, groundwater within 1 mile of the Base is not used as a source of public or private drinking water.
- A complete exposure pathway is unlikely between potential source areas within the Columbia/surficial aquifer and offsite drinking water wells because developed properties are located upgradient of NNSY and groundwater use immediately downgradient from each site is controlled by the Navy.
- The Southern Branch of the Elizabeth River is adjacent to the NNSY boundary and would likely act as a discharge point/groundwater divide in the Columbia/surficial aquifer.
- **Changes in Risk Assessment Methodologies:** Although there have been some procedural changes as to how HHRAs are conducted, including how exposure point concentrations are calculated, the exposure parameter

values (such as exposed skin surface area and body weight), and the inputs to the dermal exposure estimates from groundwater, none of these changes affect the protectiveness of the remedy.

The ERA originally completed for Site 10 concluded there were no ecological receptors and/or ecological exposure pathways associated with Site 10 based on its highly industrialized nature. Land use activities and habitats on this site have not changed over the past 5 years. It is therefore concluded there are still no complete terrestrial ecological exposure pathways for this site. Additionally, the groundwater to surface water pathway was evaluated in the 2003 SSP, and it was concluded that the potential risks to receptors from this pathway were minimal (CH2M, 2003) (**Appendix E**).

Question C: Has any other information come to light that could question the protectiveness of the remedy? No.

- A facility-wide PFAS PA/SI is scheduled for completion in Fiscal Year 2021/2022 and, as part of the PA/SI, a facility-wide CSM will be developed to identify potential PFAS source areas and set priorities for investigation of potential PFAS source areas. The findings of any PFAS data within OU6 resulting from the PFAS PA/SI will be addressed in subsequent monitoring reports and Five-Year Reviews.
- Sea level rise, increased flooding, and stronger or more frequent storm surges were identified as likely future events for the region. However, protectiveness at Site 10 would not be affected because the only risk is to residential receptors exposed to lead in soil. Any work conducted at the site in response to, or in preparation for, these events would be conducted in accordance with the LUCs and Base Master Planning.

5.6 Issues, Recommendations, and Follow-up Actions

Groundwater on and near the facility is not used as a potable water supply. In addition, LUCs and Base master planning procedures are functioning as intended and exposure to site media is controlled. Therefore, no issues that affect protectiveness have been identified.

Other Findings

A limited soil and groundwater investigation for dioxins and furans was conducted and 2,3,7,8-TCDD TEQ concentrations in preliminary Site 10 groundwater samples are above risk-based comparison criteria. Although there is no current pathway for direct exposure, the Navy will conduct additional investigations to refine the extent of dioxins and furans in groundwater and evaluate whether there is a potentially unacceptable risk to human health and/or potential for a complete exposure pathway to drinking water receptors in the future.

5.7 Statement of Protectiveness

The remedy at OU6 is protective of human health and the environment. Exposure pathways that could result in an unacceptable risk are being controlled through enforcement of LUCs (soil) and Base master planning (groundwater), and groundwater is not currently used as a potable drinking water source. LUCs are in place to prohibit development and use of the property for residential housing, elementary and secondary schools, child care facilities, or a playground.

5.8 Next Review

The next Five-Year Review for OU6 will be in 2026.

Table 5-2. Five-Year Review of ARARs for OU6 (Site 10)

Third Five-Year Review

Norfolk Naval Shipyard, Portsmouth, Virginia

Summary of ARARs- Record of Decision for OU6 (Site 10)			
Requirement	Citation	ARAR Determination	Five-year Review Comments
Chemical-Specific ARARs			
Chemical concentrations corresponding to fixed levels of human health risk (i.e., a hazard quotient of 1, or lifetime cancer risk of 10 ⁻⁶ , whichever occurs at a lower concentration).	EPA Region III RBC Tables	TBC	There are no significant changes or revisions to these requirements that would affect the protectiveness of the remedy.
Location-Specific ARARs – There are no location-specific ARARs.			
Action-Specific ARARs – There are no action-specific ARARs.			

Notes:

ARAR = Applicable or Relevant and Appropriate Requirement



EPA = United States Environmental Protection Agency

RBC = Risk-Based Concentration

TBC = To be considered



Legend

-  OU6 (Site 10) Land Use Control Boundary
-  Installation Boundary

Note:
Land Use Control Objective:
- Prohibit the development and use of the property for residential housing, elementary and secondary schools, childcare facilities, or a playground.

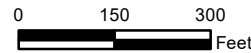


Figure 5-1
OU6 (Site 10) - 1927 Landfill
Norfolk Naval Shipyard
Portsmouth, Virginia

References

- A. T. Kearney, Inc. 1987. *Supplement to Interim Final RCRA Facility Assessment Report (RFA), Norfolk Naval Shipyard, Portsmouth, Virginia*. March.
- Baker Environmental, Inc. (Baker). 1995. *Phase I Remedial Investigation and Feasibility Study for Site 17, Norfolk Naval Shipyard Site Screening Assessment (SSA) Report*. November.
- Baker. 1999a. *Phase II Remedial Investigation for Site 17, Norfolk Naval Shipyard, Portsmouth, Virginia*. May.
- Baker. 1999b. *Norfolk Naval Shipyard Site Screening Assessment (SSA) Report*. November.
- CH2M HILL, Inc. (CH2M). 2001. *Paradise Creek Ecological Risk Assessment, Norfolk Naval Shipyard, Portsmouth, Virginia*. December.
- CH2M. 2002a. *Phase II Remedial Investigation for OU 2, Norfolk Naval Shipyard, Portsmouth, Virginia*. February.
- CH2M. 2002b. *Background Investigation, Norfolk Naval Shipyard, Portsmouth, Virginia*. Final. May.
- CH2M. 2003. *Site Screening Process Investigation and Action Determination Report: Building 236, Building 369, and the 1927 Landfill and Vicinity, Norfolk Naval Shipyard, Portsmouth, Virginia*. Final. July.
- CH2M. 2004. *Engineering Evaluation and Cost Analysis (EE/CA), Operable Unit 2, Norfolk Naval Shipyard, Portsmouth, Virginia*. April.
- CH2M. 2005. *Revised Final Focused Feasibility Study for Site 17, Norfolk Naval Shipyard, Portsmouth, Virginia*. December.
- CH2M. 2006. *Remedial Investigation and Focused Feasibility Study for Site 10, Norfolk Naval Shipyard, Portsmouth, Virginia*. June.
- CH2M. 2009. *Revised Final Focused Feasibility Study for OU 2, Norfolk Naval Shipyard, Portsmouth, Virginia*. March.
- CH2M. 2011. *Five-Year Review, Norfolk Naval Shipyard, Portsmouth, Virginia*. August.
- CH2M. 2012. *Summary of Well Abandonment Activities at Norfolk Naval Shipyard (NNSY) Sites 10 & 17, Portsmouth, Virginia*. Technical Memorandum. February.
- CH2M. 2016. *Second Five-Year Review, Norfolk Naval Shipyard, Portsmouth, Virginia*. Final. August.
- CH2M. 2017. *Sampling and Analysis Plan Supplemental Remedial Investigation Operable Unit 7 – Paradise Creek Disposal Area Groundwater, Norfolk Naval Shipyard, Portsmouth Virginia*. Final. October.
- CH2M. 2019a. *Community Involvement Plan, Norfolk Naval Shipyard, Portsmouth, Virginia*. Final. October.
- CH2M. 2019b. *Sampling and Analysis Plan Site 10 (OU6) and Site 17 (OU4) Five-Year Review Recommendations, Norfolk Naval Shipyard, Portsmouth, Virginia*. December.
- CH2M. 2020a. *Site Management Plan, Fiscal Year 2021, Norfolk Naval Shipyard, Portsmouth, Virginia*. Draft. June.
- CH2M. 2020b. *Preliminary Assessment for PFAS, Norfolk Naval Shipyard, Portsmouth, Virginia*. IN PREPARATION
- Commonwealth of Virginia. 1989. Letter from Regional Engineer for the Department of Waste Management (Mr. Aziz Farahmand, P.E.) to the Director of Environmental Programs Division for NNSY (Mr. James K. Strickland). September 1, 1989.
- Department of Defense (DoD). 2012. *Defense Environmental Restoration Program (DERP) Management Manual Number 4715.20*. March 9.

- DoD. 2014. *Five-Year Review Procedures – Update to DoD Manual (DoDM) 4715.20, “Defense Environmental Restoration Program (DERP) Management,” March 2, 2012.* June 2.
- DoD. 2019. *Investigating Per- and Polyfluoroalkyl Substances withing the Department of Defense Cleanup Program.* October.
- Department of the Navy (Navy). 2006a. *Proposed Plan, Site 17: Building 195-Plating Shop, Norfolk Naval Shipyard, Portsmouth, Virginia.* March.
- Navy. 2006b. *Record of Decision, Site 17: Building 195-Plating Shop, Norfolk Naval Shipyard, Portsmouth, Virginia.* Final. August.
- Navy. 2006c. *Proposed Plan, Site 10: 1927 Landfill, Norfolk Naval Shipyard, Portsmouth, Virginia.* September.
- Navy. 2008. *Record of Decision, Site 10: 1927 Landfill, Norfolk Naval Shipyard, Portsmouth, Virginia.* Final. September.
- Navy. 2009. *Proposed Plan, OU 2 Soil and Sediment: Paradise Creek Disposal Area, Norfolk Naval Shipyard, Portsmouth, Virginia.* March.
- Navy. 2010a. *Record of Decision, OU 2 Soil: Paradise Creek Disposal Area, Norfolk Naval Shipyard, Portsmouth, Virginia.* May.
- Navy. 2010b. *Post Closure Monitoring Plan, OU 2 Soil: Paradise Creek Disposal Area, Norfolk Naval Shipyard, Portsmouth, Virginia.* June.
- Navy. 2010c. *Land Use Control Remedial Design for Sites 10 and 17, Norfolk Naval Shipyard, Portsmouth, Virginia.* July.
- Navy. 2011a. *Land Use Control Remedial Design for OU 2 Soils, Norfolk Naval Shipyard, Portsmouth, Virginia.* May.
- Navy. 2011b. *Navy/Marine Corps Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews.* June.
- Navy. 2011c. *Remedial Action Completion Report for OU 2 Soils, Norfolk Naval Shipyard, Portsmouth, Virginia.* July.
- Navy. 2011d. *Remedial Action Completion Report for Sites 10 and 17, Norfolk Naval Shipyard, Portsmouth, Virginia.* August.
- FSSI. 2007. *Non-Time-Critical Removal Action for Site 7, Norfolk Naval Shipyard, Portsmouth, Virginia.* May.
- Foster Wheeler Environmental, Inc. (FWEI). 1995. *Remedial Investigation/Feasibility Study, Norfolk Naval Shipyard, Portsmouth, Virginia.*
- IT Corporation. 1989. *Interim Remedial Investigation, Norfolk Naval Shipyard, Portsmouth, Virginia.* August.
- Naval Facilities Engineering Command (NAVFAC). 2013. *Toolkit for Preparing Five-Year Reviews.* December 19.
- Norfolk Naval Shipyard (NNSY). 1981. *Design Drawing C-1: Building 431 Oil Holding Area Covering and Seeding.* NAVFAC Drawing Number 4070117. Code ID 80091. July (approved date).
- Natural Resources Defense Council (NRDC). 2011. *Water Facts Norfolk, Virginia: Identifying and Becoming More Resilient to Impacts of Climate Change.* July.
- NUS Corporation. 1986. *Phase I Final Interim RCRA Facility Assessment Report (RFA), Norfolk Naval Shipyard, Portsmouth, Virginia.* October.
- OHM Remediation (OHM). 1997. *Site Characterization and Conceptual Design, Norfolk Naval Shipyard, Portsmouth, Virginia.* January.
- Shaw Environmental and Infrastructure, Inc. (Shaw). 2007. *Closeout Report, OU 2 – Paradise Creek Disposal Area, Removal Action – Phase 1, Norfolk Naval Shipyard, Portsmouth, Virginia.* February.

- Shaw. 2011. *Closeout Report, OU 2 – Paradise Creek Disposal Area, Removal Action – Phase II and III, Norfolk Naval Shipyard, Portsmouth, Virginia*. April.
- Talbot and Associates. 1983. *Norfolk Naval Shipyard Landfill Management Plan*.
- United States Environmental Protection Agency (USEPA). 1994. *Aerial Photographic Site Analysis (EPIC Study), Norfolk Naval Shipyard*.
- USEPA. 2001. *Comprehensive Five-Year Review Guidance*. Office of Emergency and Remedial Response. EPA 540-R-01-007. OSWER No. 9355.7-03B-P. June.
- United States Environmental Protection Agency and the Department of the Navy (USEPA/Navy). 2004. *Federal Facilities Agreement, Norfolk Naval Shipyard, Portsmouth, Virginia*. September.
- USEPA. 2012a. *Clarifying the Use of Protectiveness Determinations for CERCLA Five-Year Reviews*. September.
- USEPA. 2012b. *Assessing Protectiveness at Sites for Vapor Intrusion: Supplement to the Comprehensive Five-Year Review Guidance*. November.
- USEPA. 2016a. *Recommended Five-Year Review Template*. January.
- USEPA. 2016b. *Climate Change Indicators in the United States*. United States Environmental Protection Agency. <https://www.epa.gov/climate-indicators/downloads-indicators-report>. Accessed 1/20/2021.
- Water and Air Research, Inc. 1983. *Initial Assessment Study, Norfolk Naval Shipyard, Portsmouth, Virginia*. March.
- White, Ronald. 1998. NNSY Code 106, Conversation with J. Rozum of Baker Environmental. November.

Appendix A
Annual Land Use Control
Inspection Reports

Annual Land Use Control Site Inspection Report Calendar Year 2016 Norfolk Naval Shipyard, Portsmouth, Virginia

PREPARED FOR: Naval Facilities Engineering Command Mid-Atlantic
PREPARED BY: CH2M HILL, Inc. (CH2M)
DATE: May 2017

1 Introduction

Annual land use control (LUC) site inspections (SI) are conducted to ensure that LUCs have been maintained at the following sites with LUC requirements: Sites 10 and 17, and Operable Unit (OU) 2. LUC inspection requirements include the following actions:

- OU2 is to be inspected as follows:
 - Assess the condition of the soil cover.
 - Verify that LUC signs and gates restricting site access to authorized personnel are in place.
 - Inspect the final cover drainage system for ponding of water, erosion, and obstruction of culverts.
 - Inspect drainage structures, including ditches, swales, culverts, and channels, for sedimentation, blockage, obstructions, and erosion, and to ensure proper drainage.
 - Ensure that permanent survey benchmarks are protected and maintained.
 - Inspect roadways for erosion, rutting, physical damage, and obstructions.
 - Inspect the Paradise Creek shoreline for instability, erosion, and releveling.
 - Inspect the landfill gas venting system, landfill gas probes, and groundwater monitoring wells for damage and tampering.
- Ensure that Site 10, Site 17, and OU2 are free of intrusive activities and dumping; in the case of Sites 10 and 17, ensure that the sites are not developed for use as residential housing, elementary and secondary schools, childcare facilities, or playgrounds.

This Annual LUC SI Report summarizes the findings of the annual SIs conducted in December 2016.

2 Site History— Norfolk Naval Shipyard

Norfolk Naval Shipyard (NNSY) is located in Portsmouth, Virginia, on the southern branch of the Elizabeth River, approximately 15 miles from the mouth of Chesapeake Bay (**Figure 1**). NNSY is the oldest continuously operated shipyard in the United States, with origins dating back to 1767 when it was a merchant shipyard under British rule and called the Gosport Shipyard. With the outbreak of the American Revolution in 1775, the Commonwealth of Virginia confiscated the Shipyard. In 1801, the federal government purchased the Shipyard.

Until the beginning of the Civil War, shipbuilding and repair facilities at the Shipyard gradually expanded. Federal authorities burned the Shipyard when war was imminent in 1861. The Confederacy took over

the Shipyard and burned it two more times during the Civil War. Following the Civil War, the Shipyard was rebuilt and activities of repair, service, and construction of ships continued. During the first and second world wars, the Shipyard became greatly expanded and modernized.

After World War II, NNSY became primarily an overhaul and repair facility and has remained such to this day. NNSY's primary mission is to repair, overhaul, dry-dock, convert, modernize, and inactivate ships, and to provide logistics services in support of the fleet.

The following official mission has been assigned to this shipyard by the Secretary of the Navy:

- Provide logistical support for assigned ships and service craft.
- Perform authorized work in connection with construction, conversion, overhaul, repair, alteration, dry-docking, and outfitting of ships and craft, as assigned.
- Perform manufacturing, research, development, and test work, as assigned.
- Provide services and material to other activities and units as directed by competent authority.

3 Site Histories

The following are brief environmental histories of the sites that require inspections of LUCs. An overview of the LUC boundaries is presented on **Figure 1**. LUCs are defined in and inspected according to requirements presented in each site's Record of Decision (ROD) and LUC Remedial Design (RD) report.

3.1 Site 10—1927 Disposal Area

Site 10 (**Figure 2**) is located in the southern portion of the Main Shipyard in an area covered with paved roads, buildings, and parking lots. The Site 10 Disposal Area was used prior to 1927 and until 1941. Wastes disposed of at the site reportedly included various solid wastes generated by NNSY, salvage waste, abrasive blast material, fly ash, and asbestos waste. There is no design information for the landfill.

The 2008 ROD-required remedy for Site 10 consisted of LUCs to prohibit use of the site for residential housing, childcare, elementary and secondary schools, or playground facilities (Navy, 2008). Naval Facilities Engineering Command (NAVFAC) completed the LUC RD in 2010 (Navy, 2010b).

3.2 Site 17—Building 195 Metal Plating Shop

Site 17 (**Figure 3**) is located near the center of the Main Shipyard and consists of Building 195 and the surrounding asphalt paved area. Building 195 was the main plating shop at NNSY from the early 1970s through the mid-1980s. The formerly unpaved area north of Building 195 was used for coal storage from the 1920s until approximately 1966. The site currently contains inactive Building 195, and the rest of the site is paved. The land use is industrial, and the surficial aquifer is not used as a potable water source.

The ROD-required remedy for Site 17 consisted of LUCs to prohibit use of the site for residential or childcare facilities, elementary and secondary schools, or playgrounds (Navy, 2006). NAVFAC completed the LUC RD in 2010 (Navy, 2010b).

3.3 OU2—Paradise Creek Disposal Area

The Paradise Creek Disposal Area (**Figure 4**) lies adjacent to Paradise Creek, south of the Main Shipyard. This OU is composed of five NNSY environmental restoration sites and contains the following:

- **Site 3, Sanitary Landfill**, was the Shipyard's landfill from 1954 through 1983. The types of waste disposed of at the site included salvage waste, abrasive blast material, boiler fly and bottom ash, residential trash, and industrial wastewater treatment plant sludge. The Site 3 Landfill consists of the Eastern Landfill and Western Landfill.

- **Site 4, Chemical Holding Pits**, is an area of five chemical waste pits that received waste from 1963 to 1977. Site 4 is located entirely within the Western Landfill boundary.
- **Site 5, Oil Reclamation Area**, is an underground storage tank (UST) site where the soils were contaminated by petroleum products related to site releases associated with the USTs, which were removed in 1982. Site 5 is located entirely within the Western Landfill boundary.
- **Site 6, East Dump**, is an area where solvents were disposed of when the Site 4 pits were full. The area was active from the mid-1960s to 1977. Site 6 is located entirely within the Western Landfill boundary.
- **Site 7, Bermed Chemical Pits**, was active from the late 1950s through the 1970s. The type and quantity of waste disposed of here are unknown. However, a test pit investigation conducted in 2003 revealed a significant amount of calcium hydroxide. Most of the calcium hydroxide formed a berm along the perimeter of the site. Site 7 was excavated and restored as a tidal wetland with a non-time-critical removal action that was completed in 2006. Site 7 does not require further action; the removal action completed in 2006 eliminated potential risks in all media.

The ROD-required soil remedy for OU2 consisted of a soil cover with side slope stabilization and LUCs to prevent receptors from direct contact with contaminated soil that could pose unacceptable risk. The soil cover would also reduce the potential for further erosion while being compatible with future actions that might be taken for groundwater at the site (Navy, 2010a). NAVFAC completed the LUC RD in 2011 (Navy, 2011).

A current task for the project management team is to review previous OU2 reports and documentation for the sediment removal that occurred at OU2 to determine the path forward to closure of the sediments under a ROD (CH2M, 2016).

4 2016 Annual Inspection Results – Norfolk Naval Shipyard

The 2016 inspections were completed on December 21 and 28, 2016. The SI checklists are included in **Attachment 1**. The following are results of the inspections for each site:

- Site 10. There were no deficiencies observed at Site 10.
- Site 17. There were no deficiencies observed at Site 17.
- OU2
 - Miscellaneous debris have accumulated outside of the northwestern perimeter fence and may be related to the nearby Southeastern Public Service Authority garbage processing facility.
 - Thirteen signs on the perimeter fence have outdated NAVFAC contact information.
 - A section of Western Landfill fencing to the northwest is leaning at roughly 60 degrees from the ground surface.
 - Sections of Western Landfill fencing on the western perimeter and along the road have heavy vegetative growth.
 - Near the northwestern corner of Site 4 is an approximately 4- by 12-foot area with standing water and phragmites growth, which could indicate a depression in the soil cover or an improperly draining swale or ditch.
 - An Eastern Landfill access gate bordering the southern drainage ditch and Paradise Creek appeared damaged and slightly pushed open but still locked.
 - Vegetative overgrowth was noted in site drainage structures.

5 Summary

The Navy Remedial Project Manager of NNSY was notified that no deficiencies were identified that needed immediate attention and was provided with a copy of the SI checklists (**Attachment 1**). Repairs are recommended for the deficiencies noted at OU2, and those deficiencies will be monitored during future SIs.

