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FINAL SITE MANAGEMENT PLAN 2014 NB NORFOLK VA
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CH2M HILL

Final

**Site Management Plan
Fiscal Year 2014**

**Naval Station Norfolk
Norfolk, Virginia**

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Contents

Acronyms and Abbreviations	v
1 Introduction	1-1
1.1 Purpose of the Site Management Plan.....	1-1
1.2 Format of the Site Management Plan.....	1-1
1.3 Facility Description.....	1-1
1.3.1 Facility Location/Physical Description.....	1-1
1.3.2 Facility History and Mission.....	1-2
1.3.3 Operations/Process Descriptions.....	1-2
1.4 Environmental Setting.....	1-2
1.4.1 Topography and Surface Water Hydrology.....	1-2
1.4.2 Geology and Hydrogeology.....	1-3
1.5 Environmental History.....	1-3
1.5.1 Installation Restoration Program.....	1-3
1.5.2 Previous Investigations.....	1-4
1.5.3 Site Classification.....	1-4
2 Site Descriptions	2-1
2.1 Installation Restoration Program Sites.....	2-1
2.1.1 Site 1—Camp Allen Landfill.....	2-1
2.1.2 Site 2—NM Slag Pile.....	2-3
2.1.3 Site 3- Q-Area Drum Storage Yard.....	2-4
2.1.4 Site 6-CD Landfill.....	2-5
2.1.5 Site 18-Former NM Waste Storage Area.....	2-6
2.1.6 Site 20-LP-20 Site.....	2-7
2.1.7 Site 22-Camp Allen Storage Yard.....	2-9
2.1.8 Site 23-LP-20 Plating Shop.....	2-10
2.2 Solid Waste Management Units.....	2-11
2.2.1 SWMU 14—Q-50 Satellite Accumulation Area.....	2-11
3 Site Management Plan Schedules	3-1
3.1 Team Partnering at Naval Station Norfolk.....	3-1
3.2 Scheduling Assumptions.....	3-1
3.2.1 Field Investigation and Laboratory Analysis/ Validation.....	3-1
3.2.2 Data Gap Analysis and Supplemental Investigations.....	3-1
3.3 IRP Site Project Schedules.....	3-2
4 References	4-1

Appendixes

- A Screening, Categorizing, and Prioritization of Sites at NSN
- B CERCLA Process Activities

Tables

- 1-1 Status Summary of ERP Sites
- 1-2 Status Summary of SWMUs
- 1-3 Additional NFA Sites
- 1-4 Status Summary of FFA Areas of Concern
- 3-1 Active Projects for FY 2014 and FY 2015
- 3-2 Document Preparation Durations

Figures

- 1-1 Installation Location Map
- 1-2 Base Map with Site Locations and Current Clean-up Status, June 2013
- 1-3 Site Clean-Up Status as of March 1997
- 1-4 Base Map—Additional SWMU Locations and Current Clean-up Status, September 2010
- 1-5 Additional SWMU Clean-Up Status as of March 1997
- 2-1 Site Map—Shallow Aquifer Treatment System, Monitoring Well Network, and Groundwater Plumes, Site 1 - Camp Allen Landfill
- 2-2 Site Map —Deep Aquifer Treatment System, Monitoring Well Network, and Groundwater Plumes, Site 1 - Camp Allen Landfill
- 2-3 Site Map, Site 2—NM Area Slag Pile
- 2-4 Site Map, Site 3—Q-Area Drum Storage, AOC 1 and AOC 2
- 2-5 Site Map, Site 6—CD Landfill
- 2-6 Site Map, Site 18—Former Naval Magazine Hazardous Waste Storage Area
- 2-7 Site Map, Site 20—LP-20 Site
- 2-8 Site Map, Site 22—Camp Allen Salvage Yard
- 2-9 Site Map, Site 23—Building LP-20 Plating Shop
- 2-10 Site Map, SWMU 14—Q-50 Satellite Accumulation Area
- 3-1 Project-Specific Schedules FY 2014

Acronyms and Abbreviations

µg/L	microgram per liter
AOC	Area of Concern
AS	air sparge
AS/SVE	air sparging and soil vapor extraction
asl	above sea level
CALF	Camp Allen Landfill
CASY	Camp Allen Salvage Yard
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CI	Confirmatory Investigation
CLEAN	Comprehensive Long-term Environmental Action–Navy
CS	Confirmation Study
DCE	dichloroethene
DD	Decision Document
DoD	Department of Defense
DPVE	dual-phase vapor extraction
EE/CA	Engineering Evaluation and Cost Analysis
EPIC	United States Environmental Protection Agency Photographic Interpretation Center
ERA	Ecological Risk Assessment
ERD	Enhanced Reductive Dechlorination
ERP	Environmental Restoration Program
FFA	Federal Facility Agreement
FS	Feasibility Study
FY	fiscal year
HHRA	Human Health Risk Assessment
IAS	Initial Assessment Study
IC	institutional control
IRP	Installation Restoration Program
IRPRI	Installation Restoration Program Remedial Investigation
LTM	long-term monitoring
LUC	land use control
MCL	Maximum Contaminant Level
MIP	membrane interface probe
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NFA	No Further Action
NFESC	Naval Facilities Engineering Support Center
NM	Naval Magazine
NPL	National Priorities List
NSN	Naval Station Norfolk
NTCRA	Non-time-critical Removal Action
OU	Operable Unit
OWS	oil-water separator

PA/SI	Preliminary Assessment/Site Inspection
PCB	polychlorinated biphenyl
PCOR	Preliminary Closeout Report
PWC	Public Works Center
QADSY	Q-Area Drum Storage Yard
RA	Risk Assessment
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFA	Resource Conservation and Recovery Act Facility Assessment
RI	Remedial Investigation
ROD	Record of Decision
RPO	Remedial Process Optimization
RRR	Relative Risk Ranking
SAP	Sampling and Analysis Plan
SC	specific conductivity
SI	Site Investigation
SMP	Site Management Plan
SSA	Site Screening Area
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TCE	trichloroethene
TCL	Target Compound List
TPH	total petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
VAC	Virginia Administrative Code
VC	vinyl chloride
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound
VSWMR	Virginia Solid Waste Management Regulations
WDA	Waste Disposal Area
WWTP	wastewater treatment plant
yd ³	cubic yard

Introduction

This document is the fiscal year (FY) 2014 Site Management Plan (SMP) for Naval Station Norfolk (NSN) located in Norfolk, Virginia. This report has been prepared by CH2M HILL for use by the Department of the Navy (Navy), United States Environmental Protection Agency (USEPA) Region III, and the Virginia Department of Environmental Quality (VDEQ). Upon request, copies will be provided to the NSN Restoration Advisory Board (RAB).

1.1 Purpose of the Site Management Plan

The purpose of the SMP is to provide a management tool for the Navy, USEPA, VDEQ, and Activity personnel for utilization in planning, scheduling, and setting priorities for environmental remedial response activities conducted at NSN. This SMP focuses on upcoming activities planned for FY 2014 and provides a projected schedule through FY 2018. NSN was proposed for inclusion on the National Priorities List (NPL) in the *Federal Register*, Volume 16, Number 117, on June 17, 1996, and was added to the NPL on April 1, 1997. NSN was included under the “Federal Facilities” section of the NPL, in which federal agencies are considered responsible for conducting the majority of the response actions at facilities under their jurisdiction. A Federal Facility Agreement (FFA) between USEPA Region III and NSN was finalized in February 1999 (USEPA/Navy, 1999). Because NSN has a final FFA in place, the USEPA’s role is less extensive than at NPL sites that do not have FFAs. However, the USEPA continues to function in an oversight role for the management and cleanup of the Environmental Restoration Program (ERP) sites and solid waste management units (SWMUs) at NSN. No Munitions Response Program sites have been identified at NSN.

The SMP presents the rationale for the sequence of environmental investigations and remedial response activities to be completed for each site and the estimated schedule for completion of these activities. Detailed activity schedules are provided for FY 2014 and FY 2015, and prospective schedules are provided for FY 2016 through FY 2018.

1.2 Format of the Site Management Plan

This SMP consists of three sections.

- **Section 1—Introduction**, describes the SMP’s scope and purpose, provides a description and history of NSN, summarizes the environmental setting and previous environmental investigations conducted at NSN, and provides the FFA site classification and supporting rationale for these determinations.
- **Section 2—Site Descriptions**, provides specific information regarding each of the active ERP sites. Site-specific information includes physical characteristics of the site, a description of past activities conducted at the site, and known contaminants in each site medium. A site map is provided for each site.
- **Section 3—Site Management Plan Schedules**, provides scheduling assumptions and SMP project schedules.

1.3 Facility Description

1.3.1 Facility Location and Physical Description

NSN, the largest naval base in the United States, is situated on 4,631 acres of land (A. T. Kearney, 1992) in the northwest portion of the City of Norfolk, Virginia. The location of NSN is shown on **Figure 1-1**. NSN is bounded on the north by Willoughby Bay, on the west by the confluence of the Elizabeth and James Rivers, and on the south and east by the City of Norfolk. A portion of NSN’s eastern boundary is also formed by Mason Creek. NSN includes approximately 4,000 buildings, 20 piers, and an airfield. The western portion of NSN is a developed waterfront area containing the piers and facilities for loading, unloading, and servicing naval vessels. Land use in the surrounding area is commercial, industrial, and residential. The waterfront area south of NSN provides shipping

facilities and a network of rail lines. Residential and recreational areas border NSN at the southern, eastern, and northeastern boundaries.

Several other military installations are located within a 25-mile radius of NSN. These include Joint Base Langley-Eustis to the north, Joint Expeditionary Base Little Creek-Fort Story to the east, Naval Air Station (NAS) Oceana to the southeast, Norfolk Naval Shipyard and St. Julien's Creek Annex to the south, and Defense Fuel Support Point Craney Island Fuel Terminal to the southwest.

1.3.2 Facility History and Mission

NSN began operations in 1917, when the United States Navy acquired 474 acres of land to develop a Naval base to support World War I activities. Bulkheads were built along the coast to extend available land, and after extensive dredge and fill operations the total land under Navy control was 792 acres. An additional 143 acres of land were acquired in 1918 and officially commissioned as NAS Norfolk. Improvements to the piers and expansion of supply and material-handling facilities were also completed from 1936 through 1941.

During World War II, major construction projects were completed, including a power plant, numerous runways and hangars, a tank farm, several barracks, and housing complexes. During this time, the area of NSN expanded to more than 2,100 acres. After World War II, NSN continued to acquire land through various types of land transfers and dredge and fill operations conducted in areas of Mason Creek, the Bousch Creek Basins, and Willoughby Bay.

During its history, NSN has expanded to become the world's largest naval installation, with 105 ships homeported in Norfolk. The Base currently has 20 piers handling approximately 3,100 ship movements annually.

The mission of NSN is to provide fleet support and readiness for the United States Atlantic Fleet.

1.3.3 Operations and Process Descriptions

NSN operates in various capacities to provide support to vessels, aircraft, and other activities. NSN houses many tenants, each performing different operations involving the servicing and maintenance of vessels and aircraft.

The service and maintenance of ships includes utilities hook-up, onboard maintenance, and coordination of ship movements in the harbor. Additional functions include loading, unloading, and handling of fuels and oils used aboard the vessels. Ship and aircraft repair operations consist of paint stripping, patching, parts cleaning, repainting, engine overhauls, sandblasting, and metal-plating processes.

1.4 Environmental Setting

1.4.1 Topography and Surface Water Hydrology

Elevations at NSN range from sea level at the north and west boundaries to approximately 15 feet above sea level (asl) in central portions of the Base.

Four major surface water features surround the greater Norfolk area, including the James River, Elizabeth River, Willoughby Bay, and Chesapeake Bay, all of which are tidally influenced in this area.

The majority of surface water at NSN flows to either Mason Creek or the remnants of Bousch Creek. The main channel of Bousch Creek was filled during the development of NSN and replaced by a network of drainage ditches and underground culverts. Due to the proximity of tidal waters and the low relief of the land, both Mason Creek and the remnant tributaries of Bousch Creek are tidally influenced throughout NSN. Both creeks discharge to Willoughby Bay, and ultimately, to the Chesapeake Bay. In addition, some surface water runoff from NSN discharges directly to the Elizabeth River.