6 References

CH2M HILL, Inc. (CH2M). 2016. *Five-Year Site Management Plan, Fiscal Year 2017, Norfolk Naval Shipyard, Portsmouth, Virginia*. December.

Department of the Navy – Naval Facilities Engineering Command Mid-Atlantic (Navy). 2006. *Record of Decision, Site 17, Norfolk Naval Shipyard, Portsmouth, Virginia*. August.

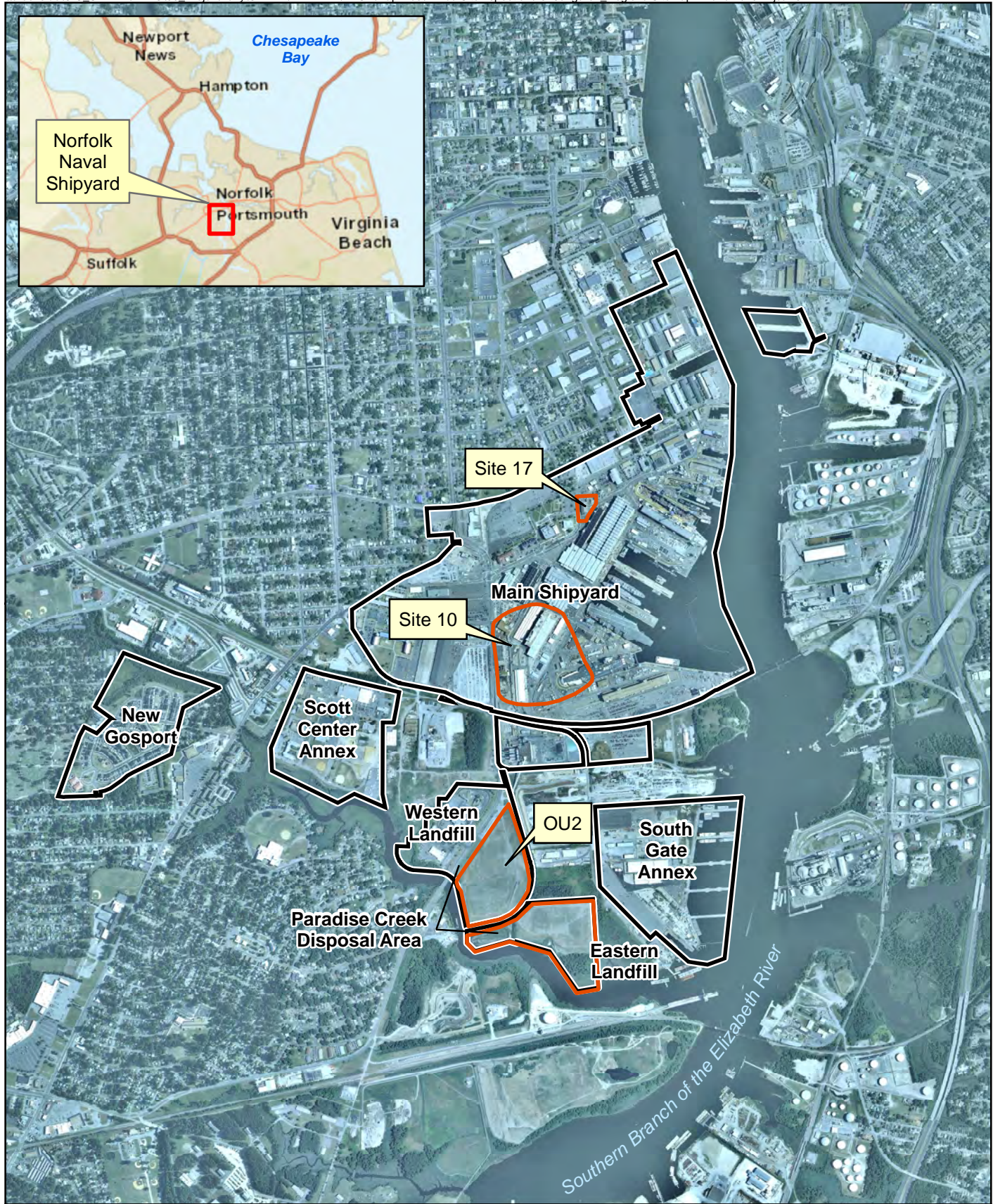
Navy. 2008. *Record of Decision, Site 10, Norfolk Naval Shipyard, Portsmouth, Virginia*. September.

Navy. 2010a. *Record of Decision, OU2, Paradise Creek Disposal Area (Soil), Norfolk Naval Shipyard, Portsmouth, Virginia*. May.

Navy. 2010b. *Remedial Design Land Use Controls for Site 10 – The 1927 Landfill and Site 17 – Building 195 Plating Shop, Norfolk Naval Shipyard, Portsmouth, Virginia*. September

Navy. 2011. *Remedial Design Land Use Controls for OU2 Paradise Creek Disposal Area, Norfolk Naval Shipyard, Portsmouth, Virginia*. June.

Figures



Legend
[Orange outline] Land Use Control Boundary
[Black outline] Installation Boundary

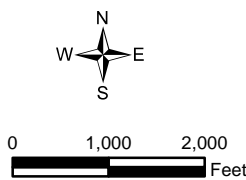
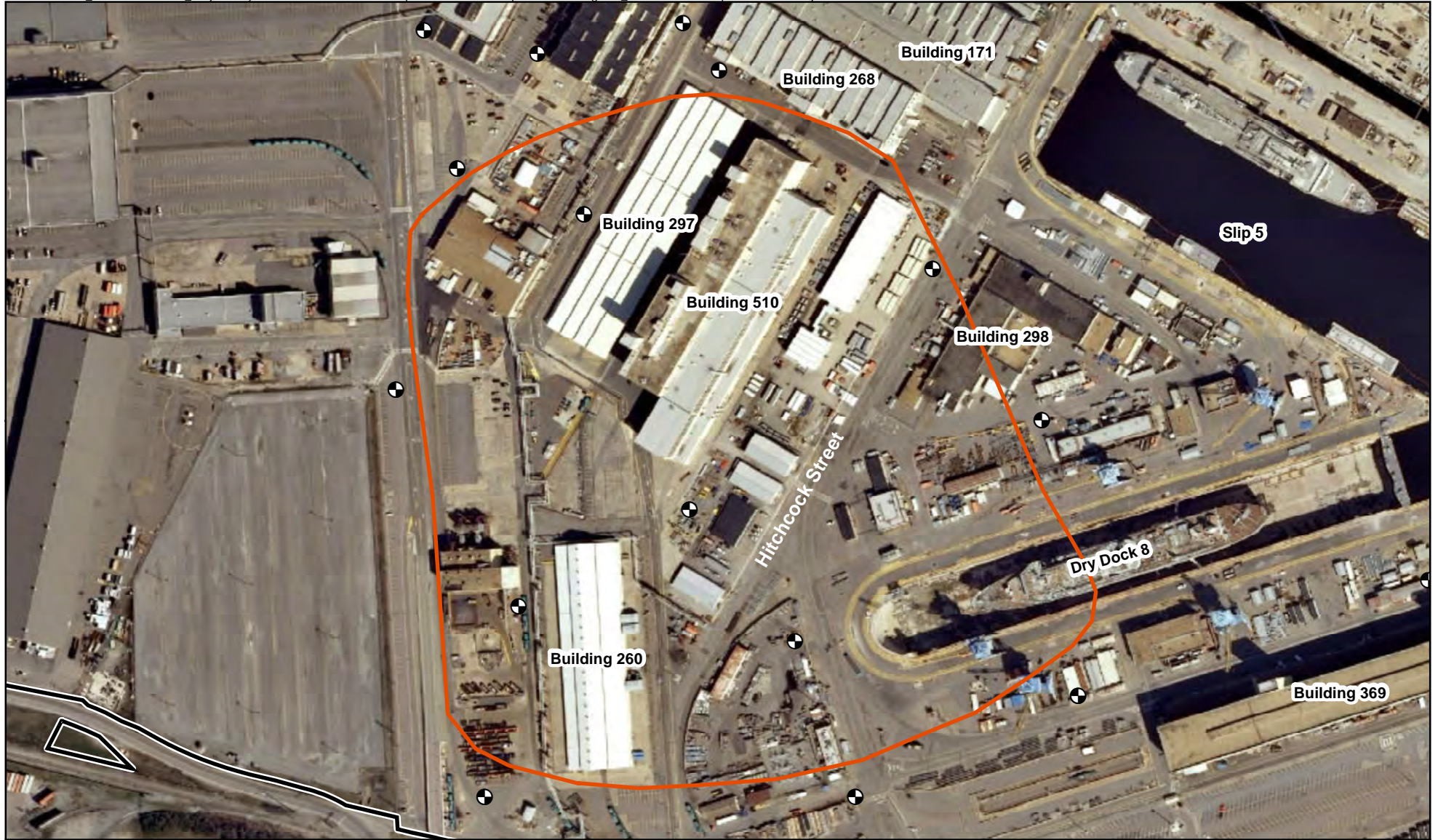





Figure 1
Site and LUC Boundary Map
Annual Site Inspection Report, Calendar Year 2016
Norfolk Naval Shipyard
Portsmouth, Virginia





Legend

-  Former Monitoring Well
-  Site 10 LUC Boundary
-  Installation Boundary

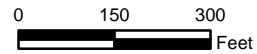
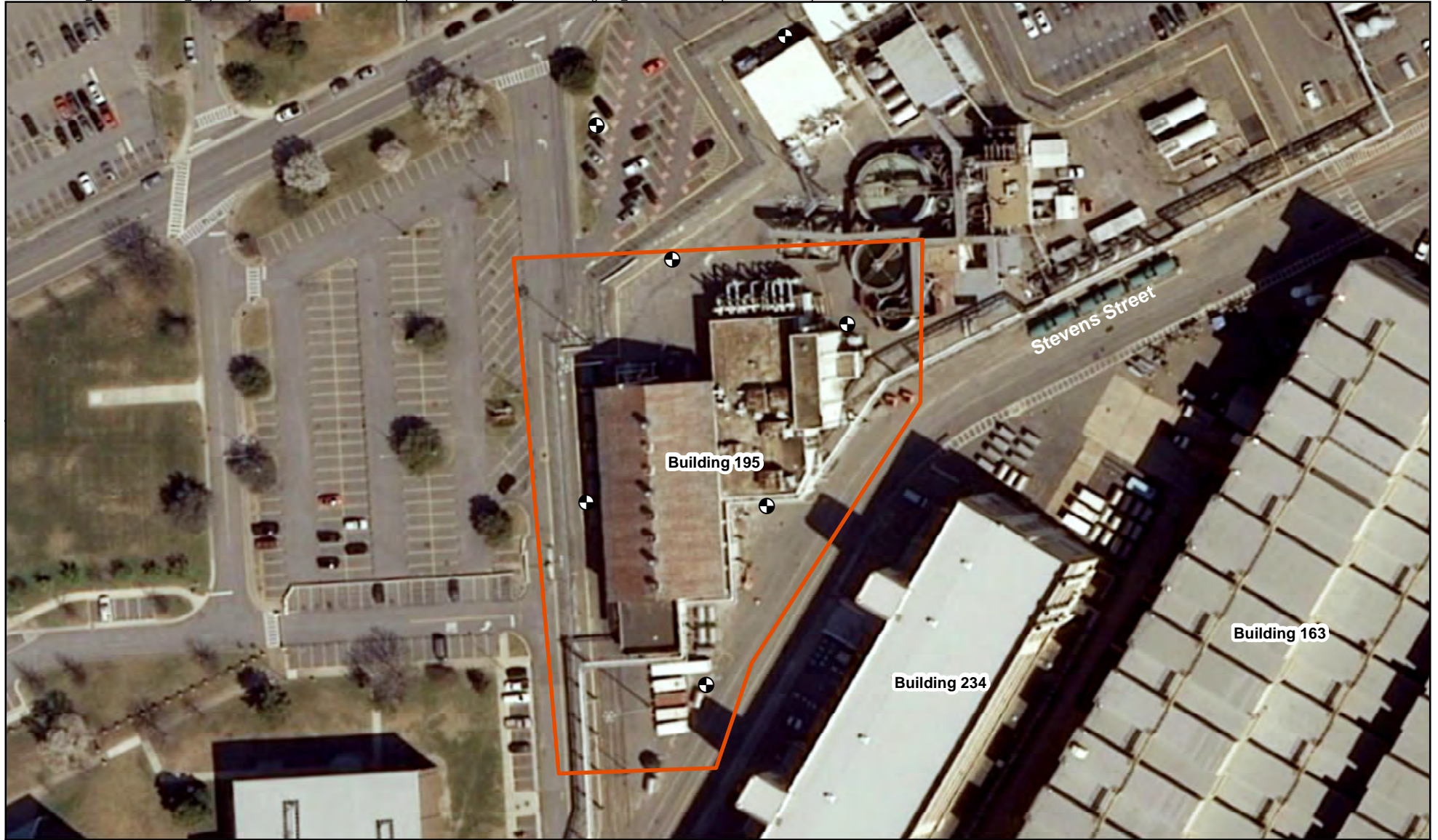


Figure 2
Site10 Location Map
Annual Site Inspection Report, Calendar Year 2016
Norfolk Naval Shipyard
Portsmouth, Virginia



Legend

- Former Monitoring Well
- ▭ Site 17 LUC Boundary

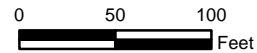
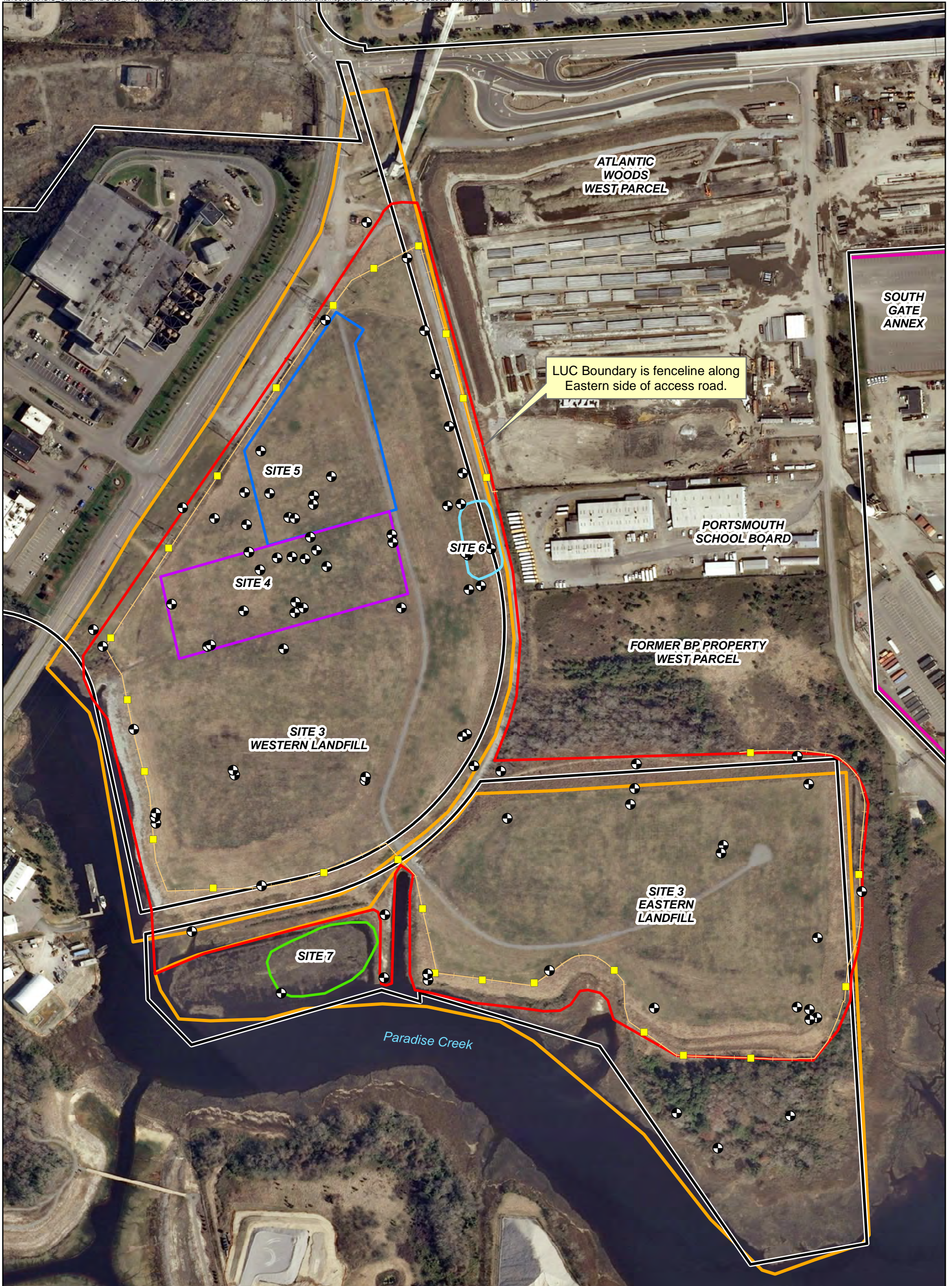


Figure 3
Site17 Location Map
Annual Site Inspection Report, Calendar Year 2016
Norfolk Naval Shipyard
Portsmouth, Virginia



- Legend**
- Monitoring Well
 - Sign Location
 - Fence Line
 - OU2 Soils LUC Boundary
 - Site 4 Boundary
 - Site 5 Boundary
 - Site 6 Boundary
 - Site 7 Boundary (No Further Action)
 - Installation Boundary

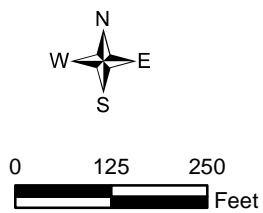


Figure 4
OU2 Location Map
 Annual Site Inspection Report, Calendar Year 2016
 Norfolk Naval Shipyard
 Portsmouth, Virginia

Attachment 1

Sites 3, 4, 5, 6, and 7 (OU2 - Paradise Creek Disposal Area and Associated Sites) Norfolk Naval Shipyard, Portsmouth, Virginia

Description: Site 3 is a 70 acre disposal area located to the north bank of Paradise Creek on the southern edge of NNSY. Sites 4, 5, and 6 are located to the north of the western portion of Site 3 and Site 7 is located to the south between Site 3 and Paradise Creek. Site 3 was used primarily for disposal of solid landfill waste. Sites 4, 6, and 7 were used as liquid waste holding sites. Site 5 was used as an oil reclamation area. Landfilling and storage at these sites began in the 1940s and continued until the 1980s. The sites are bounded to the south by Paradise Creek and to the landward side by various barriers, berms, fences and gates. Stormwater discharge and runoff is primarily to the south and east toward Paradise Creek.



Comments: (Provide related question number for each comment)

3 - Miscellaneous debris has accumulated outside the northwest perimeter fence to include mainly trash items
5 - A section of Western Landfill fencing to the northwest is leaning at roughly 60 degrees from the ground surface
5 - Sections of Western Landfill fencing on the western perimeter and along the road have heavy vegetative growth
5 - An Eastern Landfill access gate (east of the southern drainage ditch and north of Paradise Creek) appeared damaged and slightly pushed opened but still locked.
6 - Thirteen signs on the perimeter fence have outdated NAVFAC contact information.
7 - Vegetative overgrowth was noted in site drainage structures
9 - Near the northeast corner of Site 4 is an approximate 4' x 12' area with standing water and phragmites growth, which could indicate a depression in the soil cover or an improperly draining swale/ditch
(Enter suggested improvements to this form)

Betsy Reid and Daniel Christian

12/28/2016

Inspection performed by: (Print and sign)

Date

General

Yes No

1 Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose. Note - maintenance of the soil cover is ongoing.

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

2 Is the area free of storage of any investigative derived waste (IDW) on site? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator to assure their awareness and concurrence with the on-site storage. Indicate if IDW is properly labeled, per example below.

Investigative Derived Waste
Purge water from Site ID
Date
Do not handle, analysis pending
Contact Name ER Coordinator, Phone Number

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

3 Is the area free of miscellaneous debris? If no, mark location of miscellaneous debris on figure, note its condition in the comment section below, and notify activity coordinator.

Site 3		X
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

4 Is the area free of ER Site related activities/conditions resulting in stressed vegetation, scarred or stained asphalt/ground surface, or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

Site Specific

- 5 Is the site fencing in good condition and are gates locked? If no, describe condition of fence and/or uncontrolled access points, mark location(s) on map, and notify activity coordinator of any deficiencies in fences. Note - fences are in place at these sites as deterrents for Shipyard security purposes.

	X
--	---
- 6 Is the site signage in good condition? If no, describe condition of signage, mark deficient location(s) on map, and notify activity coordinator.

	X
--	---
- 7 Are drainage structures including ditches, swales, culverts, and channels free from sedimentation, blockage, obstructions, and erosion to facilitate proper drainage? If no, describe condition of drainage structures.
- | | | |
|--------|---|---|
| Site 3 | | X |
| Site 4 | X | |
| Site 5 | X | |
| Site 6 | X | |
| Site 7 | X | |
- 8 Are site monitoring wells in good condition and appear to be locked? (i.e. damaged protective posts and/or well head/casing) If no, describe condition of the deficient monitoring well(s). Note - currently site monitoring wells are not part of long-term or ongoing groundwater monitoring programs.
- | | | |
|--------|---|--|
| Site 3 | X | |
| Site 4 | X | |
| Site 5 | X | |
| Site 6 | X | |
| Site 7 | X | |
- 9 Is the area free of any signs of disturbance (i.e. digging, settlement, cracking, holes, erosion) to the site cover/cap, as depicted on the figure? If no, describe condition of the deficient cover/cap, mark location of deficient cover/cap on map.
- | | | |
|--------|---|---|
| Site 3 | | X |
| Site 4 | X | |
| Site 5 | X | |
| Site 6 | X | |
| Site 7 | X | |
- 10 Are roadways free of erosion, rutting, physical damage, and obstructions? If no, describe condition of roadways.
- | | | |
|--------|---|--|
| Site 3 | X | |
| Site 4 | X | |
| Site 5 | X | |
| Site 6 | X | |
| Site 7 | X | |

General

Yes	No
X	

1 Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose.

2 Is the area free of storage of any investigative derived waste (IDW) on site? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator. Indicate if IDW is properly labeled, per example below.

X	
---	--

Investigative Derived Waste
Purge water from Site ID
Date
Do not handle, analysis pending
Contact Name IR Coordinator, Phone Number

3 Is the area free of miscellaneous debris? If no, mark location of miscellaneous debris on figure, note its condition in the comment section below, and notify activity coordinator.

X	
---	--

4 Is the area free of stressed vegetation, scarred or stained asphalt/ground surface, or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.

X	
---	--

Site Specific

Site signage and fences are in place for Shipyard security purposes and are not in place to restrict site access for reasons other than security.

5 Is the area free of residential housing, elementary and secondary schools, childcare facilities, and playgrounds? If no, mark the address and

X	
---	--

General

The 1927 Landfill covers a large portion of the active, main Shipyard. Drum storage related to ongoing industrial activities and waste disposal areas are common within the site boundaries. The nature of any disturbances and/or storage should be noted and the department operating in that area should be identified by the inspector.

Yes	No
-----	----

1 Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose.

X	
---	--

2 Is the area free of storage of any investigative derived waste (IDW) on site? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator. Indicate if IDW is properly labeled, per example below.

X	
---	--

Investigative Derived Waste
Purge water from Site ID
Date
Do not handle, analysis pending
Contact Name IR Coordinator, Phone Number

3 Is the area free of miscellaneous debris? If no, mark location of miscellaneous debris on figure, note its condition in the comment section below, and notify activity coordinator.

X	
---	--

4 Is the area free of stressed vegetation, scarred or stained asphalt/ground surface, or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.

X	
---	--

Site Specific

6 Is the area free of residential housing, elementary and secondary schools, childcare facilities, and playgrounds? If no, mark the address and

X	
---	--

7 Is the area free of construction activity and are Buildings and or drydocks as depicted on the Figure? If no, describe discrepancies and demolition or construction of new buildings.

X	
---	--

Annual Land Use Control Site Inspection Report Calendar Year 2017 Norfolk Naval Shipyard, Portsmouth, Virginia

PREPARED FOR: Naval Facilities Engineering Command Mid-Atlantic
PREPARED BY: CH2M HILL, Inc. (CH2M)
DATE: June 2018

1 Introduction

Annual land use control (LUC) site inspections (SI) are conducted to ensure that LUCs have been maintained with LUC requirements at Sites 10 and 17, and Operable Unit (OU) 2. LUC inspection requirements include the following actions:

- OU2 is to be inspected as follows:
 - Assess the condition of the soil cover.
 - Verify that LUC signs and gates restricting site access to authorized personnel are in place.
 - Inspect the final cover drainage system for ponding of water, erosion, and obstruction of culverts.
 - Inspect drainage structures, including ditches, swales, culverts, and channels, for sedimentation, blockage, obstructions, and erosion, and to ensure proper drainage.
 - Ensure that permanent survey benchmarks are protected and maintained.
 - Inspect roadways for erosion, rutting, physical damage, and obstructions.
 - Inspect the Paradise Creek shoreline for instability, erosion, and revealing.
 - Inspect the landfill gas venting system, landfill gas probes, and groundwater monitoring wells for damage and tampering.
- Ensure that Site 10, Site 17, and OU2 are free of intrusive activities and dumping; in the case of Sites 10 and 17, ensure that the sites are not developed for use as residential housing, elementary and secondary schools, childcare facilities, or playgrounds.

This Annual LUC SI Report summarizes the findings of the annual SIs conducted in December 2017 and February 2018.

2 Site History— Norfolk Naval Shipyard

Norfolk Naval Shipyard (NNSY) is located in Portsmouth, Virginia, on the Southern Branch of the Elizabeth River, approximately 15 miles from the mouth of Chesapeake Bay (**Figure 1**). NNSY is the oldest continuously operated shipyard in the United States, with origins dating back to 1767 when it was a merchant shipyard under British rule and called the Gosport Shipyard. With the outbreak of the American Revolution in 1775, the Commonwealth of Virginia confiscated the Shipyard. In 1801, the federal government purchased the Shipyard.

Until the beginning of the Civil War, shipbuilding and repair facilities at the Shipyard gradually expanded. Federal authorities burned the Shipyard when war was imminent in 1861. The Confederacy took over the Shipyard and burned it two more times during the Civil War. Following the Civil War, the Shipyard was rebuilt and activities of repair, service, and construction of ships continued. During the first and second world wars, the Shipyard became greatly expanded and modernized.

After World War II, NNSY became primarily an overhaul and repair facility and has remained such to this day. NNSY's primary mission is to repair, overhaul, dry-dock, convert, modernize, and inactivate ships, and to provide logistics services in support of the fleet.

The following official mission has been assigned to this shipyard by the Secretary of the Navy:

- Provide logistical support for assigned ships and service craft.
- Perform authorized work in connection with construction, conversion, overhaul, repair, alteration, dry-docking, and outfitting of ships and craft, as assigned.
- Perform manufacturing, research, development, and test work, as assigned.
- Provide services and material to other activities and units as directed by competent authority.

3 Site Histories

The following are brief environmental histories of the sites that require inspections of LUCs. An overview of the LUC boundaries is presented on **Figure 1**. LUCs are defined in and inspected according to requirements presented in each site's Record of Decision (ROD) and LUC Remedial Design (RD) report.

3.1 Site 10—1927 Disposal Area

Site 10 (**Figure 2**) is located in the southern portion of the Main Shipyard in an area covered with paved roads, buildings, and parking lots. The Site 10 Disposal Area was used prior to 1927 and until 1941. Wastes disposed of at the site reportedly included various solid wastes generated by NNSY, salvage waste, abrasive blast material, fly ash, and asbestos waste. There is no design information for the landfill.

The 2008 ROD-required remedy for Site 10 consisted of LUCs to prohibit use of the site for residential housing, childcare, elementary and secondary schools, or playground facilities (Navy, 2008). Naval Facilities Engineering Command (NAVFAC) completed the LUC RD in 2010 (Navy, 2010b).

3.2 Site 17—Building 195 Metal Plating Shop

Site 17 (**Figure 3**) is located near the center of the Main Shipyard and consists of Building 195 and the surrounding asphalt paved area. Building 195 was the main plating shop at NNSY from the early 1970s through the mid-1980s. The formerly unpaved area north of Building 195 was used for coal storage from the 1920s until approximately 1966. The site currently contains inactive Building 195, and the remainder of the site is paved. The land use is industrial, and the surficial aquifer is not used as a potable water source.

The ROD-required remedy for Site 17 consisted of LUCs to prohibit use of the site for residential or childcare facilities, elementary and secondary schools, or playgrounds (Navy, 2006). NAVFAC completed the LUC RD in 2010 (Navy, 2010b).

3.3 OU2—Paradise Creek Disposal Area

The Paradise Creek Disposal Area (**Figure 4**) lies adjacent to Paradise Creek, south of the Main Shipyard. This OU is composed of five NNSY environmental restoration sites and contains the following:

- **Site 3, Sanitary Landfill**, was the Shipyard's landfill from 1954 through 1983. The types of waste disposed of at the site included salvage waste, abrasive blast material, boiler fly and bottom ash, residential trash, and industrial wastewater treatment plant sludge. The Site 3 Landfill consists of the Eastern Landfill and Western Landfill.
- **Site 4, Chemical Holding Pits**, is an area of five former chemical waste pits that received waste from 1963 to 1977. Site 4 is located entirely within the Western Landfill boundary.
- **Site 5, Oil Reclamation Area**, is a former underground storage tank (UST) site where the soils were contaminated by petroleum products related to site releases associated with the USTs, which were removed in 1982. Site 5 is located entirely within the Western Landfill boundary.

- **Site 6, East Dump**, is a former area where solvents were disposed of when the Site 4 pits were full. The area was active from the mid-1960s to 1977. Site 6 is located entirely within the Western Landfill boundary.
- **Site 7, Bermed Chemical Pits**, was active from the late 1950s through the 1970s. The type and quantity of waste disposed of here are unknown; however, a test pit investigation conducted in 2003 revealed a significant amount of calcium hydroxide. Most of the calcium hydroxide formed a berm along the perimeter of the site. Site 7 was excavated and restored as a tidal wetland with a non-time-critical removal action that was completed in 2006. Site 7 does not require further action; the removal action completed in 2006 eliminated potential risks in all media.

The ROD-required soil remedy for OU2 consisted of a soil cover with side slope stabilization and LUCs to prevent receptors from direct contact with contaminated soil that could pose unacceptable risk. The soil cover also would reduce the potential for further erosion while being compatible with future actions that might be taken for groundwater at the site (Navy, 2010a). NAVFAC completed the LUC RD in 2011 (Navy, 2011).

A current task for the project management team is to review previous OU2 reports and documentation for the sediment removal that occurred at OU2 to determine the path forward to closure of the sediments under a ROD (CH2M, 2016).

4 2017 Annual Inspection Results – Norfolk Naval Shipyard

The 2017 inspections were completed on December 21, 2017, and February 28, 2018. The SI checklists are included in **Attachment 1**. The following are results of the inspections for each site:

- Site 10. There were no deficiencies observed at Site 10.
- Site 17. There were no deficiencies observed at Site 17.
- OU2
 - Miscellaneous debris have accumulated outside of the northwestern perimeter fence and may be related to the nearby Southeastern Public Service Authority garbage processing facility.
 - Repairs are currently in progress on a section of northwest fencing that is in need of repair.
 - Sections of Western Landfill fencing on the western perimeter and along the road have heavy vegetative growth.
 - Near the northwestern corner of Site 4 is an approximately 4- by 12-foot area with standing water and phragmites growth, which could indicate a depression in the soil cover or an improperly draining swale or ditch.
 - Vegetative overgrowth was noted in site drainage structures.
 - An area of washout approximately 3 feet in diameter and 3 feet in depth was observed in the southeast corner of Site 3.
 - Approximately 50 linear feet of chain link fence was damaged due to a fallen tree along the northern boundary of Site 3.
 - Fourteen signs on the perimeter fence were replaced to reflect updated NAVFAC contact information.

5 Summary

The Navy Remedial Project Manager of NNSY was notified that no deficiencies were identified that needed immediate attention and was provided with a copy of the SI checklists (**Attachment 1**). The Navy is currently working on a contract to repair the deficiencies noted at OU2 and those deficiencies will be monitored during future SIs.

6 References

CH2M HILL, Inc. (CH2M). 2016. *Five-Year Site Management Plan, Fiscal Year 2017, Norfolk Naval Shipyard, Portsmouth, Virginia*. December.

Department of the Navy (Navy). 2006. *Record of Decision, Site 17, Norfolk Naval Shipyard, Portsmouth, Virginia*. August.

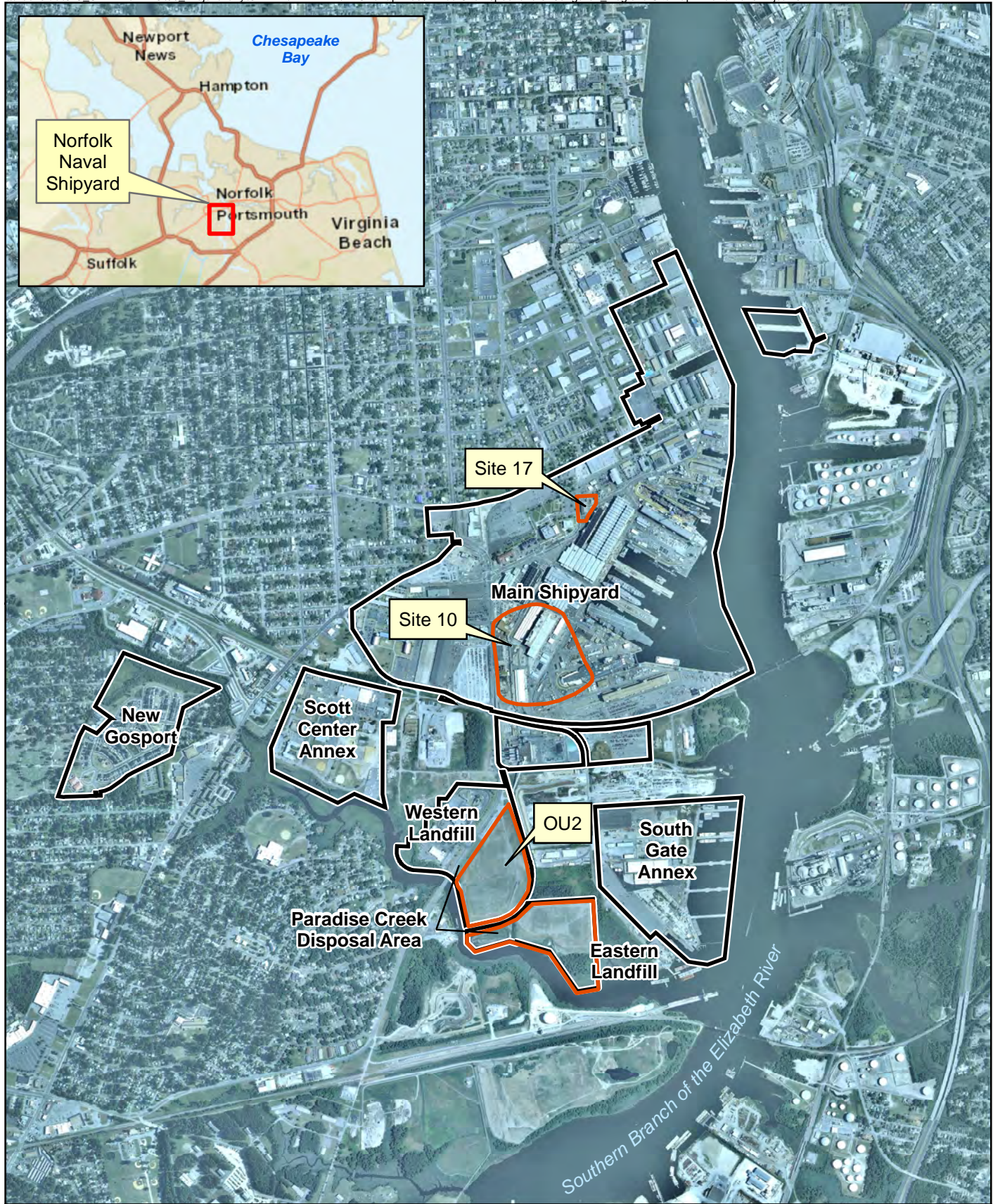
Navy. 2008. *Record of Decision, Site 10, Norfolk Naval Shipyard, Portsmouth, Virginia*. September.

Navy. 2010a. *Record of Decision, OU2, Paradise Creek Disposal Area (Soil), Norfolk Naval Shipyard, Portsmouth, Virginia*. May.

Navy. 2010b. *Remedial Design Land Use Controls for Site 10 – The 1927 Landfill and Site 17 – Building 195 Plating Shop, Norfolk Naval Shipyard, Portsmouth, Virginia*. September

Navy. 2011. *Remedial Design Land Use Controls for OU2 Paradise Creek Disposal Area, Norfolk Naval Shipyard, Portsmouth, Virginia*. June.

Figures



Legend
[Orange outline] Land Use Control Boundary
[Black outline] Installation Boundary

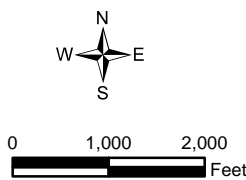
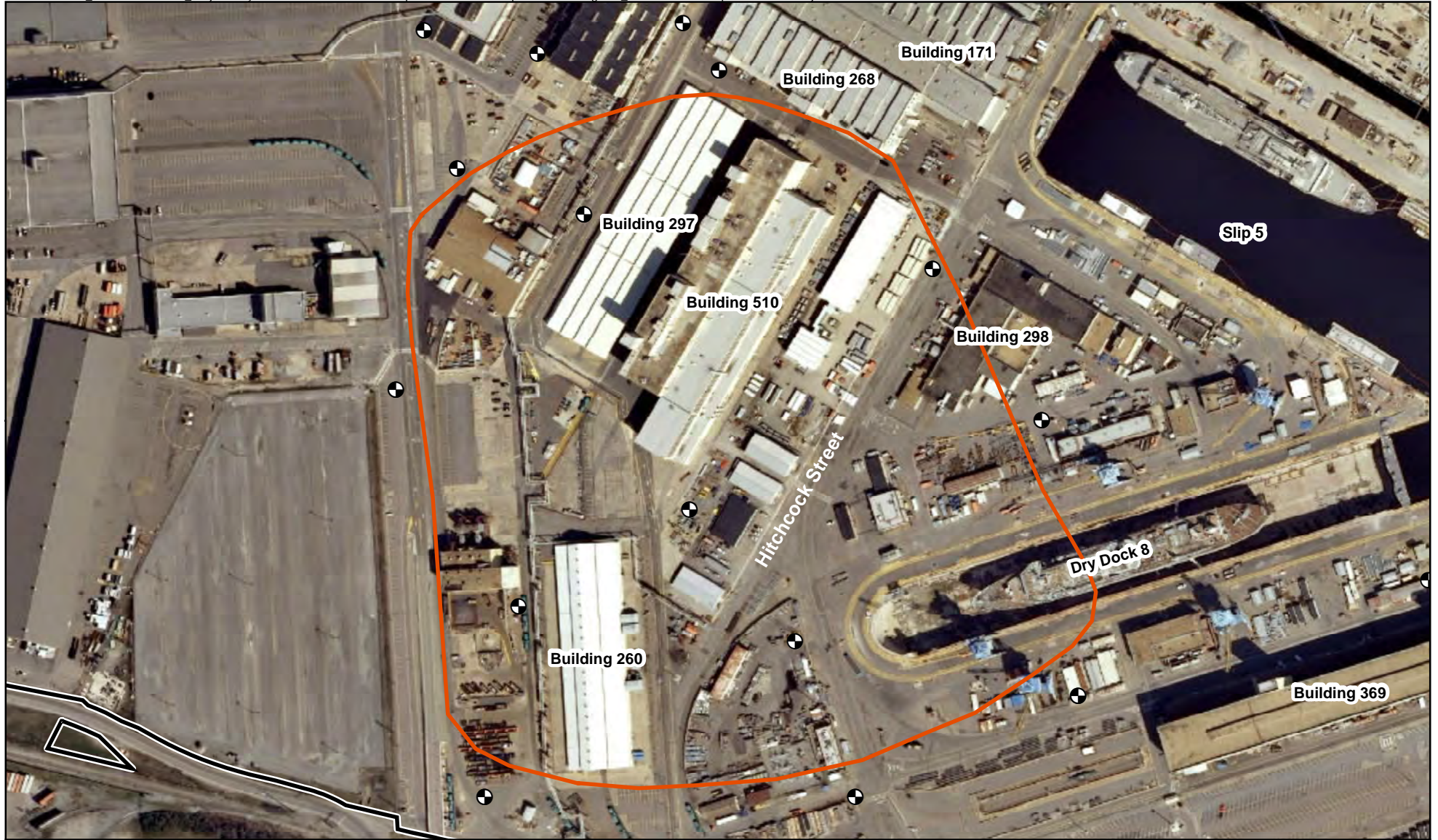





Figure 1
Site and LUC Boundary Map
Annual Site Inspection Report, Calendar Year 2017
Norfolk Naval Shipyard
Portsmouth, Virginia





Legend

-  Former Monitoring Well
-  Site 10 LUC Boundary
-  Installation Boundary

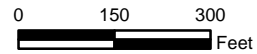
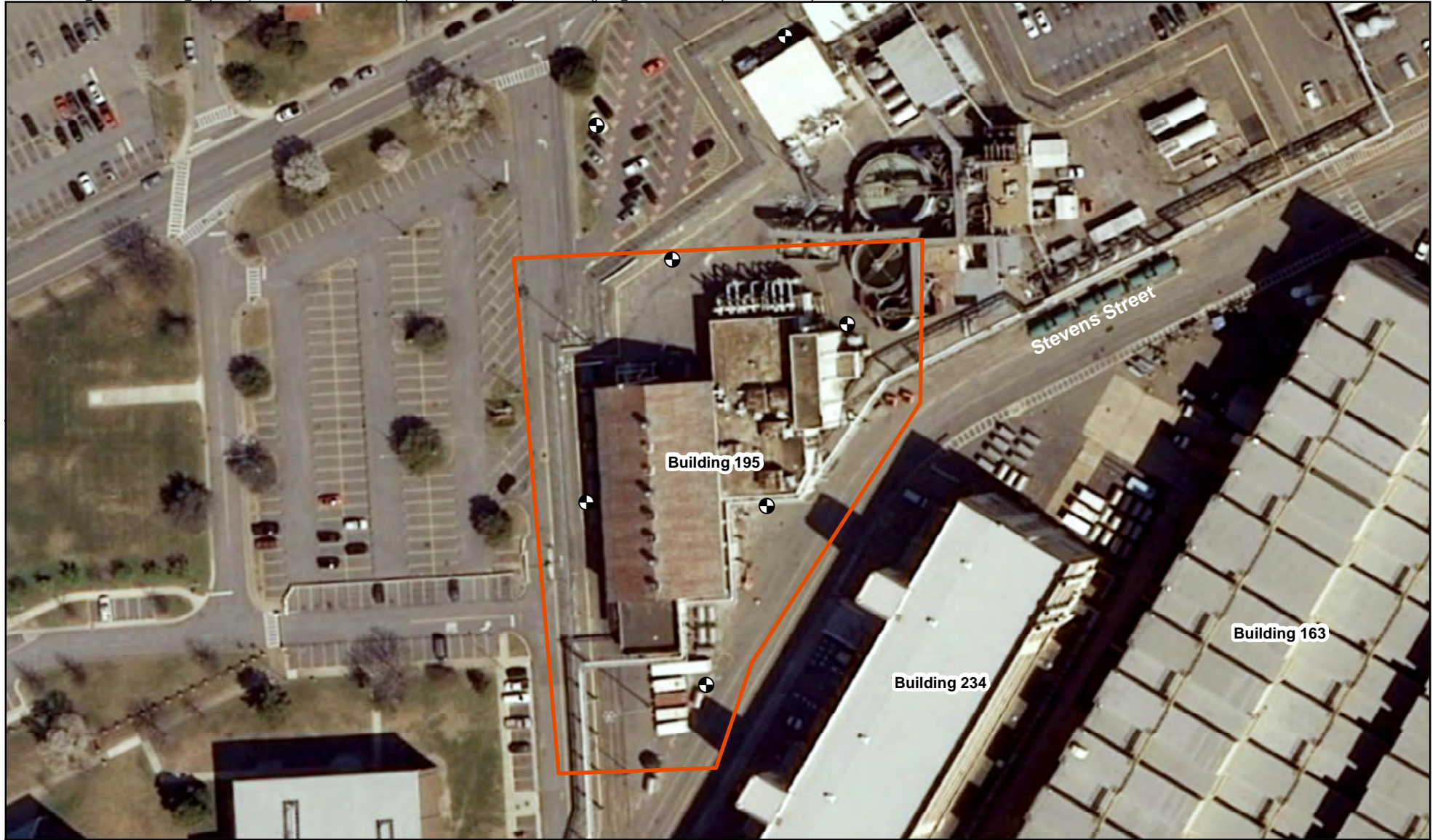