A Federal Emergency Management Agency flood insurance study established that the 100-year floodplain elevation at NSN is 8.5 feet asl (A. T. Kearney, 1992). Therefore, the portions of NSN adjacent to Willoughby Bay and the Elizabeth River are within the 100-year floodplain.

1.4.2 Geology and Hydrogeology

NSN is in the outer Atlantic Coastal Plain Physiographic Province, which is characterized by low elevations and gently sloping relief. The Base is underlain by more than 2,000 feet of gently dipping sandy sediment, ranging in age from Recent to Lower Cretaceous.

The uppermost geologic unit is the Columbia Group, composed of the Sand Bridge Formation and the underlying Norfolk Formation. The Columbia Group is approximately 60 feet thick. The upper 20 to 40 feet consists of unconsolidated fine sands and silts of low to moderate permeability. The lower 20 to 40 feet consists of relatively impermeable silt, clay, and sandy clay. The Bacon's Castle Formation and Yorktown Formation underlie the Columbia Group and are approximately 90 to 100 feet thick in the vicinity of the Base. The Yorktown Formation consists of moderately consolidated coarse sand and gravel with abundant shell fragments.

The two significant aquifer systems in the area are the water-table aquifer in the upper 20 to 40 feet of the Columbia Group and the underlying Yorktown aquifer. The water-table aquifer is thin and consists of discontinuous heterogeneous sand and shell lenses. The depth to the water table is usually less than 8 feet. The Yorktown aquifer is semi-confined beneath a clay layer in the upper Yorktown Formation. Water-bearing zones in the Yorktown aquifer consist of fine to coarse sand, gravel, and shells.

1.5 Environmental History

1.5.1 Installation Restoration Program

NSN was proposed for inclusion on the NPL on June 17, 1996, and was added to the NPL on April 1, 1997. Because NSN is on the NPL, the Navy and USEPA approval of all Records of Decision (RODs) with state concurrence is required. Prior to delisting, No Further Action (NFA) RODs will be signed to formally document site closeout through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process (after the environmental cleanup activities are complete).

In 1975, the Department of Defense (DoD) began a program to assess past hazardous and toxic materials storage and disposal activities at military installations. The goals of this program, initially referred to as the Installation Restoration Program (IRP) and now known as the ERP, were to identify environmental contamination resulting from past hazardous materials management practices, to assess the impacts of the contamination on public health and the environment, and to provide corrective measures as required to mitigate adverse impacts.

The ERP continues to be conducted in accordance with applicable federal and state environmental regulations and requirements.

In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA) to address potentially adverse human health and environmental impacts of hazardous waste management and disposal practices. RCRA was legislated to manage the present and future disposal of hazardous wastes. In 1980, CERCLA, or "Superfund," was passed to investigate and remediate areas resulting from past hazardous waste management practices. This program is administered by USEPA or state agencies.

DoD's ERP was reissued in 1981, with additional responsibilities and authorities specified in CERCLA delegated to the Secretary of Defense. The Navy subsequently restructured the ERP to match the terminology and structure of the USEPA CERCLA program. The CERCLA process is further discussed in **Appendix A** of this SMP.

Team partnering was introduced to NSN in October 1996 to streamline the cleanup of former disposal sites by using consensus-based site management strategies during the CERCLA process. The Partnering Team (the Team) consists of Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic, USEPA Region III, VDEQ, CH2M HILL, and other Navy contractors as warranted. The Team has streamlined the Site Investigation (SI) and remediation process to reduce costs and expedite cleanup and closure at ERP sites. **Appendix B** of this SMP discusses how the Partnering Team applied the CERCLA process (**Appendix A**) for sites identified at NSN.

1.5.2 Previous Investigations

1.5.2.1. Basewide Investigations

Previous basewide investigations completed through the ERP include:

- Initial Assessment Study (IAS) (ESE, 1983)
- Installation Restoration Program Remedial Investigation (IRPRI) Interim Report (Malcolm Pirnie, 1988)
- Resource Conservation and Recovery Act Facility Assessment (RFA) (A. T. Kearney, 1992)
- Aerial Photographic Site Analysis (USEPA, 1994)
- Phase I Relative Risk Ranking (RRR) System Data Collection Sampling and Analysis Report (RRR—Phase I) (Baker, 1996a)
- RRR System Data Collection Sampling and Analysis Report Phase II (RRR—Phase II) (Baker, 1996e)

1.5.3 Site Classification

1.5.3.1. Environmental Restoration Program Sites

The purpose of the 1983 IAS was to identify and assess sites posing a potential threat to human health or the environment due to contamination from past hazardous materials handling and operations activities. Eighteen potentially contaminated sites were identified based on information obtained from historical records, photographs, site inspections, and personnel interviews. Several of the IAS sites also have separate designations under the RFA. The 18 IAS sites and RFA designations are:

- **Site 1**—Camp Allen Landfill (CALF)
- **Site 2**—Naval Magazine (NM) Area Slag Pile
- **Site 3**—Q-Area Drum Storage Yard (QADSY)
- **Site 4**—Transformer Storage Area P-71 (RFA M-5)
- **Site 5**—Pesticide Disposal Site
- **Site 6**—CD Landfill
- **Site 7**—Inert Chemical Landfill (RFA L-3)
- **Site 8**—Asbestos Landfill (RFA L-4)
- **Site 9**—Q-Area Landfill (RFA L-5)
- **Site 10**—Apollo Disposal Site (RFA M-23)
- **Site 11**—Repair Shop Drains
- **Site 12**—Alleged Mercury Disposal Site (RFA M-35)
- **Site 13**—Past Wastewater Outfalls (RFA TP-10/M-45)
- **Site 14**—Oil Spill-Piers 4, 5, and 7 (RFA M-24)
- **Site 15**—Oil Spill-Piers 20, 21, and 22
- **Site 16**—Fire, Building X-136
- **Site 17**—Fire, Building SDA-215 (RFA C-25/Area of Concern [AOC] E)
- **Site 18**—Former NM Waste Storage (RFA M-26)

Each of the 18 sites was evaluated for the past history of potential releases, potential migration pathways, and pollutant receptors. Sampling and analysis activities were not performed as part of the IAS. The IAS concluded that six of the 18 sites posed sufficient threats to human health or the environment to warrant further evaluation in a Confirmation Study (CS).

CSs were performed for the six sites recommended for further investigation in the IAS (Sites 1 through 6) to confirm or refute the existence of the suspected contamination. This effort for five of the six sites was documented in the 1988 IRPRI Report. An independent CS was performed by the Navy on Site 6, CD Landfill. The

objectives of the CSs were to determine the extent of contamination, develop and evaluate economically feasible remedial alternatives, and recommend a remedial action.

Subsequent to the IAS, the Navy identified five sites (Sites 19 through 23) through historical information that were then added to the IRP:

- **Site 19**—Buildings V60/V90 (RFA M-34)
- **Site 20**—Building LP-20 Site
- **Site 21**—Building W-316 (RFA M-9/M-10)
- **Site 22**—Camp Allen Salvage Yard (CASYS) (RFA C-14)
- **Site 23**—Building LP-20 Plating Shop (RFA M-29)

Closeout reports documenting the NFA determination for eight of the ERP Sites (Sites 7, 8, 9, 10, 12, 16, 17, and 18) were prepared and approved by the NSN Partnering Team as part of a “Consensus Agreement” for reference in the FFA. In the fall of 2000, the NSN Partnering Team revisited these sites to evaluate whether the NFA determination was based on unrestricted use. For Sites 7, 8, 10, 12, 16, 17, and 18, soil-contaminant levels were initially compared only to industrial risk-based concentrations (RBCs). A reevaluation of the sites was performed that compared soil contaminant levels to residential RBCs. The results recommended four of the sites (7, 8, 12, and 17) for NFA and a Closeout Report was prepared and signed by the Tier I Partnering Team in March 2001 (CH2M HILL, 2001).

The Decision Document (DD) for Site 1 (both Areas A and B) was signed in July 1995 (Baker, 1995a). The DD required localized treatment of groundwater and soil using vacuum extraction and implementation of a groundwater extraction and treatment system to remediate groundwater underlying Areas A and B, as well as the adjacent Site 22 (CASYS), which is located between Areas A and B.

A ROD (CH2M HILL, 2000a) for Site 2 was completed in October 2000. The selected remedy was excavation of sediment, placement of asphalt and soil covers, and long-term monitoring (LTM).

The Site 3 DD (ESE, 1996b) was signed in November 1996 and called for remediation of groundwater by air sparging and soil-vapor extraction (AS/SVE). Two AOCs were identified and addressed at the site, AOC 1 and AOC 2.

The ROD for Site 6 (Baker, 1998b) selected a remedy consisting of a synthetic flexible liner capping system with groundwater monitoring and institutional controls (ICs). The construction of the landfill cap was completed in December 1999.

As previously indicated, Site 9 (Q-Area Landfill) was closed out as NFA; however, because Site 9 and SWMU 14 are co-located (the SWMU 14 accumulation pad is within the landfill boundary), the Remedial Investigation (RI)/Human Health Risk Assessment (HHRA) was completed in 2004 for SWMU 14, with the boundary corresponding to Site 9.

Sites 10, 16, and 18 were recommended for additional investigations and the fieldwork was completed in June 2001. As a result of the investigations, Closeout Reports for Sites 10 and 16 were completed in January 2002 and May 2002, respectively (CH2M HILL, 2002a, 2002b). Further investigations were completed at Site 18 in February and December of 2002, and an Expanded SI Report (CH2M HILL, 2004b) was submitted to the Tier I Partnering Team. Supplemental investigation activities were conducted in December of 2004 and June of 2006 to further evaluate a potential groundwater hotspot. In March 2008, an Engineering Evaluation and Cost Analysis (EE/CA) (CH2M HILL, 2008a) was generated for Site 18 to support a Non-time-critical Removal Action (NTCRA). The purpose of the NTCRA was to eliminate exposure of receptors to potential risk associated with groundwater at Site 18 and to prepare the site for closeout under CERCLA. In April 2008, an Action Memorandum (CH2M HILL, 2008b), serving as the DD for the EE/CA, recommended the implementation of the NTCRA using Enhanced Reductive Dechlorination (ERD) to mitigate the groundwater hotspot. Injection activities for the ERD were completed in July 2008, and the post-injection monitoring has been conducted. Following the completion of the performance monitoring for the 2008 injection, an Action Memorandum Addendum was completed to initiate a

second round of injections. The 2010 injections were completed in May, followed by approximately 3 years of performance monitoring.

Sites 13, 14, and 15 were recommended for NFA under CERCLA in the FFA, as these sites were being addressed under the jurisdiction of other environmental programs (underground storage tank [UST] or Virginia Pollutant Discharge Elimination System).

The Site 20 DD (Baker, 1996d) required that contamination at the site be treated to reduce the threat to human health and the environment. The goal of the remedial action was to treat the contaminant plume in the shallow aquifer using an AS/SVE system to prevent migration of the plume offsite and into the deep aquifer, and to reduce the contaminant concentrations to established cleanup goals.

A ROD for Site 22 was signed in September 2004 (Baker, 2004). In accordance with the Closeout Procedures for NPL, a *Remedial Action Completion Report* for IRP Site 22 was signed by the Navy January 2009 (CH2M HILL/Baker, 2009). The groundwater beneath Site 22 is currently being treated through the Site 1 remedial action.

A ROD for Site 23 was completed in September 2008. A land use control (LUC) Remedial Design (RD) was finalized July 2009 to address contaminated soil at the sites. The groundwater beneath Site 23 is being treated by the Site 20 remedial action. The LUCs will remain until contaminant levels diminish, so as to allow unrestricted use and unlimited exposure.

The final ROD for NSN reaffirmed the DD remedies for Sites 1, 3, and 20 and documented the Selected Remedy, continued enhanced bioremediation with groundwater monitoring and LUCs for Site 18. The Sites 1, 3, 18, and 20 ROD was signed August 2010 (Navy, 2010). The Final Preliminary Closeout Report (PCOR) was signed by USEPA in September 2010, documenting all site remedies at NSN are operating and are protective of human health and the environment.

The statuses of all sites are summarized in **Table 1-1**. A base map of NSN, showing the locations of the sites current status in the remedial process, is provided as **Figure 1-2**. As an indicator of the progress made in cleaning up sites, this figure can be compared to **Figure 1-3**, which shows the cleanup status of these sites in March 1997.