Figure 2
Site10 Location Map
Annual Site Inspection Report, Calendar Year 2017
Norfolk Naval Shipyard
Portsmouth, Virginia



Legend

- Former Monitoring Well
- ▭ Site 17 LUC Boundary

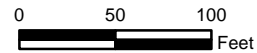
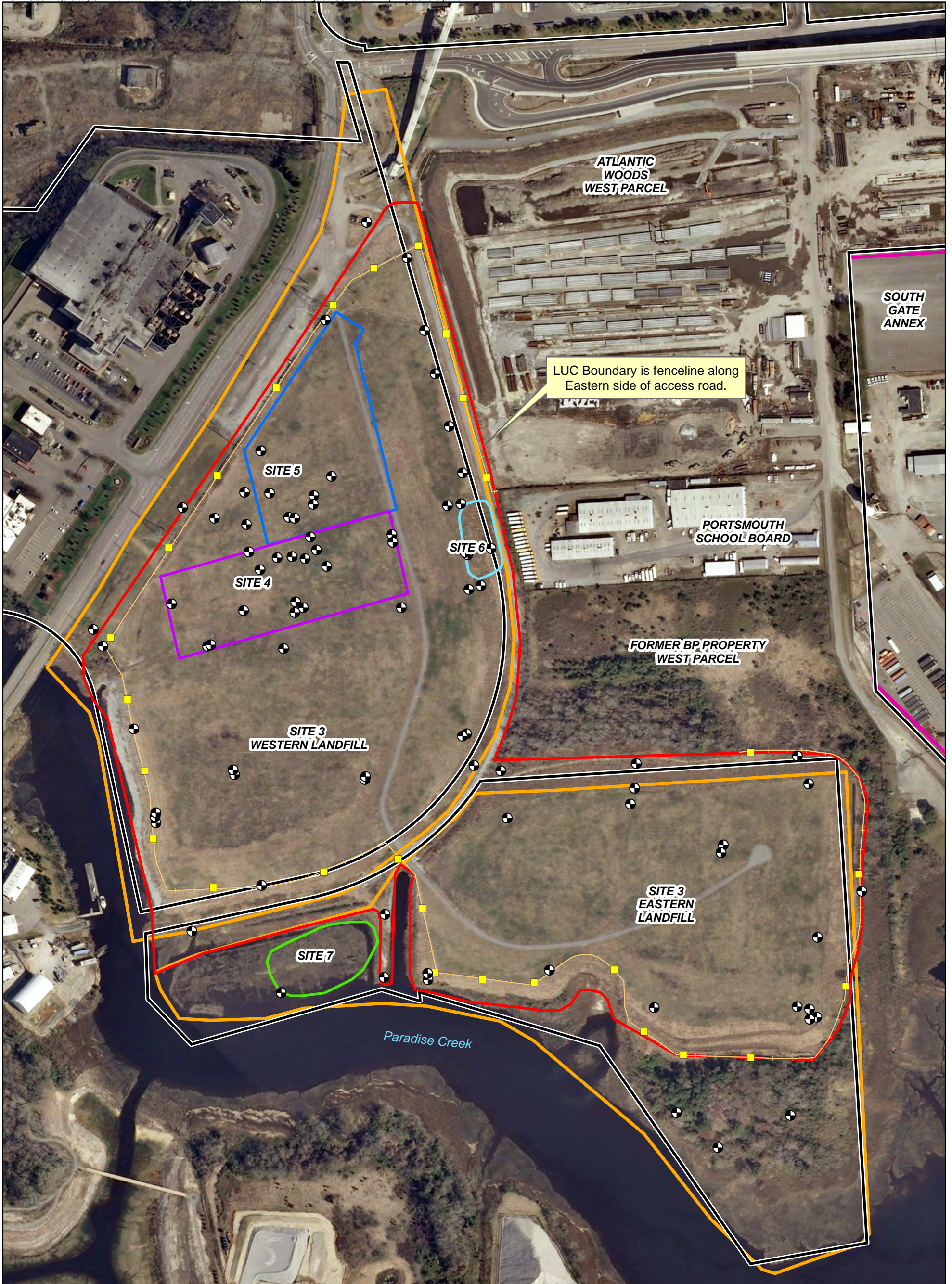


Figure 3
Site17 Location Map
Annual Site Inspection Report, Calendar Year 2017
Norfolk Naval Shipyard
Portsmouth, Virginia



LUC Boundary is fence line along Eastern side of access road.

- Legend**
- Monitoring Well
 - Sign Location
 - Fence Line
 - OU2 Soils LUC Boundary
 - Site 4 Boundary
 - Site 5 Boundary
 - Site 6 Boundary
 - Site 7 Boundary (No Further Action)
 - Installation Boundary

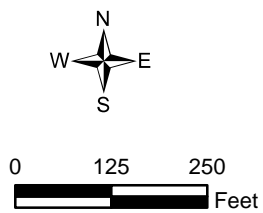


Figure 4
OU2 Location Map
 Annual Site Inspection Report, Calendar Year 2017
 Norfolk Naval Shipyard
 Portsmouth, Virginia

Attachment 1
Site Inspection Checklists

General

Yes	No
-----	----

The 1927 Landfill covers a large portion of the active, main Shipyard. Drum storage related to ongoing industrial activities and waste disposal areas are common within the site boundaries. The nature of any disturbances and/or storage should be noted and the department operating in that area should be identified by the inspector.

1 Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose.

X	
---	--

2 Is the area free of storage of any investigative derived waste (IDW) onsite? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator. Indicate if IDW is properly labeled, per example below.

X	
---	--

Investigative Derived Waste
Purge Water from Site ID
Date
Do not handle, analysis pending
Contact Name IR Coordinator, Phone Number

3 Is the area free of miscellaneous debris? If no, mark location of miscellaneous debris on figure, note its condition in the comment section below, and notify activity coordinator.

X	
---	--

4 Is the area free of stressed vegetation, scarred or stained asphalt/ground surface, or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.

X	
---	--

Site Specific

6 Is the area free of residential housing, elementary and secondary schools, childcare facilities, and playgrounds? If no, mark the

X	
---	--

7 Is the area free of construction activity and are buildings and or drydocks as depicted on the figure? If no, describe discrepancies and demolition or construction of new buildings.

X	
---	--

Annual Land Use Control Site Inspection Report Calendar Year 2018, Norfolk Naval Shipyard, Portsmouth, Virginia

PREPARED FOR: Naval Facilities Engineering Command Mid-Atlantic
PREPARED BY: CH2M HILL, Inc. (CH2M)
DATE: April 2019

Introduction

Annual land use control (LUC) site inspections (SI) are conducted to ensure that LUCs have been maintained with LUC requirements at Sites 10 and 17, and Operable Unit (OU) 2. LUC inspection requirements include the following actions:

- OU2 is to be inspected as follows:
 - Assess the condition of the soil cover.
 - Verify that LUC signs and gates restricting site access to authorized personnel are in place.
 - Inspect the final cover drainage system for ponding of water, erosion, and obstruction of culverts.
 - Inspect drainage structures, including ditches, swales, culverts, and channels, for sedimentation, blockage, obstructions, and erosion, and to ensure proper drainage.
 - Ensure that permanent survey benchmarks are protected and maintained.
 - Inspect roadways for erosion, rutting, physical damage, and obstructions.
 - Inspect the Paradise Creek shoreline for instability, erosion, and releveling.
 - Inspect the landfill gas venting system, landfill gas probes, and groundwater monitoring wells for damage and tampering.
- Verify that Sites 10 and 17, and OU2 are free of intrusive activities and dumping; in the case of Sites 10 and 17, verify that the sites are not developed for use as residential housing, elementary and secondary schools, childcare facilities, or playgrounds.

This Annual LUC SI Report summarizes the findings of the annual SIs conducted in December 2018.

Site History— Norfolk Naval Shipyard

Norfolk Naval Shipyard (NNSY) is in Portsmouth, Virginia, on the Southern Branch of the Elizabeth River, approximately 15 miles from the mouth of Chesapeake Bay (**Figure 1**). NNSY is the oldest continuously operated shipyard in the United States, with origins dating back to 1767, when it was a merchant shipyard under British rule and called the Gosport Shipyard. With the outbreak of the American Revolution in 1775, the Commonwealth of Virginia confiscated the Shipyard. In 1801, the federal government purchased the Shipyard.

Until the beginning of the Civil War, shipbuilding and repair facilities at the Shipyard gradually expanded. Federal authorities burned the Shipyard when war was imminent in 1861. The Confederacy took over the Shipyard and burned it two more times during the Civil War. Following the Civil War, the Shipyard was rebuilt and activities of repair, service, and construction of ships continued. During the first and second world wars, the Shipyard became greatly expanded and modernized.

After World War II, NNSY became primarily an overhaul and repair facility and has remained such to this day. NNSY's primary mission is to repair, overhaul, dry-dock, convert, modernize, and inactivate ships, and to provide logistics services in support of the fleet.

The following official mission has been assigned to this shipyard by the Secretary of the Navy:

- Provide logistical support for assigned ships and service craft.
- Perform authorized work in connection with construction, conversion, overhaul, repair, alteration, dry-docking, and outfitting of ships and craft, as assigned.
- Perform manufacturing, research, development, and test work, as assigned.
- Provide services and material to other activities and units as directed by competent authority.

Site Histories

The following are brief environmental histories of the sites that require inspections of LUCs. An overview of the LUC boundaries is presented on **Figure 1**. LUCs are defined in and inspected according to requirements presented in each site's Record of Decision (ROD) and LUC Remedial Design (RD) report.

Site 10—1927 Disposal Area

Site 10 (**Figure 2**) is in the southern portion of the Main Shipyard in an area covered with paved roads, buildings, and parking lots. The Site 10 Disposal Area was used before 1927 and until 1941. Wastes disposed of at the site reportedly included various solid wastes generated by NNSY, salvage waste, abrasive blast material, fly ash, and asbestos waste. There is no design information for the landfill.

The 2008 ROD-required remedy for Site 10 consisted of LUCs to prohibit use of the site for residential housing, childcare, elementary and secondary schools, or playground facilities (Navy, 2008). Naval Facilities Engineering Command (NAVFAC) completed the LUC RD in 2010 (Navy, 2010b).

Site 17—Building 195 Metal Plating Shop

Site 17 (**Figure 3**) is located near the center of the Main Shipyard and consists of Building 195 and the surrounding asphalt paved area. Building 195 was the main plating shop at NNSY from the early 1970s through the mid-1980s. The formerly unpaved area north of Building 195 was used for coal storage from the 1920s until approximately 1966. The site currently contains inactive Building 195, and the remainder of the site is paved. The land use is industrial, and the surficial aquifer is not used as a potable water source.

The ROD-required remedy for Site 17 consisted of LUCs to prohibit use of the site for residential or childcare facilities, elementary and secondary schools, or playgrounds (Navy, 2006). NAVFAC completed the LUC RD in 2010 (Navy, 2010b).

OU2—Paradise Creek Disposal Area

The Paradise Creek Disposal Area (**Figure 4**) lies adjacent to Paradise Creek, south of the Main Shipyard. This OU is composed of five NNSY environmental restoration sites and contains the following:

- **Site 3, Sanitary Landfill**, was the Shipyard's landfill from 1954 through 1983. The types of waste disposed of at the site included salvage waste, abrasive blast material, boiler fly and bottom ash, residential trash, and industrial wastewater treatment plant sludge. The Site 3 Landfill consists of the Eastern Landfill and Western Landfill.
- **Site 4, Chemical Holding Pits**, is an area of five former chemical waste pits that received waste from 1963 to 1977. Site 4 is located entirely within the Western Landfill boundary.
- **Site 5, Oil Reclamation Area**, is a former underground storage tank (UST) site where the soils were contaminated by petroleum products related to site releases associated with the USTs, which were removed in 1982. Site 5 is located entirely within the Western Landfill boundary.

- **Site 6, East Dump**, is a former area where solvents were disposed of when the Site 4 pits were full. The area was active from the mid-1960s to 1977. Site 6 is located entirely within the Western Landfill boundary.
- **Site 7, Bermed Chemical Pits**, was active from the late 1950s through the 1970s. The type and quantity of waste disposed of here are unknown; however, a test pit investigation conducted in 2003 revealed a significant amount of calcium hydroxide. Most of the calcium hydroxide formed a berm along the perimeter of the site. Site 7 was excavated and restored as a tidal wetland with a non-time-critical removal action that was completed in 2006. Site 7 does not require further action; the removal action completed in 2006 eliminated potential risks in all media.

The ROD-required soil remedy for OU2 consisted of a soil cover with side slope stabilization and LUCs to prevent receptors from direct contact with contaminated soil that could pose unacceptable risk. The soil cover also would reduce the potential for further erosion while being compatible with future actions that might be taken for groundwater at the site (Navy, 2010a). NAVFAC completed the LUC RD in 2011 (Navy, 2011).

A current task for the project management team is to determine the path forward to closure of the sediments under a ROD (CH2M, 2018).

2017 Annual Inspection Results – Norfolk Naval Shipyard

The 2018 inspections were completed on December 6, 2018. The SI checklists are included in **Attachment 1**. The following are results of the inspections for each site:

- Site 10. There were no deficiencies observed at Site 10.
- Site 17. There were no deficiencies observed at Site 17.
- OU2
 - Repairs are necessary for three sections of fencing.
 - Standing water and phragmites growth noted along northwest portion of Site 3 Western Landfill fence, which could indicate a depression in the soil cover or an improperly draining swale or ditch.
 - Vegetative overgrowth was noted in site drainage structures at Site 3 Eastern Landfill.
 - An area of washout approximately 3 feet in diameter and 3 feet in depth was observed in the landfill cover in the southeastern corner of Site 3 Western Landfill.
 - Ruts with standing water in the landfill cover noted in three locations at Site 3 Eastern Landfill.

Summary

The Navy Remedial Project Manager of NNSY was notified that no deficiencies were identified that needed immediate attention and was provided with a copy of the SI checklists (**Attachment 1**). The Navy is currently working on a contract to repair the deficiencies noted at OU2 and those deficiencies will be monitored during future SIs.

References

CH2M HILL, Inc. (CH2M). 2018. *Five-Year Site Management Plan, Fiscal Year 2019, Norfolk Naval Shipyard, Portsmouth, Virginia*. October.

Department of the Navy (Navy). 2006. *Record of Decision, Site 17, Norfolk Naval Shipyard, Portsmouth, Virginia*. August.

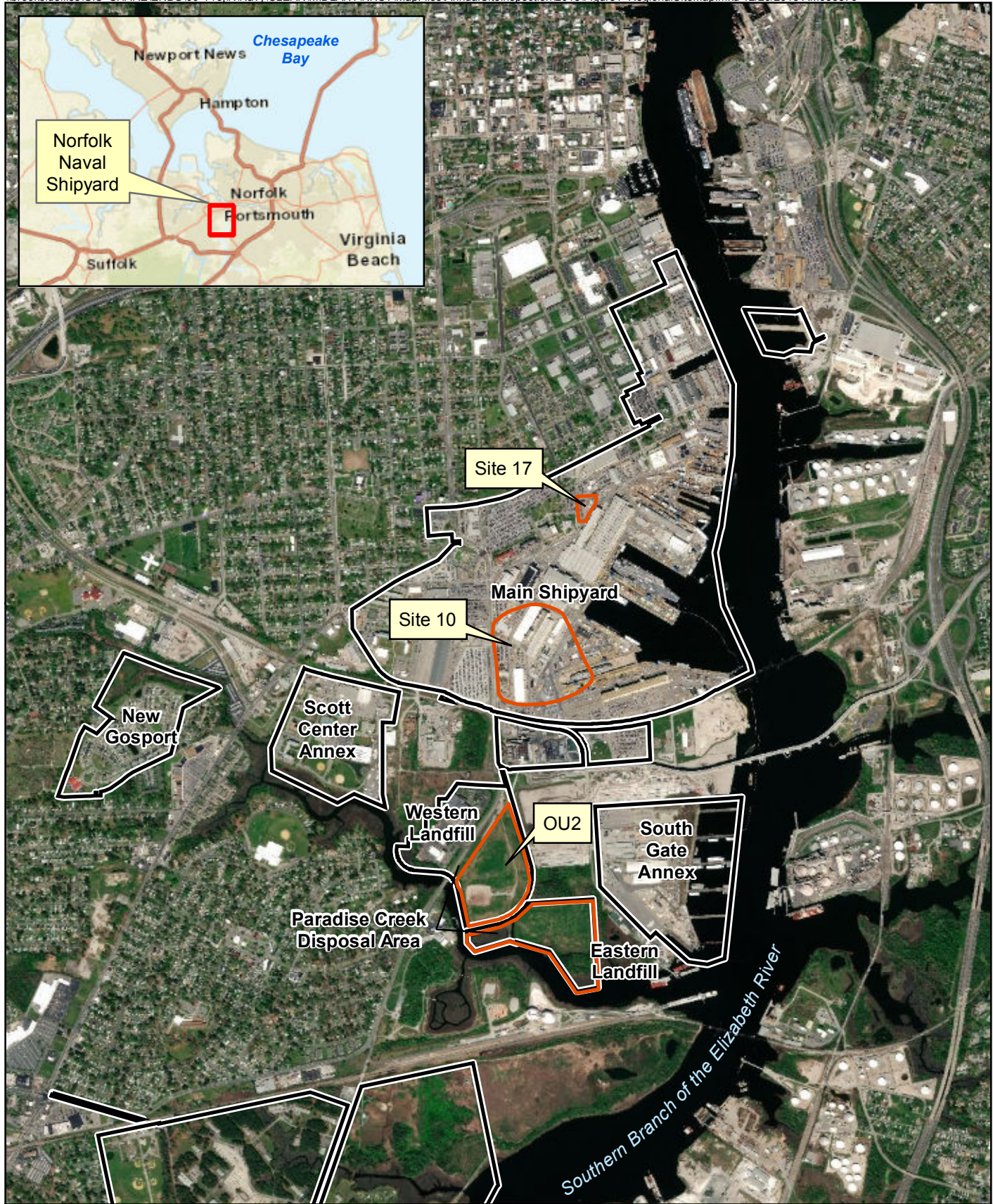
Navy. 2008. *Record of Decision, Site 10, Norfolk Naval Shipyard, Portsmouth, Virginia*. September.

Navy. 2010a. *Record of Decision, OU2, Paradise Creek Disposal Area (Soil), Norfolk Naval Shipyard, Portsmouth, Virginia*. May.

Navy. 2010b. *Remedial Design Land Use Controls for Site 10 – The 1927 Landfill and Site 17 – Building 195 Plating Shop, Norfolk Naval Shipyard, Portsmouth, Virginia.* September

Navy. 2011. *Remedial Design Land Use Controls for OU2 Paradise Creek Disposal Area, Norfolk Naval Shipyard, Portsmouth, Virginia.* June.