1.5.3.2. Solid Waste Management Units

In March 1992, an RFA was completed for NSN. This study was a basewide inventory of existing SWMUs and other AOCs. A total of 274 SWMUs and 10 AOCs were tentatively identified in this study. The September 1994 United States Environmental Protection Agency Photographic Interpretation Center (EPIC) study of aerial photography identified 37 potential waste disposal areas (WDAs). Of the sites identified by the RFA and EPIC studies, 148 were identified as potentially contaminated. The RRR—Phase I Report (Baker, 1996a) provided sampling results for 45 of the 148 identified sites. Of the sites sampled as part of the RRR—Phase I Report, the Navy identified 25 for additional evaluation and possible investigation; these 25 sites were identified as SWMUs in the FY 1996 SMP. The following lists the 25 SWMUs and their corresponding RFA/EPIC study identification:

- **SWMU 1**—SP-2B Accumulation Area (RFA C-83)
- **SWMU 2**—Building Z-309 Ash Hopper Storage Area (RFA M-13/M-14)
- **SWMU 3**—Building Z-309 Oil/Lubricant Storage Area (RFA AOC B)
- **SWMU 4**—Public Works Center (PWC) Sandblast Area (RFA M-19/M-20, EPIC WDA-1)
- **SWMU 5**—LF-61 Waste Holding Tank (RFA M-36)
- **SWMU 6**—Building V-28 Waste Pit (RFA M-31)
- **SWMU 7**—LF-18 Aircraft Ramp (EPIC WDA-3)
- **SWMU 8**—Firefighting Training School (EPIC WDA-20)
- **SWMU 9**—LP-200/MAC Terminal (EPIC WDA- 28/29)
- **SWMU 10**—LP-200/MAC Terminal/East (EPIC WDA- 31/32/35)
- **SWMU 11**—Old Weapons Station Entrance (EPIC WDA 33/34)
- **SWMU 12**—Disposal Area Near NM-37 (EPIC WDA-36)
- **SWMU 13**—Disposal Area PWC Operations, Near NM-71 (EPIC WDA-37)

- **SWMU 14**—Q-50 Satellite Accumulation Area (RFA C-17)
- **SWMU 15**—W-130 Accumulation Area (RFA C-27)
- **SWMU 16**—NM-37 Accumulation Area (RFA C-54)
- **SWMU 26**—Old Mounds Northeast of NM-140/141 (EPIC WDA-21)
- **SWMU 27**—Mason Creek Embankment (EPIC WDA-30)
- **SWMU 28**—Probable Solid Waste Disposal South of CEP) 201 (EPIC WDA-11)
- **SWMU 29**—Solid Waste Disposal Area/CD-3/CD-4 (EPIC WDA-12)
- **SWMU 30**—Sludge Fill Disposal Area/Marshy Area South of Runway (EPIC WDA-15/16/17)
- **SWMU 32**—Solid Waste Disposal Area CEP-160 Embankment (EPIC WDA-5)
- **SWMU 33**—Debris Piled at Seawall/Corner of Sustain Pier (EPIC WDA-6)
- **SWMU 34**—Solid Waste Disposal Area CEP-200 (EPIC WDA-7)
- **SWMU 35**—Solid Waste Disposal Area CEP-196/Resolute Embankment (EPIC WDA-8)

To provide additional site data, a RRR -Phase II sampling event was conducted in September 1996, with the results documented in the RRR—Phase II Report (Baker, 1996e). During FFA negotiations conducted in 1997 and 1998, several of the 148 sites were identified as SWMUs to be included FY 1997 SMP. These SWMUs (and corresponding RFA/EPIC study identification numbers) are:

- **SWMU 24**—Building LF-53 Trenches (RFA M-39)
- **SWMU 25**—Q-82/78 Former PWC Parking (EPIC WDA-2)
- **SWMU 36**—Stormwater Drainage System (RFA M-44)
- **SWMU 37**—Q-82/78 Former PWC Parking (EPIC WDA-2)
- **SWMU 38**—CD Area behind the Compost Yard (EPIC WDA-13)
- **SWMU 39**—Open Dump/Boundary of CALF (EPIC WDA-18/19)
- **SWMU 40**—MCA-603 Pits (EPIC WDA-22)
- **SWMU 41**—Disposal Area, CA-99 Golf Course (EPIC WDA-23)
- **SWMU 42**—CEP 201 Area (EPIC WDA-9)

Based upon the results of the two RRR studies, available historical operating data, and visual site inspections, the project management team recommended 10 SWMUs (SWMUs 5, 7, 11, 13, 15, 24, 26, 27, 29, and 30) for NFA under CERCLA in the FFA.

Remediation was conducted at SWMU 37, the Q-82/78 Former PWC Parking Area, in accordance with Virginia UST regulations. Therefore, the Team reviewed information pertaining to the Site Characterization and Corrective Action Plan and determined that NFA under CERCLA was required at SWMU 37.

The NSN stormwater drainage system (SWMU 36, RFA M-44) has undergone a \$10-million rehabilitation project. The inspection and assessment of the stormwater drainage system has been completed, and the rehabilitation (repair and replacement) has been conducted. Therefore, the Team determined that NFA under CERCLA is required.

A Confirmatory Investigation (CI) was conducted at SWMUs 1, 4, 6, and 8 in 1996. The CI results were documented in the *Draft Report for the Solid Waste Management Unit Confirmatory Investigation Report* (CH2M HILL, 1996). The investigation results identified lead contamination in the soil at SWMU 1, and a removal action was conducted there in October 1997. As a result of the removal, the Team determined NFA under CERCLA was required. The CI results also indicated that additional characterization was needed at SWMUs 4, 6, and 8. However, the Navy removed SWMU 4 from the CERCLA program in May 2003 because the site remains active. Due to the lack of a complete pathway and release, SWMU 6 was recommended for NFA in the Closeout Report signed by the Team in November 2002 (CH2M HILL, 2002c). A re-evaluation of SWMU 8 was performed that compared groundwater and surface and subsurface soil to RBCs for residential and industrial soil, USEPA Region III tap water RBCs, and USEPA drinking water Maximum Contaminant Levels (MCLs) for groundwater. The results recommended SWMU 8 for NFA, and a Closeout Report was prepared and signed in March 2001 (CH2M HILL, 2001).

A confirmatory SI was initiated in 1998 for SWMUs 9, 10, 12, 14, 16, 28, 32, 33, 34, 35, 38, 40, 41, and 42. The SI's objectives were to determine the extent of contamination at each SWMU, to develop and evaluate economically feasible remedial alternatives for remedial action at contaminated SWMUs, and to closeout qualified sites. SWMUs 9, 10, 32, 22, 34, 35, 41, and 42 were closed out following this investigation.

A supplemental investigation was conducted in the fall of 2000 for SWMUs 12, 14, 16, 38, and 39. The objectives of the investigation were to further characterize selected SWMUs. As a result of this investigation, SWMUs 38 and 39 were closed out.

An RI was completed for SWMUs 12 and 16 in 2003. The objectives were to characterize extent and determine potential risks to human health and the environment. As a result of the RI, no action was required for SWMUs 12 and 16, as documented in the final ROD signed in the fall of 2005 (CH2M HILL, 2005).

SWMU 14 was investigated under an RI/HHRA/Ecological Risk Assessment (ERA) in 2004, followed by a Trident Probe Study to evaluate groundwater to surface water discharge in 2006. A Technical Memorandum summarizing the results of the study to support the determination that no action was necessary for the groundwater to surface water pathway was finalized in 2007. In 2008, an NTCRA was conducted in accordance with an EE/CA to construct an asphalt cover to serve as a parking lot for base personnel. The Proposed Plan was finalized August 2009, allowing the public to comment on the Selected Remedy, LUCs. The ROD was signed August 2010 to implement LUCs at the site.

The current status of all SWMUs investigated at NSN is summarized in **Table 1-2**. A base map of NSN, showing the locations of the SWMU sites and their current statuses in the remedial process, is provided as **Figure 1-4**. As an indicator of the progress made in cleaning up SWMU sites, this figure can be compared to **Figure 1-5**, which shows the cleanup status of these sites in March 1997.

1.5.3.3. No Further Action Sites

The remaining 148 sites previously identified were individually evaluated during the NFA negotiations between the Navy and the USEPA. These sites have not been previously discussed in the SMP. The Team determined that NFA is required for the sites, as detailed in **Table 1-3**.

1.5.3.4. Federal Facility Agreement Site Screening Areas

Site Screening Areas (SSAs) are areas that either pose or may potentially pose a threat to public health, welfare, and the environment. SSAs may expand or contract in size during the SI as information becomes available indicating the extent of contamination and the area needing study. In the NSN FFA, four SSAs are identified:

- **SSA 1**—Q-72 Sandblast Area (SWMU 4; RFA M-19/M-20; EPIC WDA-1)
- **SSA 2**—V-28 Waste Pit (SWMU 6; RFA M-31)
- **SSA 3**—Fire Fighting School (SWMU 8; EPIC WDA-20),
- **SSA 4**—NM-37 Area (SWMU 12; EPIC WDA-36); (SWMU 16; RFA C-54)

SIs were completed during either 1998 or 1999 at each SSA. The investigations at each area detected levels of site-related constituents above RBCs. A background investigation was completed to assess whether the levels also exceeded background levels. SSA 3 (Fire Fighting School) and SSA 2 (V-28 Waste Pit) were recommended for NFA, and Closeout Reports have been completed. SSA 1 (Q-72 Sandblast Area) is currently an active site; therefore, the Team came to consensus that SSA 1 is NFA under CERCLA, and the cleanup of this site will be addressed when the sandblasting operations cease. SSA 4 (NM-37 Area) has undergone an RI investigation and subsequent report, including an HHRA and ERA. The Team agreed that NFA was required, and a ROD was completed in October 2005.

1.5.3.5. Federal Facility Agreement Areas of Concern

The FFA, signed by USEPA on February 18, 1999, listed eight AOCs as sites under evaluation to determine whether the sites should proceed in the screening process and be investigated as SSAs, or whether the information under review supports an NFA determination. The documentation and sampling of each of these areas were discussed at

the Tier I Partnering meeting on March 16, 1999. Descriptions of the NFA determination for each of the eight AOCs are presented in **Table 1-4**.

1.5.3.6. Preliminary Closeout Report

A PCOR summarizing the investigations and remedies at each site was signed by USEPA in September 2010. The PCOR documented construction completion for the USEPA and changed NSN's classification on the NPL. All Installation Restoration sites achieved the required documentation outlined in the FFA and have a remedy in place that is able to achieve cleanup goals in a timely manner based on current site conditions.

TABLE 1-1

Status Summary of ER Sites

Naval Station Norfolk

Site	RFA Designations	PA or IAS	SI or CS	EE/CA	Work Plans	RI	FS	PRAP	Close-Out Report	ROD/DD	RD	RA Construct	RA Ops	Comments
Remedy in Place (Ongoing O&M and LTM)														
Site 1 - Camp Allen Landfill		1983*	1988*		1991	1994	1994	1995		1995, 2010	1996, 2005	1997		Removal action (soil) completed January 1995. Construction of Groundwater Pump and Treat as well as DPVE systems complete and in operation. Long-term monitoring to evaluate system effectiveness was initiated in 1999. Performed VOC groundwater plume delineation for Area B in January 2008. Remedy reaffirmed September 2010. RPO currently ongoing. Area B Offsite Migration Evaluation initiated in July 2012. VI investigation completed FY 2012. Additional investigation scheduled for FY2013. RPO Ongoing.
Site 2- NM Slag Pile - All Media		1983*	1988*		1996, 1998	1998	1998	1999		2000	1999, 2005	1999		ROD finalized in December 2000. Sediments removed in December 1999. Annual post closure monitoring conducted from 2000 to 2004. Following 2004, groundwater sampling is conducted once every 5 years. RACR completed May 2007.
Site 3 - Q-Area Drum Storage Yard		1983*	1988*		1991	1996	1996	1996		1996, 2010	1996, 2005	1998		Construction of Air Sparge/SVE system complete and in operation. Long-term monitoring to evaluate the effectiveness of treatment system was instituted in 1999. Close-out strategy for AOC 1 implemented in 2003, Close-out strategy for AOC 2 implemented in 2006. Ongoing RPO. Remedy reaffirmed September 2010.
Site 6 - CD Landfill		1983*	1991		1993	1995	1995							Removal of contaminated sediments partially completed in fall 1997. Cap construction completed in December 1999. Post closure monitoring initiated in January 2000. Groundwater Monitoring Plan in accordance with VSWMR corrective action finalized in April 2006.. VSWMR permit revoked in May 2013. LTM continuing with a minimum basis of once every five years to support each Five Year Review.
Site 6, OU1 - Sediments								1996		1996	1996, 2005	1999		
Site 6, OU2 - Landfill Cap								1998		1998	1999, 2005	1999		
Site 18 - Former NM Hazardous Waste Storage Area	RFA M-26	1983	2002, 2003	2008	2001, 2003, 2004, 2005					2010	2010	2008		NTCRA completed 2008 and 2010 (groundwater injections for enhanced reductive dechlorination). ROD signed August 2010 documenting continued enhanced bioremediation with groundwater monitoring and LUCs as Selected Remedy. RD for LUCs finalized August 2010. Performance Monitoring period completed April 2013; future LTM strategy under discussion.
Site 20 - Building LP-20 Site	RFA M-9/M-10	1991	1991		1994	1995	1996	1996		1996, 2010	1997, 2005	1998		Construction of Air Sparge/SVE system to address TPH and chlorinated solvents in groundwater complete. Remediation systems are currently in operation. Remedy enhancement (groundwater extraction) constructed 2010 (not currently operating due to excessive maintenance requirements). Remedy (AS/SVE and groundwater extraction with LUCs and groundwater monitoring) reaffirmed September 2010. Remedy evaluation and RPO currently ongoing. VI Investigation completed FY2012 additional investigation scheduled for FY2013.
Site 22 - Camp Allen Salvage Yard	RFA C-14	1994	1994	1999, 2002	1996	1999	2002	2002		2004	2002, 2004	2002, 2009		A NCTRA was implemented at the Site in 1998 to remove PCB contaminated soils. An EE/CA was completed in January 2002 recommending that a soil cover be placed at the site. The cover was completed in Summer 2002. The ROD, addressing soil and sediment cleanup strategies, was finalized in September 2004. The RD for Land Use Controls was completed in December 2004. Remedial Action Completion Report finalized in 2009. Site groundwater is monitored under Site 1.
Site 23 - Building LP-20 Plating Shop	RFA M-29		2005	2006	2004			2008		2008	2009			Final SI report completed in April 2006. Final EE/CA completed December 2006. Construction for the interim action was implemented in June 2007. ROD signed in 2008. The RACR was signed by the Navy January 2009 and the RD was finalized July 2009.
Response Complete/NFA														
Site 4 - P-71 Transformer Storage	RFA M-5	1983*	1988*		1991	1991	1991	1991		1991	1991	1992		Cleanup completed. Construction Summary Report completed February 1993. Groundwater monitoring completed in 1995.
Site 5 - Pesticide Disposal Site		1983*	1988** 1998***	1998					2000			1999		Pesticide-contaminated soil removal action completed in November 1999 and the site was closed out.
Site 7 - Inert Chemical Landfill	RFA L-3	1983							2001					Close-Out report completed in March 2001
Site 8 - Asbestos Landfill	RFA L-4	1983							2001					Close-Out report completed in March 2001
Site 9 Q-50 Area Landfill	RFA L-5	1983							2001					Close-Out report completed; Site revisited in 2002 to determine if NFA was for unrestricted use; SWMU 14 RI included collection of soil data from Site 9.
Site 10 - Apollo Fuel Disposal Sites	RFA M-23	1983	2001		2001				2002					Close-Out report completed in January 2002
Site 12 - Alleged Mercury Disposal Site	RFA M-35	1983							2001					Close-Out report completed in March 2001

TABLE 1-1
 Status Summary of IRP Sites
 Naval Station Norfolk

Site	RFA Designations	PA or IAS	SI or CS	EE/CA	Work Plans	RI	FS	PRAP	Close-Out Report	ROD/DD	RD	RA Construct	RA Ops	Comments
Site 16 - Chemical Fire Building X-136		1983	2001		2001				2002					Close-Out report completed in May 2002
Site 17 - Chemical Fire Building SDA-215	RFA C-25/AOC E	1983							2001					Close-Out report completed in March 2001
Site 19 - Buildings V-60/V-90	RFA M-34	1988	1988		1989	1989	1989	1989		1989	1989	1991		Building demolition and site cleanup completed.
Site 21 - Building W-316	RFA M-9/10	1996	1996	1997	1996									PCB-contaminated soil removal action completed in March 1998 under TSCA. Final Closure Report for Removal Activities completed August 1998

Legend:

- 993 Year Activity Completed (fiscal year)
- X Activity Completed (date unknown)
- Aip Activity In Progress (expected completion)
- ^ Activity Planned
- PA Preliminary Assessment
- IAS Initial Assessment Study
- SI Site Investigation
- CS Confirmation Study
- EE/CA Engineering Evaluation/Cost Analysis
- RI Remedial Investigation
- FS Feasibility Study
- PRAP Proposed Remedial Action Plan
- ROD Record of Decision or Decision Document
- RD Remedial Design
- RA Remedial Action /Removal Action
- RPO Remedial Process Optimization
- TBA To Be Addressed
- NFA No Further Action
- DD Decision Document
- LTM Long-Term Monitoring
- Construct Construction Phase
- Ops Operations Phase

*Refers to "Initial Assessment Study of Sewells Point Naval Complex," dated February 1983.

** Refers to "Installation Restoration Program Investigation Interim Report," dated March 1988.

***CH2M HILL SI completed February 1998

TABLE 1-2
 Status Summary of SWMUs
 Naval Station Norfolk

SWMU	RFA Designations	Phase 1 RRR*	Phase 2 RRR**	Work Plans	PA/Sl(n)	SI/CI/SSI***	RI/FS	EE/CA	Close-Out Report	ROD/DD	RD	RA Construction	Comments
Response Complete/NFA													
1	SP-2B Accumulation Area	RFA C-83	1996	1996		1996							Lead removal in October 1997 and determined no further action under CERCLA
2	Building Z-309 Ash Hopper Storage Area	RFA M-13/ M-14	1996	1996					2000				Close-Out Report was completed in March, 2000 based on RRR report
3	Building Z-309 Oil/Lubricant Storage Area	RFA AOC B	1996	1996					2000				Close-Out Report was completed in March, 2000 based on RRR report
4	PWC Sandblast Area	RFA M-19/M-20; EPIC WDA-1	1996	1996	1996	1996							Site removed from the CERCLA program because the facility remains active
5	LF-61 Waste Holding Tank	RFA M-36	1996	1996									No further action based on RRR report
6	Building V-28 Waste Pit	RFA M-31	1996		1996, 2001	1996	1998, 1999		2002				Close-Out Report was completed in November, 2002 based on results of CI report
7	LF-18 Aircraft Ramp	EPIC WDA-3	1996	1996									No further action based on RRR report
8	Fire Fighting School	EPIC WDA-20	1996		1996	1996	1999		2001				Close-Out Report was completed in March, 2001
9	LP-200/MAC Terminal	EPIC WDA- 28/29	1996		1998	1998			2001				Close-Out Report was completed in October, 2001
10	LP-200/MAC Terminal/East	EPIC WDA- 31/32/35	1996	1996	1998	1998			2001				Close-Out Report completed in October, 2001
11	Old Weapons Station Entrance	EPIC WDA- 33/34	1996	1996									No further action based on RRR report
12	Disposal Area Near NM-37	EPIC WDA-36	1996	1996	1998	1998		2004		2005			Final RI completed in July, 2004. Final ROD completed in October 2005. No further action.
13	Disposal Area PWC Operations, Near NM-71	EPIC WDA-37	1996	1996									No further action based on RRR report
14	Q-50 Satellite Accumulation Area	RFA C-17	1996	1996	1998	1998		2004, 2009		2010	2010	2008	Final RI/HHRA/ERA completed in August, 2004. EE/CA for a non-time critical asphalt cover for soil completed in March 2008. Groundwater was deemed nonpotable per a partnering team consensus statement. The Final Proposed Plan was submitted August 2009; ROD signed August 2010. RD for LUCs completed August 2010. Limited action RACR signed September 2010.
15	W-130 Accumulation Area	RFA C-27	1996	1996									No further action based on RRR report
16	NM 37 Accumulation Area	RFA C-54	1996	1996	1998	1998		2004		2005			Final RI completed in July, 2004. Final ROD completed in October 2005. No further action.
17	Surface Disposal Area; Waste Generated from SP-10 Maintenance		1996	1996									No further action based on RRR report
18	Surface Disposal Area; Waste Generated from V-88 Lab		1996	1996									No further action based on RRR report
19	Surface Disposal Area; Waster Generated from LF-53 Painting		1996	1996									No further action based on RRR report
20	Surface Disposal Area; Waste Generated from Aircraft Maintenance, Former UST Site		1996	1996									No further action based on RRR report
22	Surface Disposal Area; Waste Generated from Bldg. LF-60 Helicopter Maintenance		1996	1996									No further action based on RRR report
24	Building LF-53 Trenches	RFA M-39	1996	1996									No further action based on RRR report
25	Q-82/78 Former PWC Parking Lot		1996	1996									No further action based on RRR report
26	Old Mounds Northeast of NM-140/141	EPIC WDA-21	1996	1996									No further action based on RRR report
27	Mason Creek Embankment	EPIC WDA-30	1996	1996									No further action based on RRR report

TABLE 1-2

Status Summary of SWMUs

Naval Station Norfolk

SWMU	RFA Designations	Phase 1 RRR*	Phase 2 RRR**	Work Plans	PA/Sl(n)	SI/CI/SSI***	RI/FS	EE/CA	Close-Out Report	ROD/DD	RD	RA Construction	Comments
28	Probable Solid Waste Disposal South of CEP 201	EPIC WDA-11	1996		1998	1998			2000				Streamlined Risk Assessment/Close-Out Report was submitted May, 2000.
29	Solid Waste Disposal Area/CD-3/CD-4	EPIC WDA-12	1996	1996									No further action based on RRR report
30	Sludge Fill Disposal Area/Marshy Area South of Runway	EPIC WDA-15/16/17	1996	1996									No further action based on RRR report
31	Solid Waste Disposal; Area V-82		1996	1996									No further action based on RRR report
32	Solid Waste Disposal Area CEP 160/161 Embankment	EPIC WDA-5	1996		1998	1998			2000				Streamlined Risk Assessment/Close-Out report was submitted in May 2000.
33	Debris Piled at Seawell	EPIC WDA-6	1996		1998	1998			2000				Streamlined Risk Assessment/Close-Out report was submitted in May 2000.
34	Solid Waste Disposal Area CEP 200	EPIC WDA-7	1996		1998	1998			2000				Streamlined Risk Assessment/Close-Out report was submitted in May 2000.
35	Solid Waste Disposal Area CEP 196/Resolute Embankment	EPIC WDA-8	1996		1998	1998			2000				Streamlined Risk Assessment/Close-Out report was submitted in May 2000.
36	Stormwater Drainage System	RFA M-44											No further action under CERCLA; undergoing a \$10 million rehabilitation project
37	Q-82/78 Former PWC Parking Lot	EPIC WDA-2	1996	1996									No further action under CERCLA; moved out of CERCLA in 1998 and into the UST Program.
38	CD Area Behind Compost Yard	EPC WDA-13		1996	1998	1998	2000		2001				Close-Out Report was completed in March, 2001
39	Open Dump & Disposal Area near boundary of Camp Allen Landfill	EPIC WDA-18/19					2000		2001				Close-Out Report was completed in March, 2001
40	MCA-603 Pits	EPIC WDA-22			1998	1998			2000				Close-Out Report was completed in May, 2000
41	Disposal Area,CA-99 Golf Course	EPIC WDA-23			1998	1998			2000				Close-Out Report was completed in May, 2000
42	CEP 201 Area	EPIC WDA-9	1996	1996	1998	1998			2000				Close-Out Report was completed in May, 2000
Sites where Information not available													
21													
23													

Legend:

- 1993 Year Activity Completed (fiscal year)
- X Activity Completed (date unknown)
- Aip Activity in Progress (expected completion)
- ^ Activity Planned
- PA Preliminary Assessment
- IAS Initial Assessment Study
- Sl(n) Site Inspection
- CS Confirmation Study
- EE/CA Engineering Evaluation/Cost Analysis
- RI Remedial Investigation
- FS Feasibility Study
- PRAP Proposed Remedial Action Plan
- ROD Record of Decision or Decision Document
- RD Remedial Design
- RA Remedial Action /Removal Action
- TBA To Be Addressed
- NFA No Further Action
- DD Decision Document
- SI Site Investigation
- Construct Construction Phase
- Ops Operations Phase