Figures



Legend
[Orange Outline] Land Use Control Boundary
[White Outline] Installation Boundary



0 1,000 2,000
Feet

Imagery Source: ©2017 Esri

Figure 1
Site and LUC Boundary Map
Annual Site Inspection Report, Calendar Year 2018
Norfolk Naval Shipyard
Portsmouth, Virginia





- Legend**
- Orange outline: Site 10 LUC Boundary
 - White outline: Installation Boundary

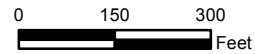
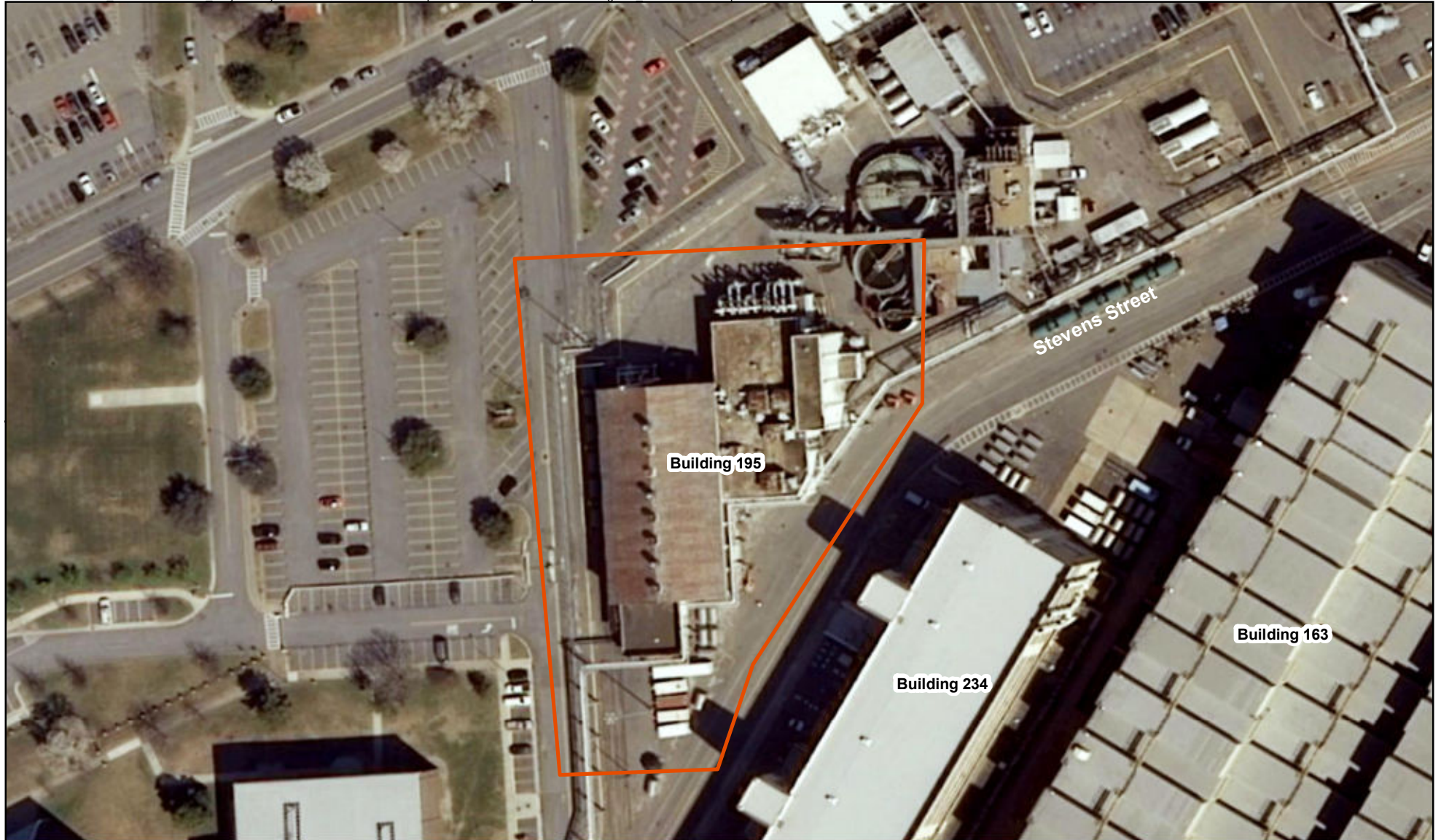
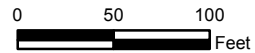


Figure 2
Site 10 Location Map
Annual Site Inspection Report, Calendar Year 2018
Norfolk Naval Shipyard
Portsmouth, Virginia



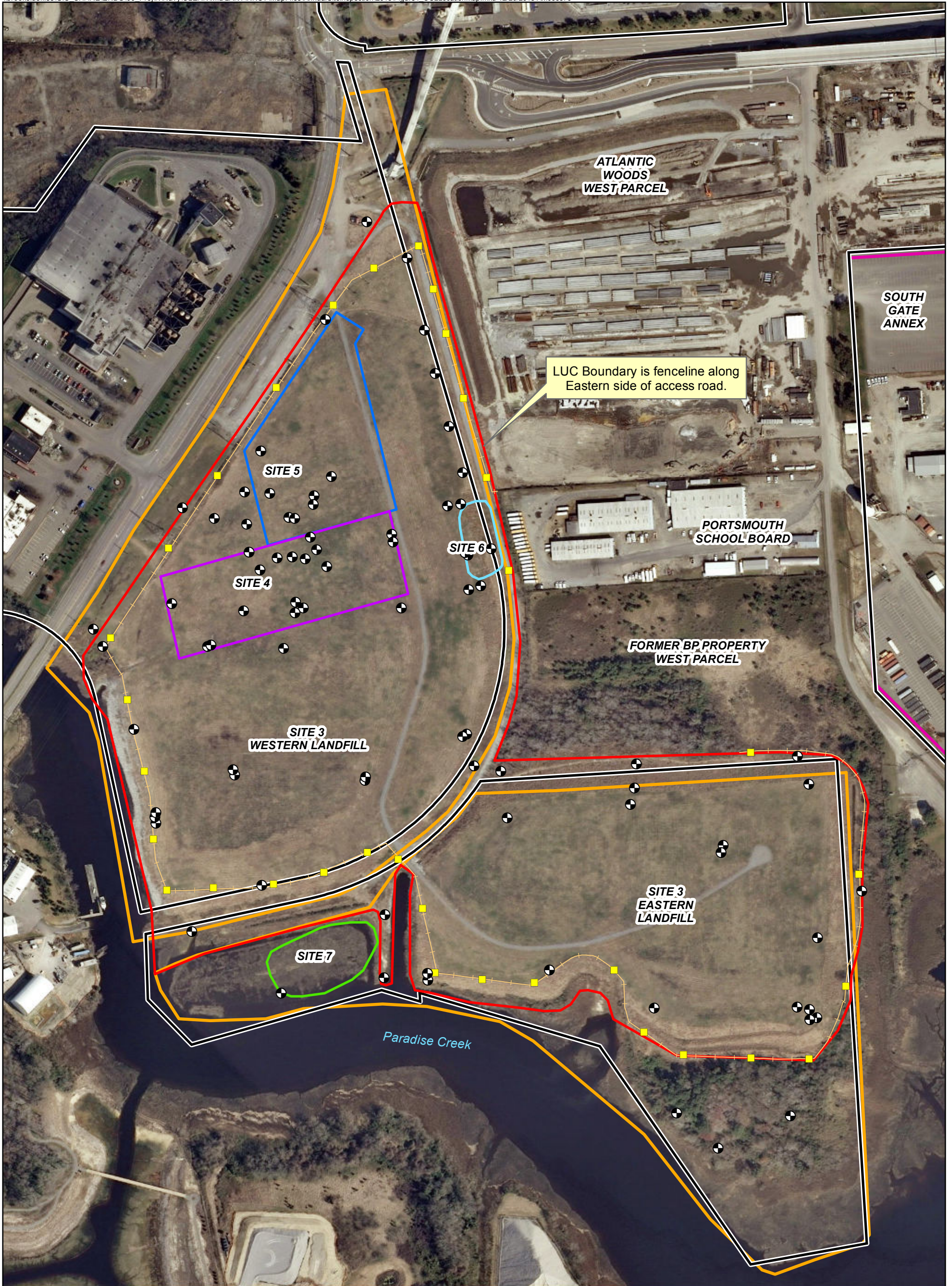
Legend
[Orange outline] Site 17 LUC Boundary



Imagery Source: ©2017 Esri

Figure 3
Site 17 Location Map
Annual Site Inspection Report, Calendar Year 2018
Norfolk Naval Shipyard
Portsmouth, Virginia





- Legend**
- Monitoring Well
 - Sign Location
 - Fence Line
 - OU2 Soils LUC Boundary
 - Site 4 Boundary
 - Site 5 Boundary
 - Site 6 Boundary
 - Site 7 Boundary (No Further Action)
 - Installation Boundary



0 125 250
Feet

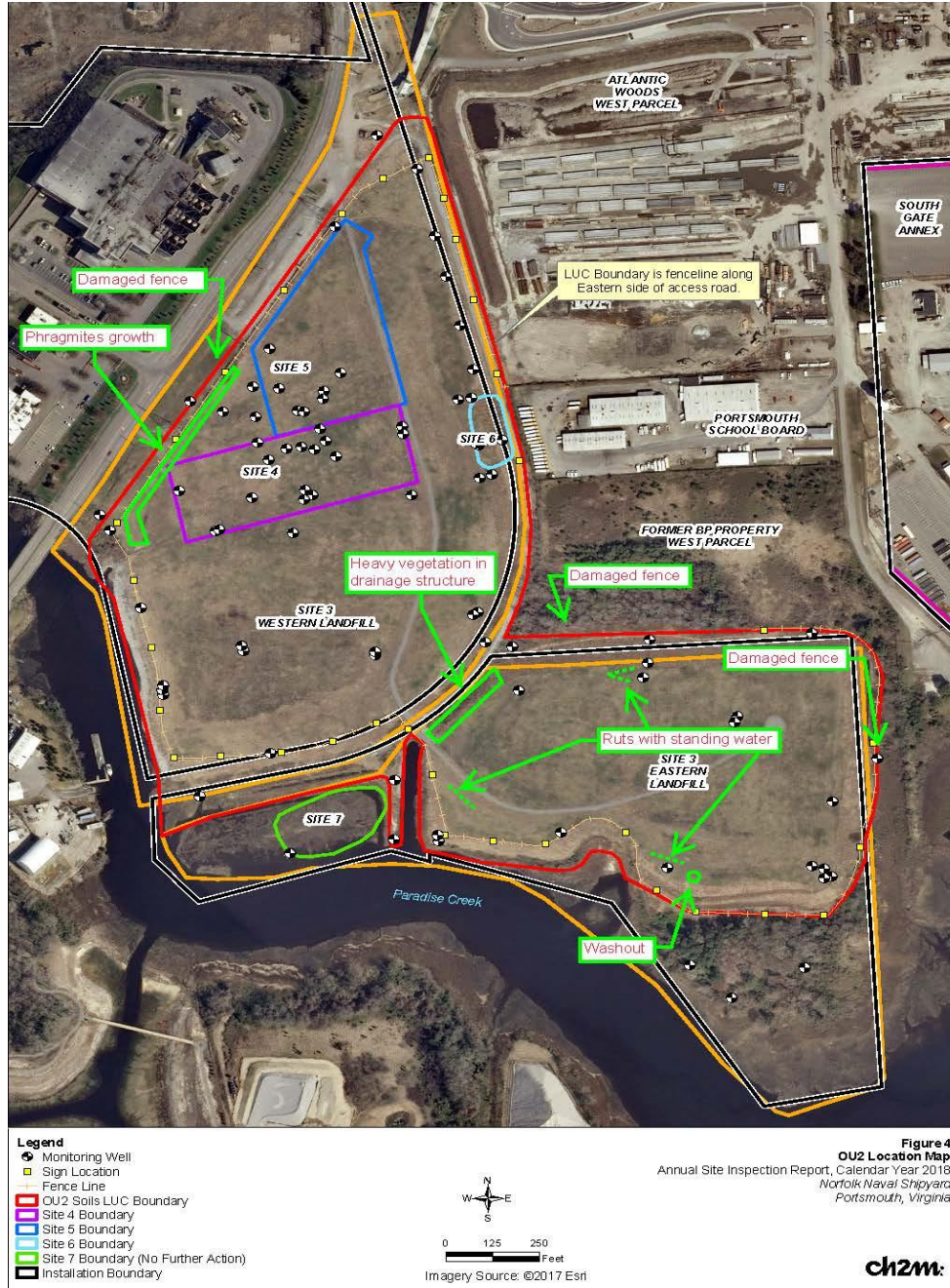
Imagery Source: ©2017 Esri

Figure 4
OU2 Location Map
Annual Site Inspection Report, Calendar Year 2018
Norfolk Naval Shipyard
Portsmouth, Virginia

Attachment 1
Site Inspection Checklists

Sites 3, 4, 5, 6, and 7 (OU2 - Paradise Creek Disposal Area and Associated Sites) Norfolk Naval Shipyard, Portsmouth, Virginia

Description: Site 3 is a 70 acre disposal area located to the north bank of Paradise Creek on the southern edge of NNSY. Sites 4, 5, and 6 are located to the north of the western portion of Site 3 and Site 7 is located to the south between Site 3 and Paradise Creek. Site 3 was used primarily for disposal of solid landfill waste. Sites 4, 6, and 7 were used as liquid waste holding sites. Site 5 was used as an oil reclamation area. Landfilling and storage at these sites began in the 1940s and continued until the 1980s. The sites are bounded to the south by Paradise Creek and to the landward side by various barriers, berms, fences and gates. Stormwater discharge and runoff is primarily to the south and east toward Paradise Creek.



Comments: (Provide related question number for each comment)

5 - Section of Northwest fencing in need of repair

5 - Two sections of fencing down at Site 3 Eastern Landfill

7 - Vegetative overgrowth was noted in site drainage structures

9 - Southeast landfill cover at Site 3 Eastern Landfill has an approximate 3 ft diameter washout

9 - Northwest Site 3 Western Landfill area with standing water and phragmites growth

9 - Ruts in landfill cover with standing water at various Site 3 Eastern Landfill locations

(Enter suggested improvements to this form)

Inspection performed by: Dan Christian

Date 12/06/18

General

Yes	No
-----	----

Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose. Note - maintenance of the soil cover is ongoing.

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

Is the area free of storage of any investigative derived waste (IDW) on site? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator to assure their awareness and concurrence with the on-site storage. Indicate if IDW is properly labeled, per example below.

Investigative Derived Waste
Purge water from *Site ID*
Date
Do not handle, analysis pending
Contact Name ER Coordinator, Phone Number

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

Is the area free of miscellaneous debris? If no, mark location of miscellaneous debris on figure, note its condition in the comment section below, and notify activity coordinator.

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

Is the area free of ER Site related activities/conditions resulting in stressed vegetation, scarred or stained asphalt/ground surface, or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

Site Specific

Is the site fencing in good condition and are gates locked? If no, describe condition of fence and/or uncontrolled access points, mark location(s) on map, and notify activity coordinator of any deficiencies in fences. Note - fences are in place at these sites as deterrents for Shipyard security purposes.

	X
--	---

Is the site signage in good condition? If no, describe condition of signage, mark deficient location(s) on map, and notify activity coordinator.

X	
---	--

Are drainage structures including ditches, swales, culverts, and channels free from sedimentation, blockage, obstructions, and erosion to facilitate proper drainage? If no, describe condition of drainage structures.

Site 3		X
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

Are site monitoring wells in good condition and appear to be locked? (i.e. damaged protective posts and/or well head/casing) If no, describe condition of the deficient monitoring well(s). Note - currently site monitoring wells are not part of long-term or ongoing groundwater monitoring programs.

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

Is the area free of any signs of disturbance (i.e. digging, settlement, cracking, holes, erosion) to the site cover/cap, as depicted on the figure? If no, describe condition of the deficient cover/cap, mark location of deficient cover/cap on map.

Site 3		X
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

Are roadways free of erosion, rutting, physical damage, and obstructions? If no, describe condition of roadways.

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	
Site 7	X	

General

Yes	No
X	

1 Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose.

X	
---	--

2 Is the area free of storage of any investigative derived waste (IDW) on site? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator. Indicate if IDW is properly labeled, per example below.

Investigative Derived Waste
Purge water from *Site ID*
Date
Do not handle, analysis pending
Contact *Name* IR Coordinator, *Phone Number*

X	
---	--

3 Is the area free of miscellaneous debris? If no, mark location of miscellaneous debris on figure, note its condition in the comment section below, and notify activity coordinator.

X	
---	--

4 Is the area free of stressed vegetation, scarred or stained asphalt/ground surface, or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.

Site Specific

Site signage and fences are in place for Shipyard security purposes and are not in place to restrict site access for reasons other than security.

X

X	
---	--

5 Is the area free of residential housing, elementary and secondary schools, childcare facilities, and playgrounds? If no, mark the address and location of the building/area and it's current use.

General

Yes	No
-----	----

The 1927 Landfill covers a large portion of the active, main Shipyard. Drum storage related to ongoing industrial activities and waste disposal areas are common within the site boundaries. The nature of any disturbances and/or storage should be noted and the department operating in that area should be identified by the inspector.

1	Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose.	X	
---	--	---	--

2	Is the area free of storage of any investigative derived waste (IDW) onsite? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator. Indicate if IDW is properly labeled, per example below.	X	
---	---	---	--

Investigative Derived Waste
Purge Water from *Site ID*
Date
Do not handle, analysis pending
Contact *Name* IR Coordinator, *Phone Number*

3	Is the area free of miscellaneous debris? If no, mark location of miscellaneous debris on figure, note its condition in the comment section below, and notify activity coordinator.	X	
---	---	---	--

4	Is the area free of stressed vegetation, scarred or stained asphalt/ground surface, or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.	X	
---	---	---	--

Site Specific

X

6	Is the area free of residential housing, elementary and secondary schools, childcare facilities, and playgrounds? If no, mark the	X	
---	---	---	--

7	Is the area free of construction activity and are buildings and or drydocks as depicted on the figure? If no, describe discrepancies and demolition or construction of new buildings.	X	
---	---	---	--

Annual Land Use Control Site Inspection Report Calendar Year 2019, Norfolk Naval Shipyard, Portsmouth, Virginia

PREPARED FOR: Naval Facilities Engineering Command Mid-Atlantic
PREPARED BY: CH2M HILL, Inc. (CH2M)
DATE: February 2020

Introduction

Annual land use control (LUC) site inspections (SI) are conducted to ensure that LUCs have been maintained with LUC requirements at Sites 10 and 17, and Operable Unit (OU) 2. LUC inspection requirements include the following actions:

- OU2 is to be inspected as follows:
 - Assess the condition of the soil cover.
 - Verify that LUC signs and gates restricting site access to authorized personnel are in place.
 - Inspect the final cover drainage system for ponding of water, erosion, and obstruction of culverts.
 - Inspect drainage structures, including ditches, swales, culverts, and channels, for sedimentation, blockage, obstructions, and erosion, and to ensure proper drainage.
 - Inspect roadways for erosion, rutting, physical damage, and obstructions.
 - Inspect the Paradise Creek shoreline for instability, erosion, and releveling.
 - Inspect the landfill gas venting system, landfill gas probes, and groundwater monitoring wells for damage and tampering.
- Verify that Sites 10 and 17, and OU2 are free of intrusive activities and dumping; in the case of Sites 10 and 17, verify that the sites are not developed for use as residential housing, elementary and secondary schools, childcare facilities, or playgrounds.

This Annual LUC SI Report summarizes the findings of the annual SIs conducted in November 2019.

Site History—Norfolk Naval Shipyard

Norfolk Naval Shipyard (NNSY) is in Portsmouth, Virginia, on the Southern Branch of the Elizabeth River, approximately 15 miles from the mouth of Chesapeake Bay (**Figure 1**). NNSY is the oldest continuously operated Shipyard in the United States, with origins dating back to 1767, when it was a merchant Shipyard under British rule and called the Gosport Shipyard. With the outbreak of the American Revolution in 1775, the Commonwealth of Virginia confiscated the Shipyard. In 1801, the federal government purchased the Shipyard.

Until the beginning of the Civil War, shipbuilding and repair facilities at the Shipyard gradually expanded. Federal authorities burned the Shipyard when war was imminent in 1861. The Confederacy took over the Shipyard and burned it two more times during the Civil War. Following the Civil War, the Shipyard was rebuilt and activities of repair, service, and construction of ships continued. During the First and Second World Wars, the Shipyard became greatly expanded and modernized.

After World War II, NNSY became primarily an overhaul and repair facility and has remained such to this day. NNSY's primary mission is to repair, overhaul, dry-dock, convert, modernize, and inactivate ships, and to provide logistics services in support of the fleet.

The following official mission has been assigned to this Shipyard by the Secretary of the Navy:

- Provide logistical support for assigned ships and service craft.
- Perform authorized work in connection with construction, conversion, overhaul, repair, alteration, dry-docking, and outfitting of ships and craft, as assigned.
- Perform manufacturing, research, development, and test work, as assigned.
- Provide services and material to other activities and units as directed by competent authority.

Site Histories

The following are brief environmental histories of the sites that require inspections of LUCs. An overview of the LUC boundaries is presented on **Figure 1**. LUCs are defined in and inspected according to requirements presented in each site's Record of Decision (ROD) and LUC Remedial Design (RD) report.

Site 10—1927 Disposal Area

Site 10 (**Figure 2**) is in the southern portion of the Main Shipyard in an area covered with paved roads, buildings, and parking lots. The Site 10 Disposal Area was used before 1927 and until 1941. Wastes disposed of at the site reportedly included various solid wastes generated by NNSY, salvage waste, abrasive blast material, fly ash, and asbestos waste. There is no design information for the landfill.

The 2008 ROD-required remedy for Site 10 consisted of LUCs to prohibit use of the site for residential housing, childcare, elementary and secondary schools, or playground facilities (Navy, 2008). Naval Facilities Engineering Command (NAVFAC) completed the LUC RD in 2010 (Navy, 2010b).

Site 17—Building 195 Metal Plating Shop

Site 17 (**Figure 3**) is located near the center of the Main Shipyard and consists of Building 195 and the surrounding asphalt paved area. Building 195 was the main plating shop at NNSY from the early 1970s through the mid-1980s. The formerly unpaved area north of Building 195 was used for coal storage from the 1920s until approximately 1966. The site currently contains inactive Building 195, and the remainder of the site is paved. The land use is industrial, and the surficial aquifer is not used as a potable water source.

The ROD-required remedy for Site 17 consisted of LUCs to prohibit use of the site for residential housing, childcare facilities, elementary and secondary schools, or playground facilities (Navy, 2006). NAVFAC completed the LUC RD in 2010 (Navy, 2010b).

OU2—Paradise Creek Disposal Area

The Paradise Creek Disposal Area (**Figure 4**) lies adjacent to Paradise Creek, south of the Main Shipyard. This OU is composed of five NNSY environmental restoration sites and contains the following:

- **Site 3, Sanitary Landfill**, was the Shipyard's landfill from 1954 through 1983. The types of waste disposed of at the site included salvage waste, abrasive blast material, boiler fly and bottom ash, residential trash, and industrial wastewater treatment plant sludge. The Site 3 Landfill consists of the Eastern Landfill and Western Landfill.
- **Site 4, Chemical Holding Pits**, is an area of five former chemical waste pits that received waste from 1963 to 1977. Site 4 is located entirely within the Western Landfill boundary.
- **Site 5, Oil Reclamation Area**, is a former underground storage tank (UST) site where the soils were contaminated by petroleum products related to site releases associated with the USTs, which were removed in 1982. Site 5 is located entirely within the Western Landfill boundary.

- **Site 6, East Dump**, is a former area where solvents were disposed of when the Site 4 pits were full. The area was active from the mid-1960s to 1977. Site 6 is located entirely within the Western Landfill boundary.
- **Site 7, Bermed Chemical Pits**, was active from the late 1950s through the 1970s. The type and quantity of waste disposed of here are unknown; however, a test pit investigation conducted in 2003 revealed a significant amount of calcium hydroxide. Most of the calcium hydroxide formed a berm along the perimeter of the site. Site 7 was excavated and restored as a tidal wetland with a non-time-critical removal action that was completed in 2006. Site 7 does not require further action; the removal action completed in 2006 eliminated potential risks in all media.

The ROD-required soil remedy for OU2 consisted of a soil cover with side slope stabilization and LUCs to prevent receptors from direct contact with contaminated soil that could pose unacceptable risk. The soil cover also would reduce the potential for further erosion while being compatible with future actions that might be taken for groundwater at the site (Navy, 2010a). NAVFAC completed the LUC RD in 2011 (Navy, 2011).

2019 Annual Inspection Results—Norfolk Naval Shipyard

The 2019 inspections were completed on November 14, 2019. The SI checklists are included in **Attachment 1**. The following are results of the inspections for each site:

- Site 10
 - There were no deficiencies observed at Site 10.
- Site 17
 - Intrusive activities were observed along the southeastern boundary of Site 17. The asphalt surface of Stevens Street had been removed to allow for resurfacing of Stevens Street; however, no soil was observed to be exposed.
- OU2
 - Repairs are necessary at one portion of fencing north of the Site 3 Eastern Landfill.
 - Four notification signs along the perimeter fencing could not be located during the SI.
 - Phragmites growth noted along the western boundary of the Site 3 Western Landfill and the drainage swale at the southern boundary of Site 4, which could indicate a depression in the soil cover or an improperly draining swale or ditch.
 - Vegetative overgrowth noted in the drainage structure at the Site 3 Western Landfill and Site 3 Eastern Landfill.
 - Five wells were noted to be missing the steel protective casing cover.
 - Monitoring wells within the perimeter fencing were not secured with locks.
 - Large diameter trees (greater than 3 inches) were noted growing along the perimeter of the soil cover and along the slope of the cover at several areas of Site 3 (Western and Eastern Landfill).

Summary

The Navy Remedial Project Manager of NNSY was notified that no deficiencies were identified that needed immediate attention and was provided with a summary of the inspection observations. The Navy is currently working on a contract to repair the deficiencies noted at OU2, and those deficiencies will be monitored during future SIs.

References

Department of the Navy (Navy). 2006. *Record of Decision, Site 17, Norfolk Naval Shipyard, Portsmouth, Virginia*. August.

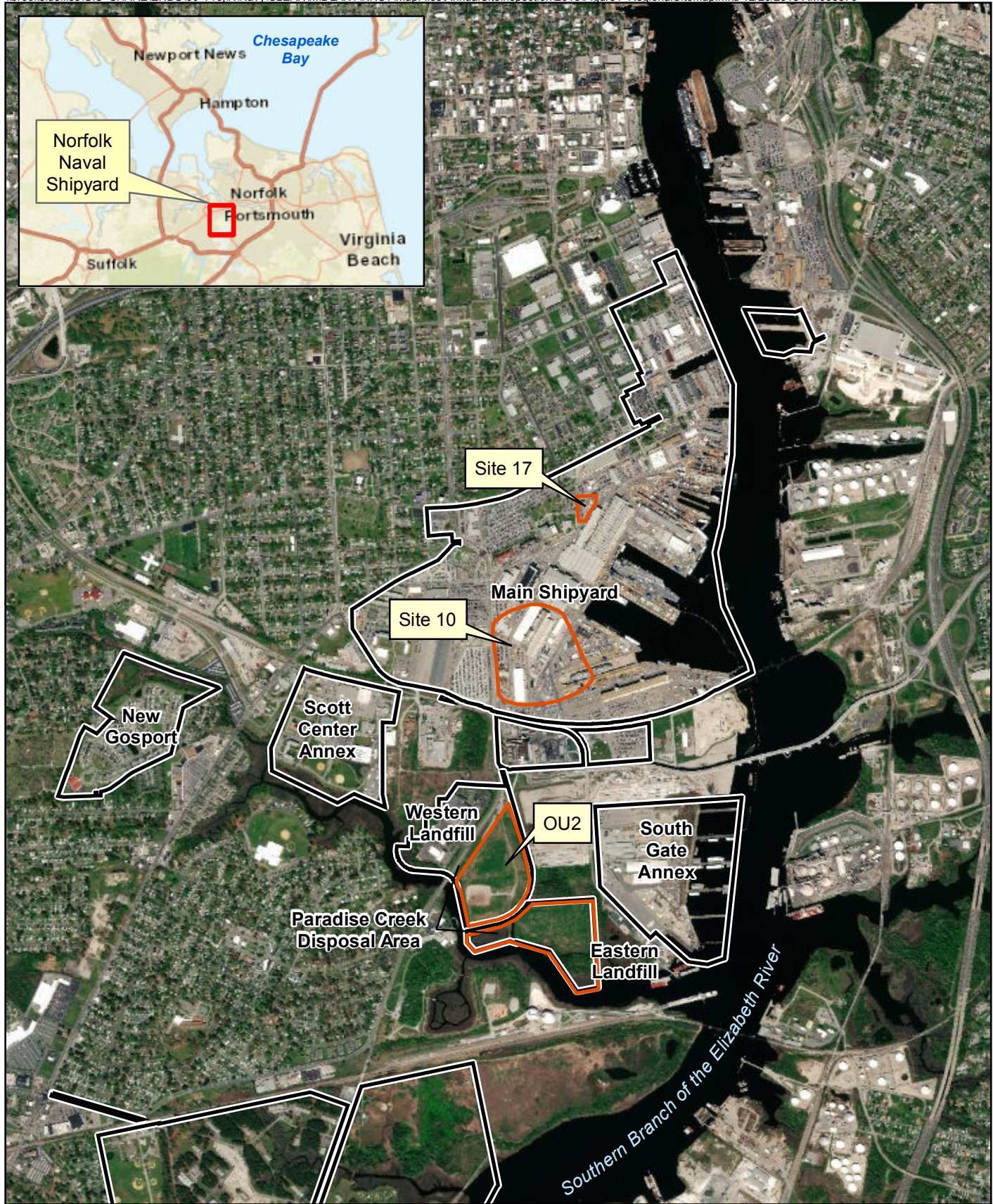
Navy. 2008. *Record of Decision, Site 10, Norfolk Naval Shipyard, Portsmouth, Virginia*. September.

Navy. 2010a. *Record of Decision, OU2, Paradise Creek Disposal Area (Soil), Norfolk Naval Shipyard, Portsmouth, Virginia*. May.

Navy. 2010b. *Remedial Design Land Use Controls for Site 10 – The 1927 Landfill and Site 17 – Building 195 Plating Shop, Norfolk Naval Shipyard, Portsmouth, Virginia*. September.

Navy. 2011. *Remedial Design Land Use Controls for OU2 Paradise Creek Disposal Area, Norfolk Naval Shipyard, Portsmouth, Virginia*. June.

Figures



Legend
[Orange outline] Land Use Control Boundary
[Black outline] Installation Boundary



0 1,000 2,000
Feet

Imagery Source: ©2017 Esri

Figure 1
Site and LUC Boundary Map
Annual Site Inspection Report, Calendar Year 2018
Norfolk Naval Shipyard
Portsmouth, Virginia





- Legend**
- Site 10 LUC Boundary
 - Installation Boundary

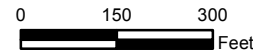
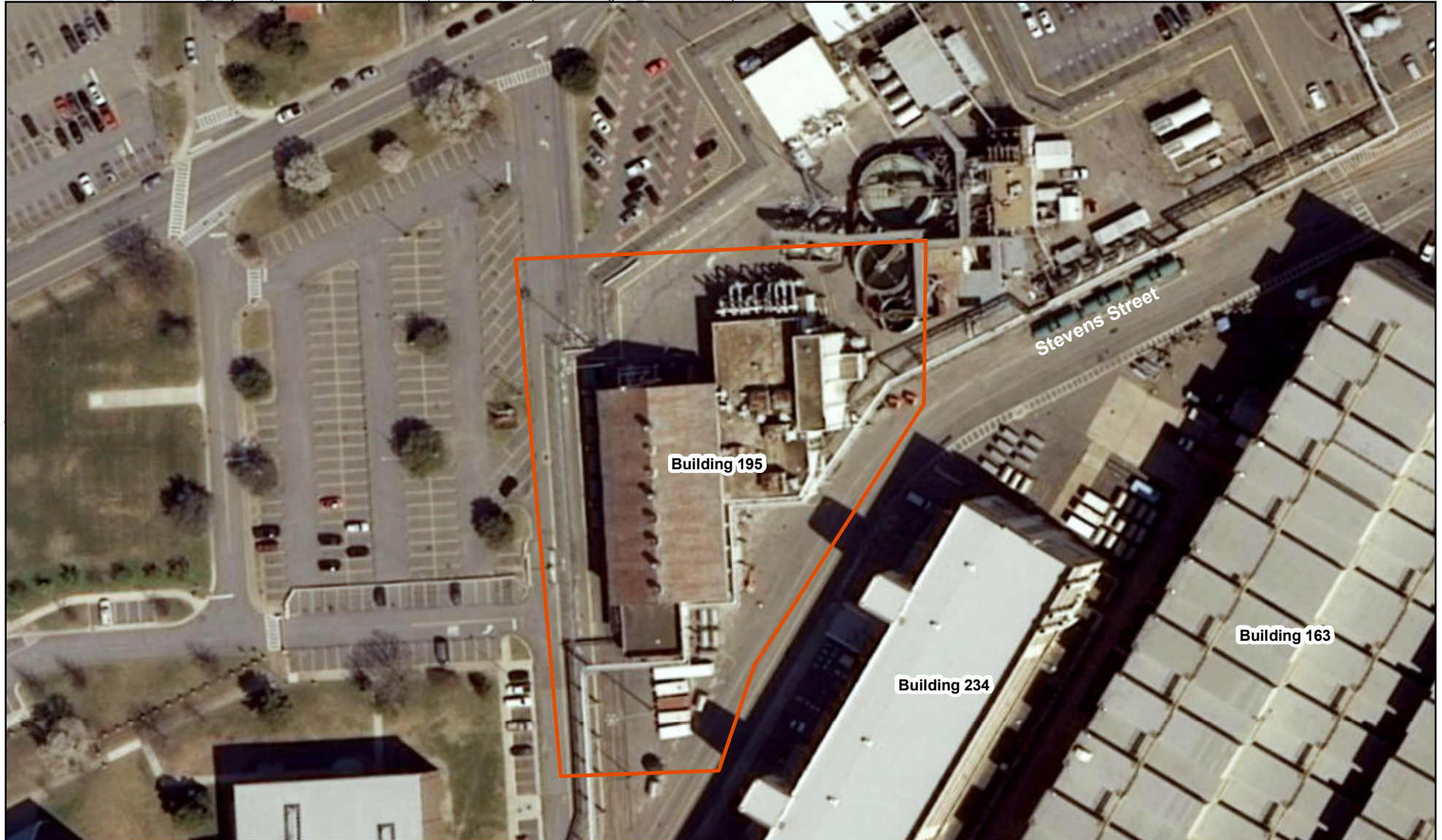
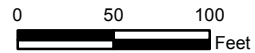


Figure 2
Site 10 Location Map
Annual Site Inspection Report, Calendar Year 2018
Norfolk Naval Shipyard
Portsmouth, Virginia



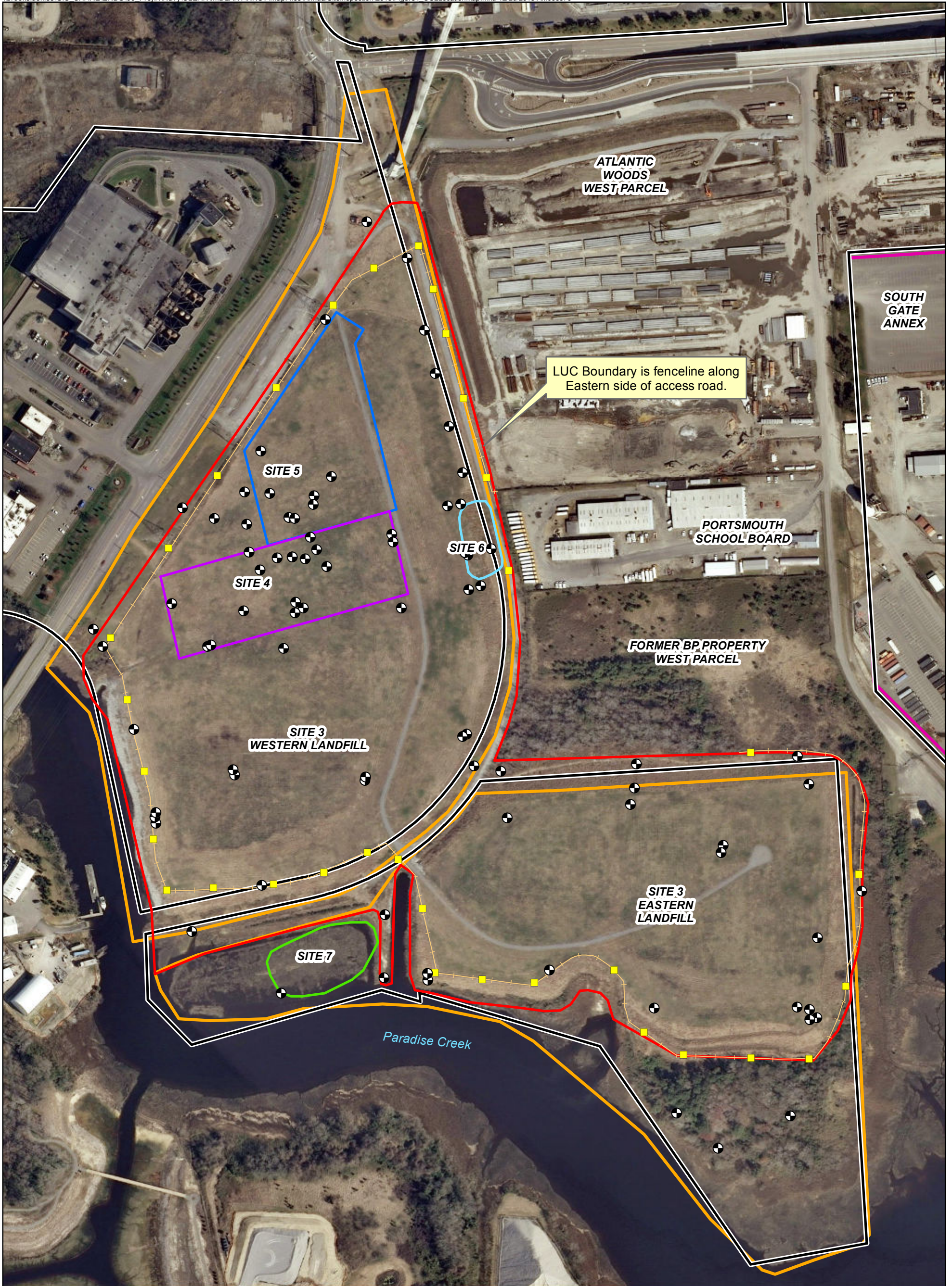
Legend
[Orange Outline] Site 17 LUC Boundary



Imagery Source: ©2017 Esri

Figure 3
Site 17 Location Map
Annual Site Inspection Report, Calendar Year 2018
Norfolk Naval Shipyard
Portsmouth, Virginia





LUC Boundary is fence line along Eastern side of access road.

- Legend**
- Monitoring Well
 - Sign Location
 - Fence Line
 - OU2 Soils LUC Boundary
 - Site 4 Boundary
 - Site 5 Boundary
 - Site 6 Boundary
 - Site 7 Boundary (No Further Action)
 - Installation Boundary



0 125 250
Feet

Imagery Source: ©2017 Esri

Figure 4
OU2 Location Map
Annual Site Inspection Report, Calendar Year 2018
Norfolk Naval Shipyard
Portsmouth, Virginia



Attachment 1
Site Inspection Checklists

Sites 3, 4, 5, 6, and 7 (OU2 - Paradise Creek Disposal Area and Associated Sites) Norfolk Naval Shipyard, Portsmouth, Virginia

Description: Site 3 is a 70 acre disposal area located to the north bank of Paradise Creek on the southern edge of NNSY. Sites 4, 5, and 6 are located to the north of the western portion of Site 3 and Site 7 is located to the south between Site 3 and Paradise Creek. Site 3 was used primarily for disposal of solid landfill waste. Sites 4, 6, and 7 were used as liquid waste holding sites. Site 5 was used as an oil reclamation area. Landfilling and storage at these sites began in the 1940s and continued until the 1980s. The sites are bounded to the south by Paradise Creek and to the landward side by various barriers, berms, fences and gates. Stormwater discharge and runoff is primarily to the south and east toward Paradise Creek. LUC Inspections are only for Sites 3 through 6 and exclude Site 7 (NFA).



Comments: (Provide related question number for each comment)

Site Specific Question 5 - A break in in the perimeter security fence was noted north of Site 3 - Eastern Landfill
Site Specific Question 6 - Signs were missing or could not be found at 4 locaitons along the perimeter fencing.
Site Specific Question 8 - All monitoring wells outside of the fence were found to be equipped with locks; monitoring wells within the locked security fence were not locked.
Site Specific Question 9 - Large diameter trees (>3") were observed along the edge of the landfill cap or in the slope of the landfill cap in various areas of Site 3.
(Enter suggested improvements to this form)

Inspection performed by: (Print and sign)

Date

General

Yes	No
------------	-----------

1 Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose. Note - maintenance of the soil cover is ongoing.

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	

2 Is the area free of storage of any investigative derived waste (IDW) on site? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator to assure their awareness and concurrence with the on-site storage. Indicate if IDW is properly labeled, per example below.

Investigative Derived Waste
Purge water from *Site ID*
Date
Do not handle, analysis pending
Contact *Name* ER Coordinator, *Phone Number*

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	

3 Is the area free of miscellaneous debris? If no, mark location of miscellaneous debris on figure, note its condition in the comment section below, and notify activity coordinator.

Site 3 - Miscellaneous wood / concrete debris observed in the southwest corner of the western landfill.		X
Site 4	X	
Site 5	X	
Site 6	X	

4 Is the area free of ER Site related activities/conditions resulting in stressed vegetation, scarred or stained asphalt/ground surface, or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.

Site 3	X	
Site 4	X	
Site 5	X	
Site 6	X	

Site Specific

- 5 Is the site fencing in good condition and are gates locked? If no, describe condition of fence and/or uncontrolled access points, mark location(s) on map, and notify activity coordinator of any deficiencies in fences. Note - fences are in place at these sites as deterrents for Shipyard security purposes.

	X
--	---
- 6 Is the site signage in good condition? If no, describe condition of signage, mark deficient location(s) on map, and notify activity coordinator.

	X
--	---
- 7 Are drainage structures including ditches, swales, culverts, and channels free from sedimentation, blockage, obstructions, and erosion to facilitate proper drainage? If no, describe condition of drainage structures.
 Site 3 - Drainage swales in the western portion of the western landfill and eastern landfill contain overgrowth in the channel and trees growing in the riprap.

	X
--	---
- | | | |
|--------|---|--|
| Site 4 | X | |
| Site 5 | X | |
| Site 6 | X | |
- 8 Are site monitoring wells in good condition and appear to be locked? (i.e. damaged protective posts and/or well head/casing) If no, describe condition of the deficient monitoring well(s). Note - currently site monitoring wells are not part of long-term or ongoing groundwater monitoring programs.
- | | | |
|--|---|---|
| Site 3 - All wells missing locks | X | |
| Site 4 - One 4-inch monitoring well missing steel protective casing cover; all wells missing locks | | X |
| Site 5 - Four recovery wells missing steel protective casing cover; all wells missing locks | | X |
| Site 6 - All wells missing locks | X | |
- 9 Is the area free of any signs of disturbance (i.e. digging, settlement, cracking, holes, erosion) to the site cover/cap, as depicted on the figure? If no, describe condition of the deficient cover/cap, mark location of deficient cover/cap on map.
- | | | |
|--------|---|---|
| Site 3 | | X |
| Site 4 | X | |
| Site 5 | X | |
| Site 6 | X | |
- 10 Are roadways free of erosion, rutting, physical damage, and obstructions? If no, describe condition of roadways.
- | | | |
|--------|---|--|
| Site 3 | X | |
| Site 4 | X | |
| Site 5 | X | |
| Site 6 | X | |
- 11 Are site gas vents and probes, as depicted on the figure, in good condition? (i.e. damaged protective posts and/or vent risers)
- | | | |
|--------|---|--|
| Site 3 | X | |
| Site 4 | X | |
| Site 5 | X | |
| Site 6 | X | |

General

Yes	No
	X

1 Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose.