*Refers to "Initial Assessment Study of Sewells Point Naval Complex," dated February 1983.
 ** Refers to "Installation Restoration Program Investigation Interim Report," dated March 1988.
 ***CH2M HILL SI completed February 1998

TABLE 1-3

Additional NFA Sites

Naval Station Norfolk

Site	Site Description	Reason for No Further Action
RFA AOC C	Building V-93-1	UST / AST; Removed
RFA AOC C	Building V-93-2	UST / AST; Removed
RFA AOC C	Building V-93-3	UST / AST; Removed
RFA AOC C	Building V-112-1	UST / AST; Removed
RFA AOC C	Building V-112-2	UST / AST; Removed
RFA AOC C	Building V-112-3	UST / AST; Removed
RFA AOC C	Building NM-71-A	UST / AST; Removed
RFA AOC C	Building NM-71-B	UST / AST; Removed
RFA AOC C	Building U-117	UST / AST; Removed
RFA AOC C	Building CA-501-1	UST / AST; Removed
RFA C-4	Building CA-483 (A) SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-5	Building CA-483 (B) SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-6	Building CA-483 (C) SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-7	Building CA-483 (D) SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-9	Building W-7 (Pier 7) SAA	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-18	Building Z-309 SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-26	Building CA-501 SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-27	Building W-130 SAA	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-33	Building V-88 SAA (SWMU 18)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-36	Building LF-53 SAA (SWMU 19)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-61	Building LP-20 SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-71	Building SP-10 SSA (SWMU 17)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-79	LP Fuel Farm SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-80	Building LP-100 SAA (SWMU 20)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-81	Building LF-59 SAA	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-82	Building LF-60 SAA (SWMU 22)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA M-18	Sanitary Sewers	Team site visit, review of existing documentation and review of operational procedures
RFA M-22	Sewage Waste Oil Barges	Team site visit, review of existing documentation and review of operational procedures
RFA M-36	Building LF-61 Waste Tank Area (SWMU 5)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA M-39	Building LF-53 Trenchs (SWMU 24)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA M-46	P-1 Pond	Team site visit, review of existing documentation and review of operational procedures
RFA R-3	LF-68 Former Hazardous Waste Storage Area	Team site visit, review of existing documentation and review of operational procedures
RFA O-1	A-80 Building O/WS	Oil / Water Separator; Managed under IWMP
RFA O-2	A-81 Building O/WS	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-3	A-127 Building	Oil / Water Separator; Managed under IWMP
RFA O-4	A-Area	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-7	CEP-188 Building	Oil / Water Separator; Managed under IWMP
RFA O-8	LF-38 Building	Oil / Water Separator; Demolition Complete
RFA O-9	LF-53 Building	Oil / Water Separator; Inactive due to BRAC closure of NSN tenants
RFA O-10	LF-59 Building	Oil / Water Separator; Managed under IWMP
RFA O-11	LF-60 Building	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-23	LP-20 Building	Oil / Water Separator; Managed under IWMP
RFA O-24	LP-22 Building	Oil / Water Separator; Demolition Complete - FY98
RFA O-25	LP-32 Building	Oil / Water Separator; Inactive due to BRAC closure of NSN tenants
RFA O-27	LP-48 Building	Oil / Water Separator; Demolition Complete - FY98
RFA O-30	LP-78 Building	Oil / Water Separator; Demolition Complete - FY97

TABLE 1-3

Additional NFA Sites

Naval Station Norfolk

Site	Site Description	Reason for No Further Action
RFA O-31	LP-167 Area 1	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-32	LP-167 Area 2	Oil / Water Separator; Managed under IWMP
RFA O-33	LP-167 Area 3	Oil / Water Separator; Managed under IWMP
RFA O-34	LP-167 Area 4	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-35	LP-167 Area 5	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-36	LP-167 Area 6	Oil / Water Separator; Managed under IWMP
RFA O-37	LP-176 Building	Oil / Water Separator; Demolition Complete - FY98
RFA O-43	SP-38 Building	Oil / Water Separator; Managed under IWMP
RFA O-45	SP-296 Hanger	Oil / Water Separator; Managed under IWMP
RFA O-46	SP-313	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-50	V-15 Building	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-51	V-27 Area 1	Oil / Water Separator; Inactive due to BRAC closure of NSN tenants
RFA O-52	V-28 Area 2	Oil / Water Separator; Inactive due to BRAC closure of NSN tenants
RFA O-55	V-49 S Area 5	Oil / Water Separator; Managed under IWMP
RFA O-56	V-49 W Area 6	Oil / Water Separator; Managed under IWMP
RFA O-57	V-146 Building	Oil / Water Separator; Demolition Complete - FY97
RFA O-59	W-6 Building	Oil / Water Separator; Managed under IWMP
RFA O-60	Fire Fighting School	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-61	Fire Fighting School	Oil / Water Separator; Demolition Complete - FY92
RFA O-62	Fire Fighting School	Oil / Water Separator; Demolition Complete - FY92
RFA T-3	Wastewater Tank 3 Building CEP-200	UST / AST; Regulated under VDEQ
RFA T-10	W-7 Building	UST / AST; Regulated under VDEQ
RFA T-12	W-388 Building high flashpoint tank	UST / AST; Regulated under VDEQ
RFA T-13	W-388	Oil / Water Separator; Managed under IWMP
RFA T-14	A-81 Building	UST / AST; Removed
RFA T-15	A-81 Building Tank No.1	UST / AST; Removed
RFA T-16	A-81 Building Tank No.2	UST / AST; Removed
RFA T-17	Fire Fighting School	UST / AST; Removed
RFA T-20	CEP-188 Building	UST / AST; Removed
RFA T-21	V-49 Building	UST / AST; Removed
RFA T-22	U-132 calibration fluid	UST / AST; Removed
RFA T-23	U-132 varsol	UST / AST; Removed
RFA T-24	U-132 waste oil	UST / AST; Removed
RFA T-26	NH-34 Building	UST / AST; Removed
RFA T-27	NH-35 Building	UST / AST; Removed
RFA T-28	NH-94-1W Building	UST / AST; Regulated under VDEQ
RFA T-29	NH-94-2W Building	UST / AST; Regulated under VDEQ
RFA T-30	MCE-225-4 Building	UST / AST; Removed
RFA T-31	MCE-57-1	Oil / Water Separator; Demolition Complete - FY97
RFA T-32	W-6-1	UST / AST; Removed
RFA T-33	W-6-2	UST / AST; Removed
RFA T-34	W-6-3	UST / AST; Removed
RFA T-35	W-6-4	UST / AST; Removed
RFA T-36	W-196 Building	UST / AST; Removed
RFA T-37	LAFB Building	UST / AST; Removed
RFA T-38	NM-59 Building	UST / AST; Removed

TABLE 1-3

Additional NFA Sites

Naval Station Norfolk

Site	Site Description	Reason for No Further Action
RFA TP-6	Fire Fighting School Wastewater Pit	Oil / Water Separator; Demolition Complete - FY99
RFA W-4	Q-50	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
EPIC WDA-3	Building LF-18 Aircraft Ramp (SWMU 7)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-4	Building V-82 Area (SWMU31)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-12	Building CD-2/CD-3	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-14	Building U-40	Team site visit, review of existing documentation and review of operational procedures
EPIC WDA-15/16/17	Marshy Area south of runway (SWMU 30)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-21	Northeast of Building NH-140/141 (SWMU 26)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-24	Building LP-3	Team site visit, review of existing documentation and review of operational procedures
EPIC WDA-25	Building SP-367	Team site visit, review of existing documentation and review of operational procedures
EPIC WDA-26	Building SP-86	Team site visit, review of existing documentation and review of operational procedures
EPIC WDA-27	Building SP-85 Area	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-30	Mason Creek Embankment (SWMU 27)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-33/34	NM-43 Old Weapons Station Entrance (SWMU 11)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-37	Building NM-71	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data

Notes:

AST - Aboveground Storage Tank.

BRAC - Base Realignment and Closure.

SAA - Satellite Accumulation Areas are container storage areas used to manage various types of wastes generated from operations in the building.

SSA - Site Screening Areas are areas that either pose or may potentially pose a threat to public health, welfare, and the environment.

IWMP - NSN Industrial Wastewater Management Plan.