X	
---	--

2 Is the area free of storage of any investigative derived waste (IDW) on site? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator. Indicate if IDW is properly labeled, per example below.

Investigative Derived Waste
Purge water from *Site ID*
Date
Do not handle, analysis pending
Contact *Name* IR Coordinator, *Phone Number*

X	
---	--

3 Is the area free of miscellaneous debris? If no, mark location of miscellaneous debris on figure, note its condition in the comment section below, and notify activity coordinator.

X	
---	--

4 Is the area free of stressed vegetation, scarred or stained asphalt/ground surface, or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.

Site Specific

Site signage and fences are in place for Shipyard security purposes and are not in place to restrict site access for reasons other than security.

X	
---	--

5 Is the area free of residential housing, elementary and secondary schools, childcare facilities, and playgrounds? If no, mark the address and

General

The 1927 Landfill covers a large portion of the active, main Shipyard. Drum storage related to ongoing industrial activities and waste disposal areas are common within the site boundaries. The nature of any disturbances and/or storage should be noted and the department operating in that area should be identified by the inspector.

Yes	No
-----	----

1	Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose.		X
---	--	--	---

2	Is the area free of storage of any investigative derived waste (IDW) on site? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator. Indicate if IDW is properly labeled, per example below.	X	
---	--	---	--

Investigative Derived Waste
Purge water from *Site ID*
Date
Do not handle, analysis pending
Contact *Name* IR Coordinator, *Phone Number*

3	Is the area free of miscellaneous debris? If no, mark location of miscellaneous debris on figure, note its condition in the comment section below, and notify activity coordinator.	X	
---	---	---	--

4	Is the area free of stressed vegetation, scarred or stained asphalt/ground surface, or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.	X	
---	---	---	--

Site Specific

6	Is the area free of residential housing, elementary and secondary schools, childcare facilities, and playgrounds? If no, mark the address and	X	
---	---	---	--

7	Is the area free of construction activity and are Buildings and or drydocks as depicted on the Figure? If no, describe discrepancies and demolition or construction of new buildings.		X
---	---	--	---

Appendix B
Public Notices



**PUBLIC NOTICE
CERCLA Five-Year Review
Norfolk Naval Shipyard
Portsmouth, Virginia**

The Department of the Navy and the United States Environmental Protection Agency Region 3, with concurrence from the Virginia Department of Environmental Quality, are announcing the start of the third Five-Year Review of the existing Record of Decision (ROD) documents and associated remedial actions at Norfolk Naval Shipyard, located in Portsmouth, Virginia. The Five-Year Review will include Sites 3, 4, 5, and 6 (Operable Unit [OU] 2), Site 17 (OU 4), and Site 10 (OU 6).

The purpose of a Five-Year Review is to ensure that cleanup actions are continuing to protect human health and the environment. A site is included in the Five-Year Review if contaminants remain in environmental media greater than levels that would allow for unlimited use and unrestricted exposure and if there is a signed ROD in place. The ROD, which includes an evaluation of the potential human health or environmental risks posed by the site, documents the cleanup remedy that was selected following consideration of public comments.

The final report is anticipated to be complete in August 2021.

RODs and Remedial Actions to be Reviewed:

Sites 3, 4, 5, and 6 (OU 2) – Paradise Creek Disposal Area: The ROD was signed in May 2010 to address unacceptable human health risks posed by metals and polycyclic aromatic hydrocarbons in soil and waste-in-place. The selected remedy includes installation of a soil cover over the landfill contents, side slope stabilization, and land use controls (LUCs). The selection was chosen to prevent exposure to metals and polycyclic aromatic hydrocarbons in site soil and waste remaining in place and prohibit land development, unauthorized access, or activities which negatively affect the integrity of the soil cover.

Site 17 (OU 4) – Building 195 – Plating Shop: The ROD was signed in August 2006 to address potential unacceptable risk to future residents from exposure to site soils. The selected remedy, LUCs, was chosen to prevent unrestricted exposure to contaminated soil by prohibiting the development and use of the property for residential housing, elementary or secondary schools, childcare facilities, or a playground.

Site 10 (OU 6) – 1927 Landfill: The ROD was signed in September 2008 to address potential unacceptable risk to future residents from exposure to lead in site soils. The selected remedy, LUCs, was chosen to prevent the development and use of the property for residential housing, elementary or secondary schools, childcare facilities, or a playground.

FOR MORE INFORMATION

The public is encouraged to participate in this review. If you have questions or information regarding the effectiveness of the remedies that would help the review team, please contact:

Terri Davis, Public Affairs Officer
Phone: (757) 396-8122
Email: terri.k.davis@navy.mil

The Navy has established a public website, where detailed site information can be accessed, as well as the Administrative Record file for Norfolk Naval Shipyard, at the following location:
<https://go.usa.gov/cwTf5>

Virginian Pilot Classifieds

Notices

Posted February 16, 2020

PUBLIC NOTICE CERCLA Five-Year...

PUBLIC NOTICE

CERCLA Five-Year Review

Norfolk Naval Shipyard

Portsmouth, Virginia

The Department of the Navy and the United States Environmental Protection Agency Region 3, with concurrence from the Virginia Department of Environmental Quality, are announcing the start of the third Five-Year Review of the existing Record of Decision (ROD) documents and associated remedial actions at Norfolk Naval Shipyard, located in Portsmouth, Virginia.

The Five-Year Review will include Sites 3, 4, 5, and 6 (Operable Unit [OU] 2), Site 17 (OU 4), and Site 10 (OU 6).

The purpose of a Five-Year Review is to ensure that cleanup actions are continuing to protect human health and the environment. A site is included in the Five-Year Review if contaminants remain in environmental media greater than levels that would allow for unlimited use and unrestricted exposure and if there is a signed ROD in place. The ROD, which includes an evaluation of the potential human health or environmental risks posed by the site, documents the cleanup remedy that was selected following consideration of public comments.

The final report is anticipated to be complete in August 2021.

RODs and Remedial Actions to be Reviewed:

Sites 3, 4, 5, and 6 (OU 2) - Paradise Creek Disposal Area: The ROD was signed in May 2010 to address unacceptable human health risks posed by metals and polycyclic aromatic hydrocarbons in soil and waste-in-place. The selected remedy includes installation of a soil cover over the landfill contents, side slope stabilization, and land use controls (LUCs). The selection was chosen to prevent exposure to metals and polycyclic aromatic hydrocarbons in site soil and waste remaining in place and prohibit land development, unauthorized access, or activities which negatively affect the integrity of the soil cover.

Site 17 (OU 4) - Building 195 - Plating Shop: The ROD was signed in August 2006 to address potential unacceptable risk to future residents from exposure to site soils. The selected remedy, LUCs, was chosen to prevent unrestricted exposure to contaminated soil by prohibiting the development and use of the property for residential housing, elementary or secondary schools, childcare facilities, or a playground.

Site 10 (OU 6) - 1927 Landfill: The ROD was signed in September 2008 to address potential unacceptable risk to future residents from exposure to lead in site soils. The selected remedy, LUCs, was chosen to prevent the development and use of the property for residential housing, elementary or secondary schools, childcare facilities, or a playground.

FOR MORE INFORMATION

The public is encouraged to participate in this review. If you have questions or information regarding the effectiveness of the remedies that would help the review team, please contact:

Terri Davis, Public Affairs Officer

Phone: (757) 396-8122

Email: terri.k.davis@navy.mil

The Navy has established a public website, where detailed site information can be accessed, as well as the Administrative Record file for Norfolk Naval Shipyard, at the following location: <https://go.usa.gov/cwTf5> 2/16/2020 6599690

Appendix C
Interview Questionnaire

Norfolk Naval Shipyard Five-Year Review Interview Questions

Date: 3/23/2020 and 3/25/2020
Name: Compiled
Title/organization: Mechanical Engineer (Utilities) NAVFAC FEAD, Installation Environmental Program Director
Address: N/A
Email/phone: N/A

Summary of Review and Remedy:

As a contractor to the Navy, CH2M (now Jacobs) is assisting in the Navy 5-year review process for remedial actions related to potential environmental contamination present at Norfolk Naval Shipyard (NNSY). The following remedies were selected for each site.

Site 10 (OU 6) – 1927 Landfill:

- The Record of Decision (ROD) was signed in September 2008 to address potential unacceptable risk to future residents from exposure to lead in site soils.
- Land use controls (LUCs) were the selected remedy to prohibit non-industrial use.

Site 17 (OU 4) – Building 195 – Plating Shop:

- The ROD was signed in August 2006 to address potential unacceptable risk to future residents from exposure to site soils.
- LUCs were the selected remedy to prohibit non-industrial use and restrict exposure to contaminated soil.

Sites 3, 4, 5, and 6 (OU 2) – Paradise Creek Disposal Area:

- The ROD was signed in May 2010 to address unacceptable human health risks posed by metals and polycyclic aromatic hydrocarbons in soil and waste-in-place.
- The selected remedy includes installation of a soil cover over the landfill contents, side slope stabilization, and land use controls (LUCs) to prohibit non-industrial use.

More information about each remedy is attached below in Table 2-6 from the Site Management Plan.

Questions:

1. What is your overall impression of the program?

- Overall the program is effective and seems to be working well. The RPM reviews all projects that need environmental checklists (ECs) and provides comments which get transferred into the scopes of work. RPM also reviews the 90% designs to see if close to/within LUC boundary and responds to questions and concerns from the planners and contractors.

- I am impressed with the dedication and sense of responsibility everyone has invested in to these Management plans and projects.

2. What impacts, if any, has the remedy had on the surrounding community? Are you aware of any community concerns?

- The Paradise Creek site, in partnership with the City of Portsmouth has created a welcoming park. The LUCs do not impact on the ability of Portsmouth citizens to be able to enjoy the local park area. Other sites (10, 17) are well within the government boundary and do not impact the community.
- Don't see many specific concerns about the ER program but do see basic concerns (unrelated to IRP) from community. The area near NNSY is also an environmental justice area. The fact that the program is cleaning up sites is good. There are people in the community monitoring the environmental actions. Look forward to the RAB being reinstated.

3. Does the program and/or site remedies affect the day to day base operations? If so, how?

- Not tremendously, no intention to use land otherwise (daycare etc), other things that are required in the EC are also generally required for all work on the Base.
- The program, nor the remedies do not affect day to day operations. However, design projects that include excavation (site 10) are affected. The soil is considered "hazardous" and must be addressed by the local environmental department. There is an additional cost for this work.

4. Are LUCs and their objectives clear to appropriate base personnel and are the LUCs functioning as intended? If not, what recommendations would you make to increase awareness?

- They are in the ECs and functioning as intended. Might be helpful to have a booth at the earth day event (or other similar Base event) or have flyers for shipyard employees/community. If we end up having tours as part of the RAB it would be helpful to point these sites out.
- 1. The LUCs are not clearly delineated on the base, nor to base personnel. Site 10 is not physically bounded nor is there any signage onsite. Site 17 is not noted on site, but the building has been abandoned in place.
- 2. Recommendations would include a link on the NAVFAC website that provides information in regards to the Sites and the LUCs with maps. Signage would assist anyone who is not familiar with the environmental program or environmental sensitivities.

5. Do you have any comments or recommendations regarding the program and/or site remedies?

- Could include any specific information on the LUCs in Public Works Department monthly reports if needed. Keep Public Affairs Officer in the loop.
- Publicize the program and sites more. The history of these sites is of interest to many. Again, signage would prevent accidental impact to these sites by local shops/departments/codes. NNSY has an intranet. This would also be a good place for a link to a website with more information.

SMP Table 2-6 Environmental Restoration Program Land Use Controls

Norfolk Naval Shipyard

Portsmouth, Virginia

Environmental Restoration Program Site	Site Name	Date of Final ROD	Location on NNSY	Estimated Area	LUC Objectives	LUC Implementation and Maintenance Actions
OU 2 (Sites 3, 4, 5, 6, & 7)	Paradise Creek Disposal Area	May-10	South of the main shipyard, east of Victory Boulevard	91 acres	1) Prevent exposure to contaminated soils and waste remaining in place 2) Prohibit residential development or any other land use inconsistent with the RAO and selected soil remedy 3) Prevent unauthorized access to the site with fencing, secured and locked gates, No-Trespassing signs, and limited site access 4) Prevent activities that negatively affect the integrity of the soil cover and side slopes 5) Comply with the Post-Closure Monitoring Plan, which includes gas monitoring, visual inspections, and maintenance activities.	<ul style="list-style-type: none"> ●5-year site remedy reviews ●Annual inspections of LUCs ●Indicate where LUCs have been imposed and annotate LUC objectives in the Navy GIS database and real estate summary map(s) for the installation, and follow LUC-related procedures pertaining to the ground-disturbing activity and changes in land use ● Post and maintain No-Trespassing signs ●Notify USEPA and VDEQ at least 45 days in advance of: proposals for changes in land use that would be inconsistent with use restrictions and exposure assumptions described in the ROD; any anticipated action that may disrupt LUC effectiveness; or any action that may alter or negate the need for LUCs ●Notify USEPA and VDEQ 6 months in advance of any anticipated transfer, out of Navy custody and control, of real property subject to LUCs ●Notify USEPA and VDEQ as soon as practicable of the discovery of activity at OU2 inconsistent with LUC objectives, and then promptly investigate and take appropriate corrective action ●Obtain USEPA and VDEQ concurrence prior to modifying or terminating LUC objectives or required LUC implementation actions ●Maintain a comprehensive list of LUCs with associated boundaries and expected durations ●Notify and invite comment from USEPA and VDEQ at least 14 days prior to making changes to internal LUC-related policies or procedures if such changes are reasonably likely to negatively impact the effectiveness of LUCs
Site 10	1927 Disposal Area	Sep-08	Southern portion of main shipyard east of Williams avenue and west of Dry Dock 8 and Slip 5.	36 acres	1) Prevent residential or childcare use until site conditions allow for unlimited use and unrestricted exposure to surface and subsurface soil	<ul style="list-style-type: none"> ●5-year site remedy reviews ●Annual inspections of LUCs ●Indicate where LUCs have been imposed and annotate LUC objectives in the Navy GIS database and real estate summary map(s) for the installation, and follow LUC-related procedures pertaining to the ground-disturbing activity and changes in land use ●Notify USEPA and VDEQ at least 45 days in advance of: proposals for changes in land use that would be inconsistent with use restrictions and exposure assumptions described in the ROD; any anticipated action that may disrupt LUC effectiveness; or any action that may alter or negate the need for LUCs ●Notify USEPA and VDEQ 6 months in advance of any anticipated transfer, out of Navy custody and control, of real property subject to LUCs ●Notify USEPA and VDEQ as soon as practicable of the discovery of activity at Site 10 inconsistent with LUC objectives, and then promptly investigate and take appropriate corrective action ●Obtain USEPA and VDEQ concurrence prior to modifying or terminating LUC objectives or required LUC implementation actions ●Maintain a comprehensive list of LUCs with associated boundaries and expected durations ●Notify and invite comment from USEPA and VDEQ at least 14 days prior to making changes to internal LUC-related policies or procedures if such changes are reasonably likely to negatively impact the effectiveness of LUCs

SMP Table 2-6 Environmental Restoration Program Land Use Controls

Norfolk Naval Shipyard

Portsmouth, Virginia

Environmental Restoration Program Site	Site Name	Date of Final ROD	Location on NNSY	Estimated Area	LUC Objectives	LUC Implementation and Maintenance Actions
Site 17	Building 195 Metal Plating Shop	Aug-06	Central portion of the main shipyard within the Controlled Industrial Area.	< 1 acre	1) Prevent residential or childcare use until site conditions allow for unlimited use and unrestricted exposure to surface and subsurface soil 2) Prohibit unrestricted exposure to contaminated soil	<ul style="list-style-type: none"> ●5-year site remedy reviews ●Annual inspections of LUCs ●Indicate where LUCs have been imposed and annotate LUC objectives in the Navy GIS database and real estate summary map(s) for the installation, and follow LUC-related procedures pertaining to the ground-disturbing activity and changes in land use ●Notify USEPA and VDEQ at least 45 days in advance of: proposals for changes in land use that would be inconsistent with use restrictions and exposure assumptions described in the ROD; any anticipated action that may disrupt LUC effectiveness; or any action that may alter or negate the need for LUCs ●Notify USEPA and VDEQ 6 months in advance of any anticipated transfer, out of Navy custody and control, of real property subject to LUCs ●Notify USEPA and VDEQ as soon as practicable of the discovery of activity at Site 10 inconsistent with LUC objectives, and then promptly investigate and take appropriate corrective action ●Obtain USEPA and VDEQ concurrence prior to modifying or terminating LUC objectives or required LUC implementation actions ●Maintain a comprehensive list of LUCs with associated boundaries and expected durations ●Notify and invite comment from USEPA and VDEQ at least 14 days prior to making changes to internal LUC-related policies or procedures if such changes are reasonably likely to negatively impact the effectiveness of LUCs

Notes:

USEPA - United States Environmental Protection Agency

VDEQ- Virginia Department of Environmental Quality

LUC - land use control

ROD - Record of Decision

NNSY - Norfolk Naval Shipyard

Appendix D

2016 Five-Year Review Recommendations
Preliminary Investigation Results

Table D-1. OU4 (Site 17) Per- and Polyfluoroalkyl Substances Results in Groundwater

Station ID	SLs (Oct, 2019; USEPA, 2021) ¹	IR17-MW22	IR17-MW23	IR17-MW24		IR17-MW25	IR17-MW26
Sample ID		IR17-MW22-0220	IR17-MW23-0220	IR17-MW24-0220	IR17-MW24P-0220	IR17-MW25-0220	IR17-MW26-0220
Sample Date		02/05/20	02/05/20	02/05/20	02/05/20	02/05/20	02/05/20
Chemical Name							
Per- and Polyfluorinated Alkyl Substances (ng/l)							
Perfluorooctane sulfonic acid (PFOS)	40	19.1	98.7	80.3	75.6	976	31.0
Perfluorooctanoic acid (PFOA)	40	24.2	36.2	1,134	927	265	19.9
Perfluorobutanesulfonic acid (PFBS)	600	5.66	11.4	318	267	135	17.4

Notes:

Shading indicates exceedance of SLs

J - Analyte present, value may or may not be accurate or precise

ng/l - Nanograms per liter

¹SLs for PFOA and PFOS listed above were calculated using the RSL calculator and a hazard quotient (HQ) of 0.1 in accordance with the process described in the Assistant Secretary of Defense memo, dated October 15, 2019. The SL for PFBS was calculated similarly, but the value was updated based on *Human Health Toxicity Values for Perfluorobutane Sulfonic Acid and Related Compound Potassium Perfluorobutane Sulfonate* (USEPA, April 2021).

Table D-2. OU6 (Site 10) Preliminary Dioxin and Furan Results in Soil

Sample ID	Industrial Soil RSLs, HQ=0.1 (May 2020)	Risk-Based SSLs, HQ=0.1 (May 2020)	IR10-SB01-0708-0120 1/27/20	IR10-SB04-0607-0120 1/29/20	IR10-SB09-0607-0120 1/29/20	IR10-SB10-0708-0120 1/30/20	IR10-SB10P-0708-0120 1/30/20	IR10-SB13-0708-0120 1/28/20	IR10-SB14-0809-0120 1/28/20	IR10-SB15-0506-0120 1/30/20	IR10-SB17-0506-0120 1/31/20
Chemical Name											
Dioxin/Furans (NG/KG)											
1,2,3,4,6,7,8-Heptachlorodibenzofuran	--	--	37.7	25.5	0.314 J	0.294 J	1.2 U	0.738 J	1.07 J	12.3	18.5
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	75.3	33.3	14	85.1	77.5	39.1	33.2	45.6	57.8
1,2,3,4,7,8,9-Heptachlorodibenzofuran	--	--	2.52 J	2.06 J	1.14 U	1.17 U	1.2 U	1.15 U	1.32 U	0.717 J	2.13 J
1,2,3,4,7,8-Hexachlorodibenzofuran	--	--	10.2	14.6	1.14 U	1.17 U	1.2 U	1.15 U	0.349 J	3.1 J	4.55 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	--	--	2.15 J	1.39 J	0.34 J	0.465 J	0.306 J	1.15 U	0.841 J	1.05 J	1.65 J
1,2,3,6,7,8-Hexachlorodibenzofuran	--	--	9.2	8.14	1.14 U	1.17 U	1.2 U	1.15 U	1.32 U	2.98 J	3.49 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	2.8 J	2.96 J	0.477 J	0.699 J	0.444 J	0.48 J	1.17 J	1.32 J	2.81 J
1,2,3,7,8,9-Hexachlorodibenzofuran	--	--	2.78 J	2.25 J	1.14 U	1.17 U	1.2 U	1.15 U	1.32 U	0.737 J	1.42 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	3.15 J	2.69 J	0.892 J	1.45 J	1.3 J	0.897 J	2.15 J	2.15 J	3.21 J
1,2,3,7,8-Pentachlorodibenzofuran	--	--	6.78	10.3	1.14 U	0.334 J	1.2 U	1.15 U	1.32 U	2.55 J	2.69 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	--	--	2.29 J	1.18 U	1.14 U	1.17 U	1.2 U	1.15 U	0.67 J	0.906 J	1.49 J
2,3,4,6,7,8-Hexachlorodibenzofuran	--	--	10.7	10.3	1.14 U	1.17 U	1.2 U	0.37 J	0.378 J	3.85 J	3.76 J
2,3,4,7,8-Pentachlorodibenzofuran	--	--	12.1	23.3	1.14 U	1.17 U	1.2 U	1.15 U	0.371 J	4.48 J	3.49 J
2,3,7,8-TCDD (dioxin)	--	--	0.545 J	0.329 J	0.341 U	0.35 U	0.36 U	0.258 J	0.395 U	0.26 J	0.333 J
2,3,7,8-Tetrachlorodibenzofuran	--	--	5.6	18	0.352 U	0.361 U	0.372 U	0.356 U	0.277 J	2.87	2.06 J
Octachlorodibenzofuran	--	--	12.6	8.44 J	2.27 U	2.33 U	2.4 U	2.3 U	0.853 J	3.56 J	19.2
Octachlorodibenzo-p-dioxin	--	--	19,900	1,480	384	9,310	7,640	2,290	1,090	2,210	2,760
Total TEQ due to DIOXIN (DIOXINTEQ)	22	0.059	20.7	14.7	0.429	4.44	3.79	1.51	1.97	4.66	6.66

Notes:

Total TEQ calculated using WHO 2005 TEFs and ND=0 (samples are not screened against WHO 2005 TEFs). At the laboratory, and after DV, nondetects, rejections, and results U-qualified due to blank contamination contribute zero to the Total TEQ

For HHRA, the screening levels shown for Total TEQ (RSL and SSL) are those from 2,3,7,8-TCDD

Shading indicates exceedance of Industrial Soil RSLs

Bold text indicates exceedance of Risk-based SSLs

J - Analyte present. Value may or may not be accurate or precise

NG/KG - Nanograms per kilogram

NS - Not sampled

RSL - regional screening level

SSL - soil screening level

TEF - toxic equivalency factor

TEQ - toxicity equivalents

U - The material was analyzed for, but not detected

WHO - World Health Organization

Table D-3. OU6 (Site 10) Preliminary Screening Dioxin and Furan Results in Groundwater

Sample ID	MCL	Tapwater RSLs (Nov 2019) HQ = 0.1	IR10-DP01-0409-0120		IR10-DP04-0712-0120	IR10-DP09-0712-0120	IR10-DP10-0712-0120	IR10-DP13-0813-0120	IR10-DP13P-0813-0120	IR10-DP14-0914-0120	IR10-DP15-0611-0120		IR10-DP17-0611-0120
Sample Date			1/27/20	1/29/20	1/30/20	1/30/20	1/28/20	1/28/20	1/29/20	1/30/20	1/31/20		
Chemical Name													
Dioxin/Furans (NG/L)													
1,2,3,4,6,7,8-Heptachlorodibenzofuran	--	--	0.14	0.14	0.006 JQQ	0.005 J	0.01 U	0.01 U	0.01 U	0.008 JQQ	2.9	3	0.01 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	0.05	0.07 J	0.012 J	0.025 J	0.033	0.064	0.057	0.032	5.2	5.1	0.047
1,2,3,4,7,8,9-Heptachlorodibenzofuran	--	--	0.006 J	0.02 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.18	0.19	0.01 U
1,2,3,4,7,8-Hexachlorodibenzofuran	--	--	0.019 J	0.029 J	0.003 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.4	0.4	0.003 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	--	--	0.01 U	0.015 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.33	0.32	0.01 U
1,2,3,6,7,8-Hexachlorodibenzofuran	--	--	0.017 J	0.033 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.43	0.42	0.01 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	0.01 U	0.018 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.45	0.44	0.003 J
1,2,3,7,8,9-Hexachlorodibenzofuran	--	--	0.004 J	0.024 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.051	0.053 J	0.01 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	0.01 U	0.02 JQQ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.46	0.46	0.003 J
1,2,3,7,8-Pentachlorodibenzofuran	--	--	0.006 J	0.018 JQQ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.16	0.16	0.01 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	--	--	0.01 U	0.051 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.28	0.28	0.01 U
2,3,4,6,7,8-Hexachlorodibenzofuran	--	--	0.03	0.044 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.35	0.35	0.003 J
2,3,4,7,8-Pentachlorodibenzofuran	--	--	0.017 J	0.035 J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.21	0.2	0.01 U
2,3,7,8-TCDD (dioxin)	--	--	0.002 U	0.01 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.017	0.015 J	0.002 U
2,3,7,8-Tetrachlorodibenzofuran	--	--	0.00369 JCC	0.009 J	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.046 CC	0.041	1.00E-03 JQQ
Octachlorodibenzofuran	--	--	0.056	0.069 J	0.021 U	0.006 J	0.02 U	0.021 U	0.021 U	0.009 J	4.4	4.5	0.009 J
Octachlorodibenzo-p-dioxin	--	--	11	9.9	0.48	0.62	2	3.1	2.2	1.7	66 E	51	3.9
Total TEQ	0.03	0.00012	0.018	0.032	0.0006	0.0005	0.0009	0.002	0.001	0.0008	0.72	0.71	0.003

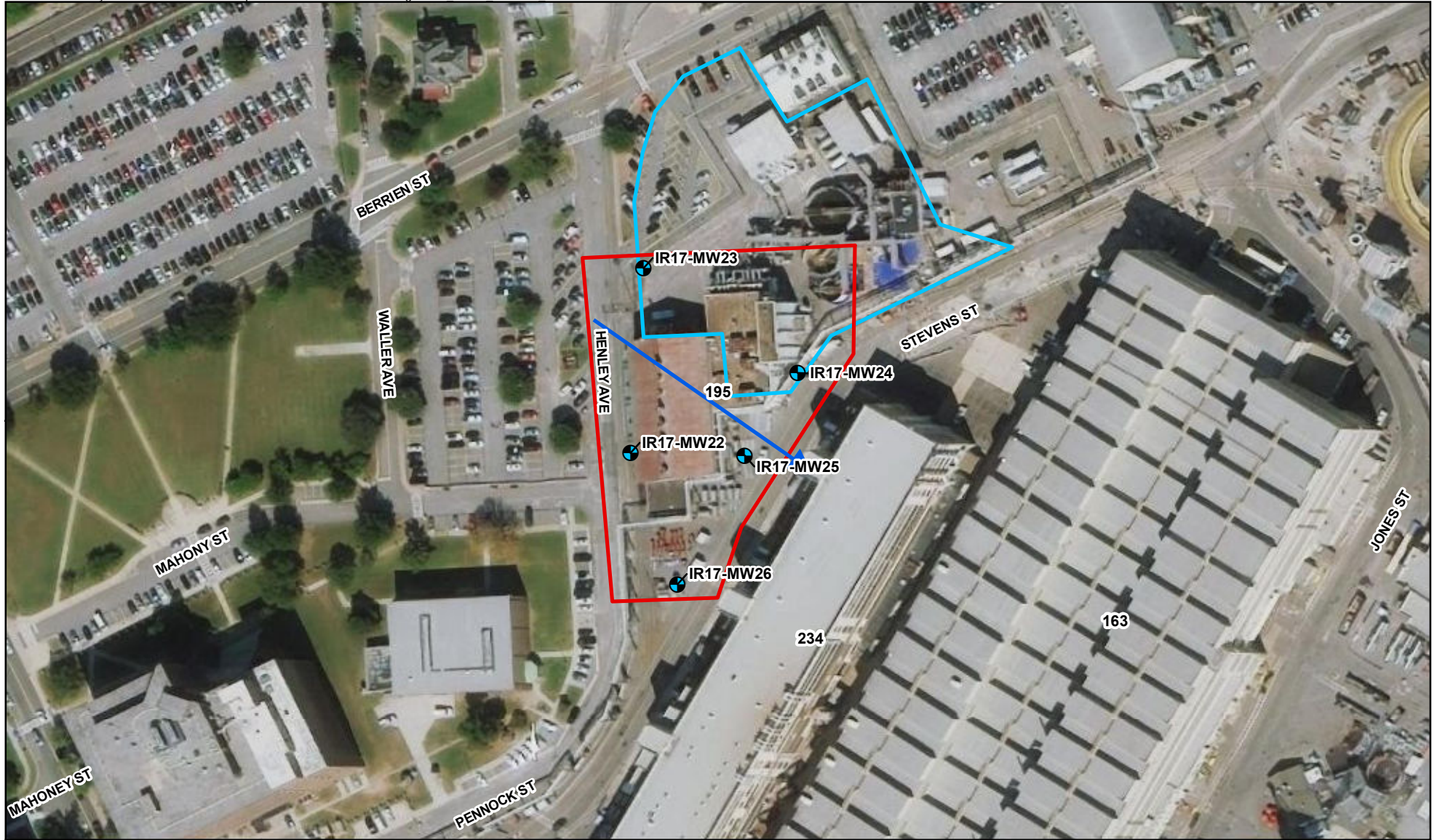
Notes:

- C - Confirmed quantitation on secondary column
- E - Exceeds calibration range
- J - Analyte present. Value may or may not be accurate or precise
- Q - EMPC - Estimated Maximum Possible Concentration
- NG/L - Nanograms per liter
- NS - Not sampled
- U - The material was analyzed for, but not detected





Total TEQ Screening

Shading indicates exceedance of Tapwater RSLs

Bold text indicates exceedance of MCL



Legend

-  Monitoring Well Location
-  Approximate groundwater flow direction in Columbia aquifer
-  Approximate Area Affected by Coal Storage (Prior to Mid-1960's)
-  Site 17 LUC Boundary

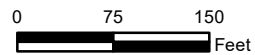


Figure D-1
Site 17 Sampling Locations – January-February 2020
Norfolk Naval Shipyard
Portsmouth, Virginia



Legend

- Soil Boring Location
- ⊗ Soil Boring Location - Refusal
- Soil Boring not Attempted Due to Site Conditions
- ▲ SWMU/AOC Site
- Site 10 LUC Boundary
- Approximate Boundary of Historic Tidal Back Creek *
- Installation Boundary

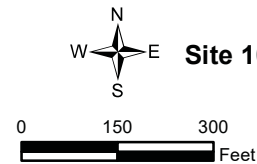


Figure D-2
Site 10 Sampling Locations – January-February 2020
 Norfolk Naval Shipyard
 Portsmouth, Virginia

* - Boundary of historic tidal Back Creek georeferenced from a 1921 USGS topographic map (<http://historicalmaps.arcgis.com/usgs/>)

Appendix E
Groundwater Discharge to Surface Water
Pathway Review for OU4 and OU6

Groundwater Discharge to Surface Water Pathway Review for OU4 and OU6

At the request of the United States Environmental Protection Agency (USEPA), a desktop audit was completed for the groundwater discharge to Elizabeth River pathway at Environmental Restoration Program Site 10 and Site 17, located within Norfolk Naval Shipyard (NNSY) in Portsmouth, Virginia. Site 10 (Operable Unit [OU] 6) is identified as the former 1927 Landfill, and Site 17 (USEPA OU4) is the Building 195 Plating Shop (CH2M, 2019). The physical setting of Sites 10 and 17 include paved roads, paved parking lots, and buildings. The surrounding areas are industrial, while the eastern side of Site 10 is adjacent to Slip 5 and Dry Dock 8 along the Southern Branch of the Elizabeth River (Figure 1). Groundwater from Sites 10 and 17 flows toward the Elizabeth River. The potential for groundwater exposure was expected to be for infauna, which are directly exposed to contaminants while burrowing in sediments and to contaminants in pore water.

In 2003, an Ecological Risk Assessment was completed for Site 10 as part of a Site Screening Process (SSP) investigation (CH2M, 2003). An evaluation of the groundwater intrusion to surface water and sediment of the Elizabeth River pathway was conducted through comparison of concentrations of dissolved inorganics in the groundwater to adjusted Biological Technical Assistance Group marine surface water benchmarks and background upper tolerance limits. Iron and manganese were detected at groundwater concentrations exceeding the surface water benchmark and the background UTL. The SSP concluded that these potential risks were acceptable because no source area or discernable plume of groundwater contamination was identified, and there was no statistical difference in groundwater concentrations upgradient or downgradient of Site 10. The 2003 evaluation supported the following conclusions: 1) there has not been a CERCLA release from the OU and the surrounding area to the groundwater, and 2) any aquatic risks to ecological receptors are negligible. These conclusions indicate that the groundwater to surface water and/or sediment chemical exposure route did not present an adverse effect on ecological receptors. Therefore, no further action (NFA) for groundwater at Site 10 was warranted for the protection of ecological receptors.

In 2006, a Focused Feasibility Study was conducted for Site 17 (CH2M, 2006). The Focused Feasibility Study presented Site 17 groundwater data compared to data from adjacent sites where ecological risk assessments were completed. The 2003 SSP was conducted to determine whether NFA, or additional investigation or remedial investigations were warranted for three NNSY areas: Site 20, Site 21, and Site 10. Site 20 is to the northwest and upgradient of Site 17; the single monitoring well installed for Site 17 was assessed as part of Site 20 in this evaluation. The SSP resulted in an NFA determination for ecological concerns at all three sites. The SSP investigation found that the groundwater at Site 10 is similar to that at Site 17 (primarily low concentrations of inorganics). The Site 17 groundwater concentrations of inorganics, specifically arsenic, were similar to or lower than concentrations in the Site 10 groundwater. The 2003 SSP concluded that the groundwater to surface water and/or sediment chemical exposure route from Site 10 did not present an adverse effect on ecological receptors. In addition, Site 17 is significantly smaller in size than Site 10 and is located upgradient where additional dilution and attenuation will occur from this smaller source prior to groundwater reaching the river. Therefore, it was concluded that Site 17 also posed no unacceptable risk to ecological receptors.

Further, in 2016, a sediment investigation was conducted in the Elizabeth River and included the river immediately east of Sites 10 and 17 (CH2M, 2018) (Figure 1). Minimal aquatic habitat was present within the entirety of the Elizabeth River study area during the November 2016 field investigation. The sediment data were evaluated against ecological screening criteria. The report concluded that although there are exceedances of the most conservative screening levels, comparison of site concentrations to the more realistic (probable effects) benchmarks revealed only isolated exceedances in areas that had not yet undergone capital improvement (encapsulating existing sediment or dredging during demolition). Because of the lack of natural habitat and minimal observations of biota during the 2016 investigation, there was a low potential for the study area to support significant populations of ecological receptors. Therefore, there is a low potential for receptor exposure to any chemical constituents that might be present within the hyporheic zone of the river. The spatially limited

risks and the limited to no suitable habitat observed in the sediment during the investigation resulted in the conclusion that Elizabeth River sediment concentrations do not pose a potential unacceptable risk to ecological receptors.

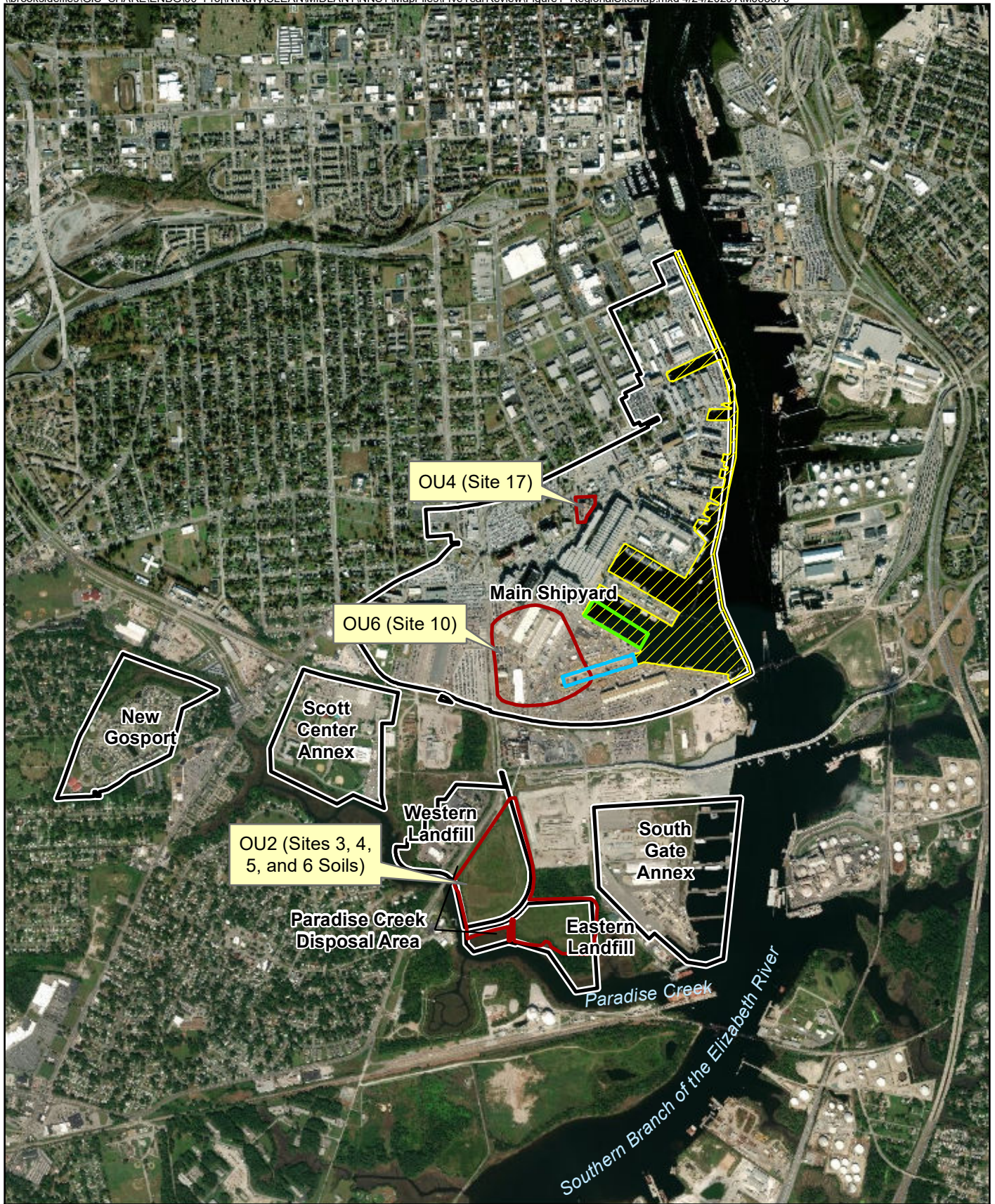
The natural components of the aquatic habitat of the Elizabeth River in this area have been greatly altered to meet the mission of NNSY. The bulkhead consists of piers, berths, dry docks, and wet slips. Additionally, all areas are dredged in association with maintenance of the main shipping channel or during routine dredging for wet slips and berths. Routine and repeated dredging activities physically reduce the likelihood that the benthic environment will maintain a significant or diverse infaunal ecological community. Qualitative surveys revealed that the river, in the vicinity of Sites 10 and 17, contains little, if any, natural habitat to support ecological receptors (CH2M, 2018). The benthic macroinvertebrate community is limited because of the periodic dredging and Base activities. The river east of the Site 10 and 17 is actively used for industrial operations, so there is a great deal of boat traffic and prop wash across the area, except at the dry docks. However, the dry docks are periodically dewatered when servicing ships. When vessels are stored in the “dry” and not in use, the establishment of habitat is limited in these areas (CH2M, 2018). The water depths typically exceed 30 feet, and are as deep as 52 feet east of Sites 10 and 17. Minimal light penetration because of water depth and the existence of manmade cover (wharfs, piers, etc.) limit biological activity. Dissolved oxygen in this area is likely at or near zero in the late summer based on water depth and the urban nature of the region. Rooted aquatic plants are not present, likely because of the bulkheading and water depth (CH2M, 2018).

In conclusion, an assessment of available groundwater data was completed to assess the Site 10 and Site 17 groundwater discharge to surface water pathways in 2003 and 2006, respectively. The evaluations concluded that there are no unacceptable ecological risks from groundwater. The 2016 Elizabeth River ecological sediment evaluation supports the finding that any aquatic risks to ecological receptors are negligible in the river near the OUs. Further, the investigation confirmed sparse benthic biota communities, no rooted aquatic plant communities, and no aquatic habitat in the Elizabeth River in the vicinity of these two OUs. The benthic community of the Elizabeth River system, including the Southern Branch where Sites 10 and 17 are located, is low in biomass and diversity because of multiple environmental stressors, such as lack of light penetration, low dissolved oxygen, and sedimentation and sediment disturbances (dredging). Further, the United States Army Corps of Engineers (USACE) and the Department of the Navy (Navy) continue to maintain a 40-foot or greater depth adjacent to NNSY. With the combination of programs to support navigation along the river and Navy access to NNSY (USACE/VPA, 2017), historical releases that may have occurred are unlikely to occur again with these dredging programs that will continue for the foreseeable future. Therefore, NFA is warranted for the protection of Elizabeth River aquatic receptors from exposure to Site 10 and Site 17 groundwater.

References

- CH2M HILL, Inc. (CH2M). 2003. *Site Screening Process Investigation and Action Determination Report, Building 236, Building 369, and the 1927 Landfill and Vicinity*. Final. Norfolk Naval Shipyard. Portsmouth, VA.
- CH2M. 2006. *Focused Feasibility Study Operable Unit No. 4 (Site 17 – Building 195 and Vicinity)*. Revised Final. Norfolk Naval Shipyard. Portsmouth, VA.
- CH2M. 2018. *Site Investigation Report, Site 15 – Nearshore Sediments*. Final. Norfolk Naval Shipyard. Portsmouth, VA.
- CH2M. 2019. *Five-Year Site Management Plan, Fiscal Year 2020*. Final. Norfolk Naval Shipyard. Portsmouth, VA. October.
- United States Army Corps of Engineers (USACE)/Virginia Port Authority (VPA). 2017. *Elizabeth River and Southern Branch Navigation Improvements, Draft General Reevaluation Report and Environmental Assessment*. December.

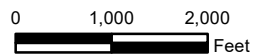
Figure



Legend

- ▬ Land Use Control Boundary
- Installation Boundary
- Wet Slip 5
- Dry Dock 8
- 2016 Sediment Investigation Area

Note:
Operable unit boundary is the land use control boundary.



Imagery Source: Esri 2017

Figure 1
Regional Site Map
Norfolk Naval Shipyard
Portsmouth, Virginia