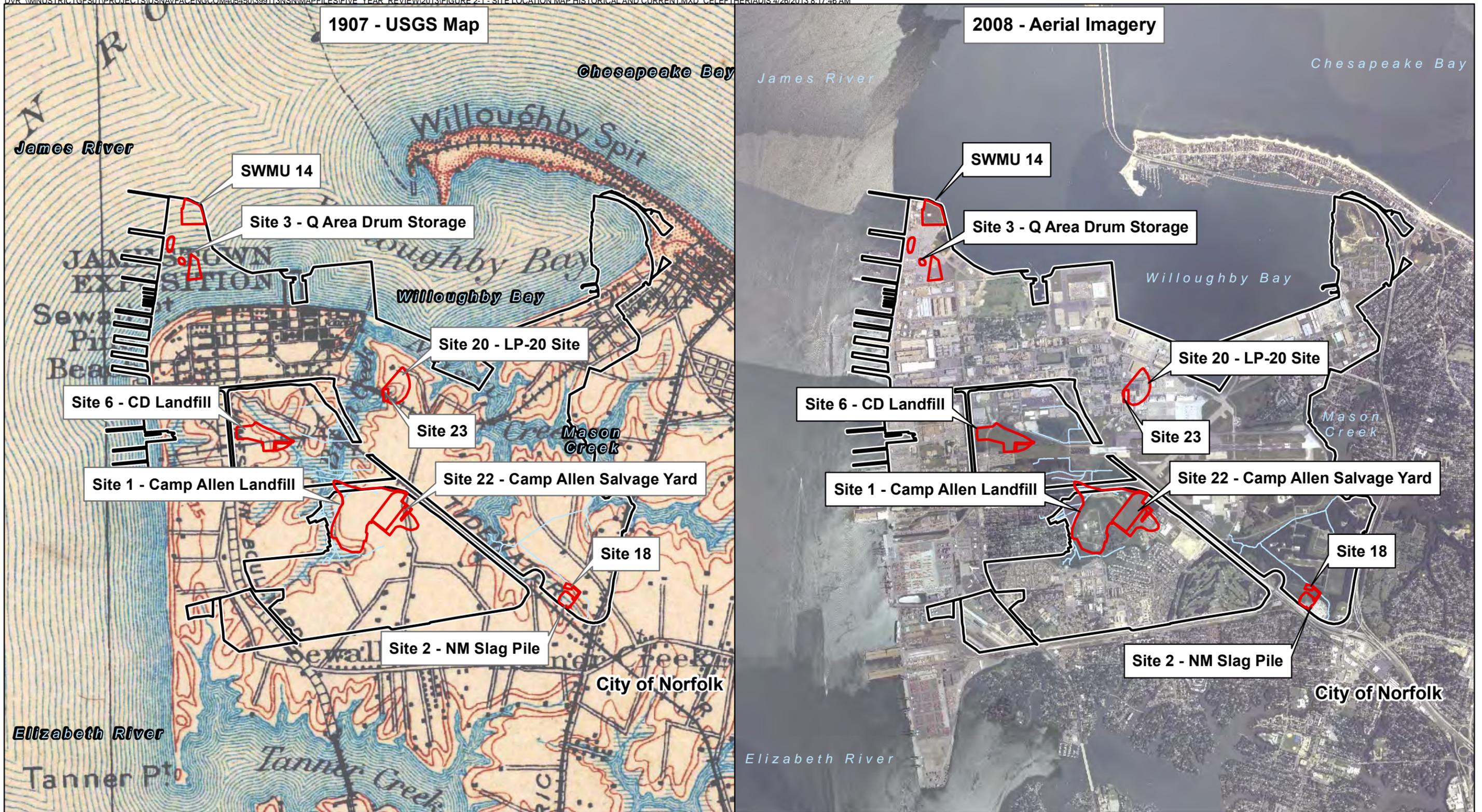
O/ WS - Oil/ Water Separator

TABLE 1-4

Status Summary of FFA Areas of Concern

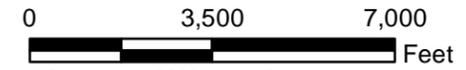
Naval Station Norfolk

AOC Designation		Site Description	Evaluation Determination
AOC 1	Building Z-309 Area	SWMU 2; RFA M-13/14	In March 2000, Close-Out Report Approved, No Further Action is Required and the Land Use will be Unrestricted
		SWMU 3; RFA AOC B	In March 2000, Close-Out Report Approved, No Further Action is Required and the Land Use will be Unrestricted
AOC 2	MAC Area	SWMU 9; EPIC WDA-28/29	In October 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unrestricted
		SWMU 10; EPIC WDA-31/32/35	In October 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unrestricted
AOC 3	CEP 201 Area	SWMU 42; EPIC WDA-9/10	In March 2000, Close-Out Report Approved, No Further Action is Required and the Land Use will be Unrestricted
	CEP Area	SWMU 28; EPIC WDA-11	In May 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unrestricted
		SWMU 32; EPIC WDA-5	In May 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unrestricted
		SWMU 33; EPIC WDA-6	In May 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unrestricted
		SWMU 34; EPIC WDA-7	In May 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unrestricted
		SWMU 35; EPIC WDA-8	In May 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unrestricted
AOC 4	Q-50 PWC Accumulation Area	SWMU 14; RFA C-17	<i>Refer to Table 1-2 for status</i>
AOC 5	CD Area Behind the Compost Yard	SWMU 38; WPIC WDA-13	In March 2001, Close-Out Report Signed, No Further Action is Required and the Land Use will be Unrestricted
AOC 6	Open Dump and Disposal Area at Boundary of Camp Allen Landfill	SWMU 39; EPIC WDA-18/19	In March 2001, Close-Out Report Signed, No Further Action is Required and the Land Use will be Unrestricted
AOC 7	MCA-603 Pits	SWMU 40; EPIC WDA-22	In March 2000, Close-Out Report Approved, No Further Action is Required and the Land Use will be Unrestricted
AOC 8	CA-99 Golf Course Disposal Area	SWMU 41; EPIC WDA-23	In March 2000, Close-Out Report Approved, No Further Action is Required and the Land Use will be Unrestricted



Legend

- Surface Water Features
- Land Use Control Area
- Installation Boundary

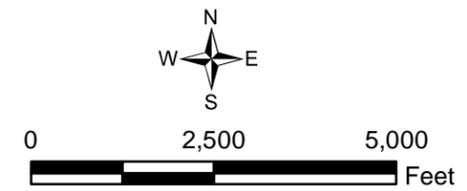


Reference: 2008 Aerial Photography
 1907 Map Source: USGS. Norfolk Virginia Special Map. Edition of June 1907

Figure 1-1
Site Location Map
 Naval Station Norfolk
 Norfolk, Virginia



- Legend**
- NFA Sites Per FFA Close-out Reports
 - Remedial/Removal Action Complete
 - Remedial/Removal Action in Progress
 - Installation Boundary



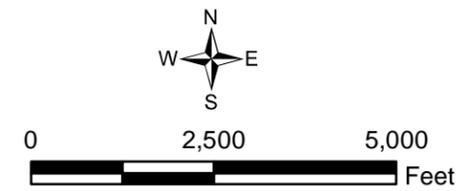
Reference: 2008 Aerial Imagery

Figure 1-2
Base Map with Site Locations
and Current Clean-up Status
 June 2013
 Naval Station Norfolk
 Norfolk, Virginia



Legend

- NFA Sites Per IAS Recommendation
- Remedial/Site Investigation in Progress
- Remedial/Removal Action Complete
- Remedial Design in Progress
- Remedial/Removal Action in Progress
- Installation Boundary



Reference: 2008 Aerial Imagery

Figure 1-3
Site Clean-up Status
 As of March 1997
 Naval Station Norfolk
 Norfolk, Virginia



- Legend**
- NFA Sites Per FFA Close-out Reports
 - Remedial/Removal Action Complete
 - Transferred from CERCLA Program
 - Installation Boundary

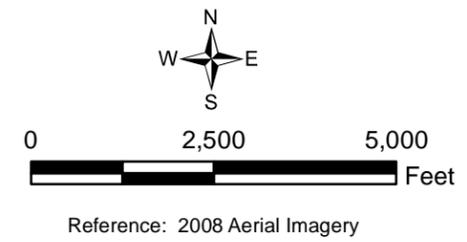


Figure 1-4
Base Map
Additional SWMU Locations
and Current Clean-up Status
 June 2013
 Naval Station Norfolk
 Norfolk, Virginia
CH2MHILL



LEGEND

- Remedial/Removal Action Complete
- Remedial/Removal Action In Progress
- Remedial/Site Investigation In Progress
- To Be Determined



0 1800 3600 Feet

Figure 1-5
Additional SWMU Clean-Up Status
As of March 1997
Naval Station Norfolk

Site Descriptions

This section provides specific information regarding the ERP sites and SWMUs at NSN that have been investigated and are currently undergoing remediation. Site-specific information includes site physical characteristics, a description of past activities conducted at the site, and known contaminants in each site medium. In addition, the current status of each site is briefly discussed. A site map (**Figure 1-2**) is provided for the IRP sites and SWMUs. However, inactive sites that were either closed out through a consensus agreement or recommended for NFA are not discussed in this section.

2.1 Environmental Restoration Program Sites

The following descriptions include physical characteristics, past activities, detected contaminants, and ongoing remediation strategies for each site, if known.

2.1.1 Site 1—Camp Allen Landfill

The CALF site includes two distinct areas (Area A, the 45-acre landfill, and Area B, the 2-acre fire disposal area), as shown on **Figures 2-1 and 2-2**. The Area A landfill, which operated from the mid-1940s until approximately 1974, was used for the disposal of metal plating and parts cleaning sludge, paint-stripping residue, various chlorinated organic solvents, overage chemicals, pesticides, asbestos, incinerator ash, fly and bottom ash from the base power plant, and miscellaneous debris. Wastes from a fire at CASY (Site 22), including drums containing various chemicals, were buried in 1971 in trenches at Area B.

Contamination from prior disposal practices at the CALF site has affected the surface and subsurface soil, sediment, surface water, and groundwater. The primary contaminants found in all media at the site are volatile organic compounds (VOCs). Areas of inorganic contamination in surface water and sediments in the surrounding drainage ditches and in the onsite pond were also identified. Groundwater contamination was found in both the water-table aquifer and the Yorktown aquifer in Areas A and B. The presence of contamination in the deeper Yorktown aquifer is thought to be due to the presence of a discontinuous confining layer between the two aquifers beneath much of the CALF area.

Currently, only a heliport is located over a portion of the Area A landfill. The base brig facility was demolished in FY 2013. Area A is soil-covered and vegetated to minimize surface erosion. Area B was converted to an asphalt parking area during the construction of Fleet Recreational Park completed in 2010. Areas A and B are both adjacent to tidal drainage ditches that convey stormwater runoff to Willoughby Bay.

An NTCRA was implemented at Area B in May 1994 and completed in January 1995 to remove the primary source areas of contamination. The CALF site RI/Feasibility Study (FS) was completed in 1994 (Baker, 1994b). The DD (Baker, 1993) was signed in July 1995, requiring localized treatment of groundwater and soil using vacuum extraction and a groundwater extraction and treatment system to remediate groundwater underlying Areas A, B, and CASY.

Prior to the initiation of the groundwater remediation systems, baseline groundwater, surface water, and sediment data were collected in 1997 and 1998. Continuous operation of the groundwater extraction and treatment system began in November 1998 and consists of pump-and-treat systems for groundwater remediation installed in Area A (for Yorktown aquifer groundwater in the western part of the area and for Columbia aquifer groundwater in the northern part of the area) and in Area B (for both Columbia and Yorktown aquifer groundwater). A dual-phase vapor extraction (DPVE) system was completed and began operation in May 1998 to address a known hotspot in Area A. The initial LTM Plan required by the DD was initiated in 1999 following the system startup.

An aquifer pumping test study was conducted during the summer of 2000 and groundwater modeling was completed during the fall of 2000 to delineate the extent of the capture zones for the individual extraction wells.

In addition, the system operational data were reviewed quarterly to assess the performance of the remediation system. Based on recommendations from these reviews, adjustments have been made to both the treatment system operations and the monitoring program to optimize the efficiency of the system operations. A revised LTM Plan for CALF (CH2M HILL, 2007a) was submitted in 2007 to evaluate the groundwater remediation systems more effectively, requiring annual sampling of up to 50 monitoring wells and five stream locations and analysis of Target Compound List VOCs. Based on the evaluation of LTM data, the DPVE system was turned off (but maintained in an operable condition) in 2008 because there were no signs of contaminant migration in groundwater downgradient of the waste material. The LTM program is conducted to ensure that the shutoff of the DPVE system does not affect the downgradient groundwater.

In accordance with recommendation from the 2008 Five-Year Review, a vapor intrusion investigation was conducted at the barracks building located near Area B in 2011 and 2012. The results of the vapor intrusion investigation, summarized in the *Sites 1 and 20 Vapor Intrusion Risk Assessment Technical Memorandum* (CH2M HILL 2012b), warranted additional data collection to support the Risk Assessment (RA). As a result, an additional round of sampling is being planned for December 2013.

Shallow groundwater in Area B was investigated in January 2008 to determine if VOC contamination was limited to the vicinity of monitoring wells B-MW3A and B-MW11A and to evaluate if there was a viable alternate remediation approach to operating the shallow groundwater treatment system. The results did not support an alternate remediation approach. In 2011, the Team agreed to complete an alternative LTM event to refine the groundwater plume boundary and determine whether additional investigation is warranted for the Navy housing area based upon an elevated VOC detection in its vicinity. This alternative LTM event was completed in April 2011; the groundwater results from this alternative event (documented in the 2011 LTM Report) and historical data collected at the site are being used to refine the LTM program for Site 1. An updated LTM Sampling and Analysis Plan (SAP) is expected to be completed by December 2013. The results of the alternative 2011 LTM were used to develop an additional Area B delineation investigation west of B-MW16 in the housing area. A Tier II SAP, *Area B Offsite Migration Evaluation Sampling and Analysis Plan, Site 1*, was prepared to present the technical approach for an evaluation of offsite migration southwest of Area B (CH2M HILL, 2012a). The results will be summarized in the forthcoming 2012 LTM Report. Based upon the vertical distribution of groundwater contaminants, a vapor intrusion investigation for the housing area was not warranted; however, additional investigation is being planned to support delineating the extent of groundwater contamination

ICs currently in place at CALF include prohibitions of the use of groundwater for any purpose other than environmental monitoring, as well as digging prohibitions that are enforced through the use of a dig permit system and the Navy's site approval process. LUCs are shown on **Figures 2-1 and 2-3** for the Columbia and Yorktown aquifers, respectively. Additionally, the pre-NPL remedy selected by the 1995 DD (Baker, 1995a) was reaffirmed by the Sites 1, 3, 18, and 20 Proposed Plan and ROD. The ROD was signed in September 2010.

In early 2008, an NTCRA was completed for sediments in Bousch Creek that were considered to be associated with Site 1. Specifically, the removal action addressed contaminated sediments potentially posing ecological risk as defined in the *Final Ecological Risk Assessment (ERA) Step 7 Report, Upper Reaches of Bousch Creek, Camp Allen Landfill (Site 1)* (CH2M HILL, 2006b). In lieu of proceeding to Step 8 of the ERA process, a removal action was considered and evaluated in the *Engineering Evaluation/Cost Analysis (EE/CA) for Upper Reaches of Bousch Creek, Naval Station Norfolk, Norfolk, Virginia* (CH2M HILL, 2007b). The supporting *Final Action Memorandum for Upper Reaches of Bousch Creek, Camp Allen Landfill (Site 1), Naval Station Norfolk, Norfolk, Virginia* (CH2M HILL, 2007c) was approved as the DD for the NTCRA in October 2007.

The NTCRA consisted of excavating approximately 2,400 linear feet of the creek in the vicinity of Site 1. Specifically, 2 feet of sediment were excavated throughout the designated removal areas and backfilled with 1 foot of clean fill. Sediment was removed to the concrete bottom within the concrete-lined canal portion north of Site 1. Construction activities are summarized in the *Final Construction Closeout Report Upper Reaches of Bousch Creek (Site 1, Camp Allen Landfill) Naval Station Norfolk, Norfolk, Virginia* (AGVIQ/CH2M HILL, 2008b).

The Lower Reaches of Bousch Creek, considered to be associated sites in the industrial portion of the facility and not with Site 1, was investigated in 2010. The results of the investigation were included in the *Final Ecological Assessment for the Lower Reaches of Bousch Creek Naval Station Norfolk, Norfolk, Virginia* (CH2M HILL, 2010) completed in July 2010. Results of the investigation indicate that no further investigation and NFA is warranted. The NSN Partnering Team signed a consensus statement stating that no further investigation and NFA is warranted in August 2010.

2.1.2 Site 2—Naval Magazine Slag Pile

The NM Slag Pile (**Figure 2-3**) is a 1-acre disposal area for slag generated by an aluminum smelting operation during the 1950s and 1960s. The slag is a residual cinder material formed from fusion rocks such as limestone with impurities from the aluminum ore and ash from the blast furnace fuel. In order to create a level surface upon which the slag could be deposited, fly ash and/or bottom ash (derived from coal burning operations elsewhere at NSN) was also used as fill material at the site. During the smelting operation, the slag pile area was defined by a lack of vegetation around the site near the slag pile. The site surface has since been regraded and vegetation was planted. Prior to remediation activities, the surface of the site consisted of a gravel parking lot and an open grassy field.

The potential for site contamination from metals, including chromium, cadmium, and zinc, was identified in the 1983 IAS (ESE, 1983). Trace amounts of inorganics were detected in surface soil, surface water, and sediment samples taken during the 1988 IRPRI (Malcolm Pirnie, 1988); however, the samples were taken after site regrading and placement of gravel surfacing. Since these activities disturbed the surface soil, these analytical results may not be representative of potential subsurface contamination at the site.

The 1998 RI conducted at the site concluded that the disposal activities had impacted the groundwater and soil at the site, as well as sediment and surface water in the adjacent drainage channel. In correlation with the type of material disposed at the site, the primary contaminants consist of metals including arsenic, antimony, cadmium, chromium, copper, iron, lead, nickel, silver, and zinc. However, significant concentrations of organic chemicals (4,4'-dichlorodiphenyldichloroethene and trichloroethene [TCE]) were also detected. Sediment and surface soil sampling was conducted in February of 1998 to delineate the contamination limits for a sediment removal action.

Initially, sediment contamination was being addressed separately from other media through an EE/CA. Design plans and specifications for the sediment removal action were prepared in spring and early summer of 1998. The final RI (CH2M HILL, 1998a) and FS (CH2M HILL, 1998c) documents for the entire site were completed in 1998. The final Remedial Action Design for the sediment removal program was submitted (CH2M HILL, 1999), and approximately 2,000 cubic yards (yd³) of sediment were removed in November 1999. The final ROD (CH2M HILL, 2000a) was completed in December 2000. In February 2000, an asphalt and soil cover remedy was placed over the site.

The post-closure monitoring plan consists of the collection of sediment, surface water, and groundwater samples for Target Analyte List metals analysis. The first five rounds of sampling were completed annually in from 2000 to 2004. In 2004, statistical analysis results indicated that the concentrations of site constituents were decreasing in groundwater. In addition, the concentrations of site constituents in the surface water and sediment demonstrated little change since the remedial actions at the site. Therefore, based on the ROD, it was recommended that the LTM groundwater sampling be reduced to a period of once every 5 years and sediment and surface water LTM sampling be discontinued. The most current round of LTM groundwater sampling occurred November 2012 and will be presented in the forthcoming 2012 Annual LTM Report. In preparation for the 2008 Five-Year Review, sediment samples were collected in June 2007 and analyzed for lead and are also discussed in the 2007 Annual LTM Report (CH2M HILL, 2008c). The results for lead indicated concentrations were below the established cleanup goal and no further sediment sampling was required following this event.

The ROD for Site 18 stated the inorganic contamination detected at upgradient wells should be associated with Site 2; therefore, Site 2 and upgradient Site 18 were sampled and analyzed for total and dissolved inorganics in

November 2012. The results will be incorporated into the Five-Year Review (2013). Additionally, Site 2 will be included in the new LTM SAP to refine and update the LTM program for the site.

2.1.3 Site 3—Q-Area Drum Storage Yard

The QADSY, shown on **Figure 2-4**, was previously a compound that occupied approximately 5 acres in the northwest corner of the NSN near the carrier piers. This area of the NSN was created by dredging operations in the early 1950s as the base expanded in area. The QADSY was an open earthen yard that was used from the 1950s until the late 1980s to store tens of thousands of drums. Most of the drums contained new petroleum products, various chlorinated organic solvents, paint thinners, and pesticides. Previous investigations showed dark stains on the soil and oil-saturated soil throughout the storage yard, indicating past spills. The northern portion of the yard, which was used to store leaking or damaged drums and hazardous materials, was particularly stained.

In 1986, Navy fire inspectors expressed concern with the oil-saturated soils at the northern end of the storage area (previously used to store damaged or leaking drums). On the basis of a potential fire hazard, the top 6 inches of soil was excavated from an area of 4,240 square yards (totaling approximately 750 yd³ of soil removed) in the northern section and disposed offsite in 1987. Following the removal action, this area of the storage yard was paved.

An RI/FS (ESE, 1996a) for this site revealed that the soil was contaminated with total petroleum hydrocarbons, VOCs, and pesticides. In addition, VOC contamination was found in the groundwater beneath the site and outside the site boundary. The shallow groundwater beneath the hazardous materials area and the northern portion of the petroleum products area was impacted the most. Some low VOC levels were also observed in the deep wells. This may be due to the lack of a confining layer between the two aquifers in this area. The general extent of the groundwater plume, which affected approximately 29 acres beneath the fleet parking area west of the site, was defined with monitoring well and direct-push groundwater sampling.

The DD (ESE, 1996b) for the site was signed in November 1996 and calls for remediation by AS/SVE. A pilot treatability study was performed prior to the system being constructed. The remediation system began operation in August 1998. Several monitoring wells were sampled for VOCs in 1998 to provide baseline water-quality data before the remediation system was started.

The LTM for the QADSY has historically been (from 1999 through 2012) on a biannual sampling schedule for VOCs. Based on the significant reduction of VOC concentrations during the first year of operation, the system operation was modified during September 1999 to a 2-week cycle of pulsing. The system operational data collected by Shaw Environmental, Inc., and the monitoring data collected by CH2M HILL have been reviewed so that the system operations and maintenance program could be adjusted as necessary.

In July 2002, the Team agreed to a closeout strategy for AOC 1. The closeout strategy included the accelerated remediation proximal to CMW-101 to address the high concentrations of vinyl chloride (VC), followed by continued monitoring, and ultimately the shutdown and dismantling of the system. The accelerated remediation was accomplished by the extension of the treatment system and installation of a new air sparge (AS) well proximal to well CMW-101. The closeout strategy was implemented on April 4, 2003, when the new AS well began operation. Following the installation of the new AS well, four rounds of monitoring data were collected and showed that the concentrations of VC in well CMW-101 have decreased substantially from 92 micrograms per liter ($\mu\text{g/L}$) (February 2003, prior to installation of the new AS well) to below the detection limit (February 2005). As planned in the closeout strategy for the site, the AS system was shut down in June 2005. Subsequent monitoring events have reflected VC concentrations above the cleanup goal ($0.08 \mu\text{g/L}$).

Based upon the LTM results with a minimum of four consecutive results below the MCL, monitoring was recently completed for only CMW-101 in the LTM for AOC 1. From 2008 to 2010, the VC concentration exceeded the MCL.

Similar to AOC 1, a closeout strategy for AOC 2 was also implemented in June 2006 with the installation of an additional AS well proximal to CMW-202 to treat TCE and VC. In accordance with the exit strategy, analytical data for those wells that continue to demonstrate VOC concentrations above the cleanup goals will be evaluated, and

if the VOC concentrations are below the MCL, then it would be proposed that the system is shut down and an additional two rounds of LTM be completed at the selected wells.

The remedy selected by the 1996 DD (ESE, 1996c) was reaffirmed by the Sites 1, 3, 18, and 20 Proposed Plan and ROD (Navy, 2010). The ROD was signed in September 2010. In addition to documenting the pre-NPL remedy, the groundwater cleanup goals set at the risk-based values presented in the November 1996 DD (based upon the most likely exposure scenarios) will continue to serve as the cleanup goals, as the risk-based goals are more stringent than the respective MCLs.

In 2011, a site-wide groundwater monitoring event was conducted as part of LTM to assess monitoring wells that had not been sampled during LTM as a result of previously achieving cleanup goals in accordance with the established close-out strategies. Results from AOC 1 indicated exceedances of cleanup goals in groundwater. As a result, the AS portion of the system was re-started. Based upon Team discussion of the groundwater data collected in 2012, the systems at AOC 1 and AOC 2 have been shut down in June 2013 while LTM continues. Data will be evaluated to assess impacts (or the lack of) to groundwater contaminant concentrations without the AS systems in operation in future LTM reports. Also, it has been proposed that monitoring frequency be completed annually; this will be documented in the forthcoming basewide LTM SAP.

2.1.4 Site 6—CD Landfill

The CD Landfill site occupies approximately 22 acres and is located just east of Hampton Boulevard and south of the Naval Exchange, as illustrated on **Figure 2-5**. The site incorporates two areas of landfilling operations—the easternmost (unpermitted) section and the western (permitted) section. The unpermitted portion of the landfill operated from 1974 to 1979 and was used for demolition debris and inert solid waste, fly ash, and incinerator residue.

In October 1979, NAVFAC received a permit from the Virginia Department of Health to use the landfill (western portion) for disposal of demolition debris and other non-putrescible wastes, excluding fly ash, incinerator residues, chemicals, and asbestos. Blasting grit used for sandblasting cadmium-plated aircraft parts was deposited at the landfill until 1981, when the blasting grit was tested and found to exceed the USEPA Extraction Procedure toxicity limit for cadmium. The grit was classified as a hazardous waste and onsite disposal of the material ceased. Landfilling operations continued in the western portion of the site until 1987. At the time the landfill permit was granted, a portion of the southeast corner of the site was removed and regraded to allow for runway expansion at the NAS. The design of the runway expansion specified that excess material was to be spread over the landfill and not removed from the site.

In 1993, Seabee Road was constructed over the site and opened to the public. Construction plans required only the addition of fill material; no cutting or grading into the existing landfill occurred. Most of the existing debris mounds situated in the north-central portion of the landfill were leveled and spread around the site to reduce the amount of standing water that accumulated after rain events.

The results of several investigations (performed in 1993 and 1994) guided the scoping of the RI. The RI was completed in three separate rounds of sampling. Soil, sediment, groundwater, and surface water samples were collected. As a result of the RI/RA Report (Baker, 1995b), an FS (Baker, 1996b) was prepared in July 1996 to address contaminated media at the CD Landfill site. Potential risks associated with contaminants in the soil, sediments, and groundwater (including surface water) were identified, and these guided the development and evaluation of the media-specific remedial action alternatives. In addition to the FS, a separate geostatistical analysis was performed to evaluate and better define the areas of sediment contamination.

A 1996 DD (Baker, 1996c) for the contaminated sediments (designated as Operable Unit [OU] 1) outlined a removal action for sediments at the CD Landfill that exceeded the Effects Range–Medium levels. Removal of heavy metal- and pesticide-contaminated sediments was partially completed in the fall of 1997 but was postponed during the winter because of inclement weather. When the OU 2 (soil and groundwater) landfill cap was designed, the cap was extended to cover the remaining contaminated sediments so no further removal would be required. In June 1997, the Team agreed to an additional sampling event to characterize the fill material

and determine closure requirements. A statistical sampling approach was developed to determine within a specified confidence interval whether the fill material would be classified as hazardous. All of the samples collected and analyzed during the June event were below the regulatory standards. Based on the statistical findings, the fill material at the CD Landfill is not considered a hazardous waste and it was agreed that the site would be closed under the Virginia Solid Waste Management Regulations (VSWMR).

A Proposed Remedial Action Plan for OU 2 (Baker, 1998a) identified the preferred alternative, a synthetic flexible liner-capping system with groundwater monitoring with ICs, for the CD Landfill. The final ROD was issued on September 28, 1998 (Baker, 1998b). The construction of the landfill cap was completed in December 1999. As a requirement of the VSMWR (Part D of 9 Virginia Administrative Code 20-80-270), the CD Landfill is part of the LTM program at NSN with groundwater and surface water monitoring, as well as annual inspections and maintenance of the landfill's environmental controls for 10 years after the closure was completed. The groundwater monitoring program initially consisted of sampling eight monitoring wells on a quarterly basis for 1 year, followed by semiannual monitoring for selected analytical parameters. The initial 4 years of groundwater monitoring were completed in 2000, 2001, 2002, and 2003. The analytical data from the first 4 years of monitoring are discussed in the 2003 Post-Closure Monitoring Report (AGVIQ/CH2M HILL, 2004) and in the 2004 First Determination Report for Site 6 (CH2M HILL, 2004a). The final 2005 Annual Report (CH2M HILL, 2006a) summarizes the results of the LTM for the period between February 2005 and August 2005 and compares the monitoring results to baseline monitoring (2000), as well as previous LTM events.

Based on the statistical analysis of the Phase I and Phase II data, as discussed in the First Determination Report for Site 6 (CH2M HILL, 2004a), it was recommended that the Phase II monitoring be discontinued and the Phase I monitoring be reinstated at the site. Therefore, during the 2004 and 2005 monitoring events, semiannual groundwater samples were collected and analyzed for groundwater indicator parameters (specific conductivity, pH, total organic carbons, and total organic halogen). Overall, the indicator parameters appear to be relatively consistent over the sampling events performed.

A meeting between the Navy and VDEQ was held in October 2006 to discuss the status of Site 6 as it relates to following both the CERCLA process and the VSWMR. Additionally, options for a path forward were discussed. The Navy submitted a groundwater monitoring plan to VDEQ that detailed the proposed sampling approach and the analytical parameters for the Site 6 groundwater monitoring plan in March 2007. All eight of the monitoring wells are sampled quarterly for the first 2 years (2007 and 2008), then semiannually for the third year (2009). These 10 rounds of sampling comprise the data set for the first corrective action site evaluation report, which was submitted March 2011. The most recent round of groundwater sampling occurred June 2011.

An HHRA was conducted on the data collected from 2007 and 2011 to evaluate any changes in the contaminants driving risk in groundwater as established in the 1994 RI/HHRA, to determine if contaminants detected in groundwater warrant further evaluation, and to refine groundwater flow estimates at the site. In consideration in the transition of reporting requirements for Site 6 from VSWMR to CERCLA, a Technical Memorandum *Site 6 CD Landfill Human Health Risk Assessment and Piezometer Installation Summary* (CH2M HILL, 2013a) was developed. Based on the outcome of these actions, the LTM program will be modified and documented in the NSN LTM SAP. The solid waste permit for the site under VSWMR has been revoked by VDEQ (VDEQ, 2013).

2.1.5 Site 18-Former Naval Magazine Waste Storage Area

The NM Storage Area (**Figure 2-6**) is located in the southeastern corner of NSN and was used from 1975 to 1979 to store drums of hazardous waste, consisting of waste oil, metal plating solutions and sludges, chlorinated organic acids (including TCE and 1,1,1 trichloroethane), and paint stripping solutions. Spillage of waste oil and hazardous wastes occurred in this area. A pit was excavated and an existing drainage ditch was widened and lengthened to channel waste oil and contaminated runoff into an unlined pit. Oil and contaminated water were periodically pumped from the pit and transported to a wastewater treatment plant (WWTP). In accordance with a permit obtained from the Commonwealth of Virginia, monitoring of the site continued for over 4 years before a determination was made on the basis that no significant contamination was observed. On the basis of the 1995 RRR—Phase I (Baker, 1996a), Site 18 was determined to be an NFA site. In the fall of 2000, the Team determined

it was necessary to reevaluate Site 18 because the NFA determination was based on USEPA Region III industrial RBCs and USEPA Region III residential RBCs would be considered more appropriate. The initial phase of the investigation was conducted in June 2001 and consisted of the installation and sampling of three monitoring wells. Based upon the findings from the initial investigation, additional monitoring wells were installed in February 2002 to further delineate the contamination at the site. The groundwater analytical results from both phases of the field investigation indicate that the RBCs and drinking water MCLs were exceeded for four VOCs (1,4-dichlorobenzene, cis-1,2-dichloroethene [DCE], TCE, and VC) (CH2M HILL, 2002d).

In an effort to fill data gaps, additional characterization of the site soil, sediment, surface water, and groundwater was conducted in December 2002. Two deep monitoring wells were installed to evaluate vertical transport of site constituents. In addition, surface and subsurface soil samples were collected across the site, and sediment and surface water samples were collected in the drainage channel adjacent to the site. The results of the additional investigation are presented in the *Final Expanded Site Investigation Report for Site 18* submitted by CH2M HILL in July 2004 (CH2M HILL, 2004b).

Soil and sediment were determined to no longer be media of concern, and investigations were focused on VOCs in groundwater. A membrane interface probe (MIP) survey was recommended to further delineate the horizontal and vertical extent of the VOCs in the subsurface groundwater at the site. An additional round of sampling at the two existing monitoring wells was collected to track VOC concentrations over time. The MIP study and collection of groundwater was conducted in December 2004. Based on the MIP study and groundwater sampling, an additional groundwater investigation was recommended for further site evaluation. The additional activities included the installation of three monitoring wells (MW08S, MW09S, and MW10S) to confirm the MIP results and to collect groundwater samples from these wells and three existing monitoring wells (MW03S, MW03C, and MW05S). Based on the analytical data and a preliminary monitored natural attenuation evaluation, it was determined that there is evidence for biodegradation of TCE at Site 18. An EE/CA (CH2M HILL, 2008a) was finalized in March 2008, detailing an interim groundwater action focused on the MW03 cluster hotspot. In April 2008, an Action Memorandum (CH2M HILL, 2008b) recommended the implementation of ERD to mitigate the potential human health risk, an interim action of injection in the area of the MW03 cluster, and extending to MW10, was completed in July 2008 in accordance with the *Final Non-Time-Critical Removal Action Work Plan, Site 18, Former Naval Magazine Waste Storage Area, Naval Station Norfolk, Norfolk, Virginia* (AGVIQ/CH2M HILL, 2008a). Quarterly performance monitoring of VOCs in groundwater was initiated in October 2008 and was completed July 2009. A Performance Monitoring Report documenting the effectiveness of the NTCRA was completed in December 2009. The Report recommended an additional injection to encourage further reduction of VOCs in groundwater. The additional injection was implemented as an Addendum to the 2008 Action Memorandum in May 2010. Performance monitoring has been conducted through March 2013 to evaluate the effectiveness of the May 2010 injection. A Technical Memorandum to summarize and evaluate the results of the performance monitoring will be completed following the March 2013 groundwater sampling event. The recommendations of this Technical Memorandum will be used to develop the LTM program for the site and will be included in the NSN LTM SAP. As discussed in Section 2.1.3, the upgradient monitoring wells from Site 18 will be combined with Site 2 in the future LTM program.

Site 18 is included in the Sites 1, 3, 18, and 20 ROD for NSN, which was signed in August 2010 (Navy, 2010). The Selected Remedy documented by the ROD is continued enhanced bioremediation with groundwater monitoring and LUCs. Additional injections may be necessary if cleanup goals are not met in a reasonable timeframe in accordance with the ROD. The Team will evaluate site groundwater monitoring data as input into whether additional monitoring or additional injections are warranted.

2.1.6 Site 20—LP-20 Site

As shown on **Figure 2-7**, Building LP-20 is one of many large buildings located northwest of the NAS main runway. Currently, the building primarily houses the PWC's Transportation Department. In the past, a portion of the building was used for aircraft engine overhaul and maintenance. Previous activities at the building included painting, X-ray facilities, cleaning and blasting, and a metal-plating operation. Waste products generated from

these activities were transferred to the industrial WWTP via underground piping. In addition, a large fuel storage area is also located south of the building. An underground pipeline extends from the Fuel Farm to buildings LP-78 and LP-176, located east of the site. Between the 1940s and 1990s, numerous spills or releases of wastewater and petroleum have been documented. Significant releases were associated with damage to underground wastewater lines during construction activities, and leakage of the underground petroleum pipeline.

Investigations at the site began in 1986 following a release of Jet Propulsion-5 fuel from the underground pipeline. Since 1986, numerous investigations have been conducted to evaluate the extent of releases from underground fuel pipelines, the industrial wastewater line, and various USTs at the site. These investigations determined that significant amounts of free product, as well as chlorinated solvents, are present. An RI and FS summarizing the previous investigation data were completed in 1995 (Baker, 1995c) and 1996 (Baker, 1996b), respectively.

The data generated during the RI indicate that VOCs are the primary contaminants detected in the area. Specifically, chlorinated solvents were detected in the vicinity of LP-20 and LP-26. In addition, petroleum products are present east of Building LP-22 and south of Building LP-179. VC, 1,1-DCE, 1,2-DCE, 1,2-dichloroethane, TCE, and benzene were detected in the shallow aquifer (Columbia). Furthermore, VC, 1,2-DCE, and TCE were also detected in the deep aquifer (Yorktown).

As a result of the free product at the site, two product recovery systems were installed south and southeast of Building LP-22. Product Recovery System #1 was constructed in 1986, and Product Recovery System #2 was reportedly constructed sometime between 1988 and 1990. Both systems operated four recovery wells that pumped groundwater and product into oil-water separators (OWSs). The OWSs discharged into Bousch Creek and the free product was collected in an aboveground storage tank. Reportedly, neither system performed as anticipated, and both systems were seldom in operation due to mechanical problems. The systems were shut off in December 1994 and dismantled in 1995.

The DD (Baker, 1996d) for the LP-20 site required that contamination at the site be treated to reduce the threat to human health and the environment. The goal of the remedial action was to treat the contaminant plume in the shallow aquifer using an AS/SVE system to prevent migration of the plume offsite and into the deep aquifer, and to reduce the contaminant concentrations to established cleanup goals. In addition, aquifer use restrictions (for both the shallow and deep aquifer) were mandated to prevent the groundwater from being used for either a potable or non-potable (industrial water) source.

The treatment system began operating on April 14, 1998. The shallow aquifer is treated by an AS/SVE system consisting of 31 air injection wells and 21 vapor extraction wells. The system was placed throughout the center and downgradient extent of the contaminant plume in accessible areas. In addition, several monitoring wells were sampled for VOCs in February 1998 to provide baseline water-quality data before the remediation system was started (CH2M HILL, 1998b).

As a requirement of the DD, the LP-20 site is part of the LTM program at NSN. Monitoring currently consists of an annual sampling of groundwater monitoring wells in the shallow and deep aquifer to track the levels of contaminants at the site and to determine if these constituents are migrating offsite or into the deep aquifer. The first round of LTM was performed in February 1999, after approximately 10 months of system operation (CH2M HILL, 2000b), and annual LTM has continued since.

The effectiveness of the existing AS/SVE system continues to be evaluated by the Remedial Process Optimization (RPO) team based upon monitoring results. In accordance with suggestions from the RPO team, the AS/SVE system was shut down in March 2009 following the LTM sampling event so the site could be evaluated to determine potential options to enhance the remedy. The system was re-started in September 2010. Additional investigation to determine the extent of the VOC plume was conducted late 2009 and early 2010, which included the installation of nine new shallow groundwater monitoring wells and the sampling of 36 monitoring wells across the site. Following recommendations from the RPO team, a groundwater extraction system was installed at the site to supplement the existing AS/SVE system. The enhanced system (groundwater extraction and AS/SVE systems) began operation August 2010. The groundwater extracted contains high concentrations of VOCs that are treated and removed, creating an overall mass reduction of VOCs in groundwater at Site 20.

High iron concentrations in groundwater cause scaling in the air stripper, which must be taken offline to perform maintenance. Additionally, the extraction system has captured residual petroleum, oil, and lubricants, which clog the filter bags. Because of the operational issues requiring significant maintenance activities, the extraction system is not operating. Modifications and upgrades to the extraction system will be evaluated following additional groundwater investigation planned for the summer of 2013.

The remedy selected by the DD was reaffirmed by the Sites 1, 3, 18, and 20 Proposed Plan and ROD (ROD signed September 2010). In addition to documenting the pre-NPL remedy, the groundwater cleanup goals were revised from the risk-based values presented in the 1996 DD (based upon the most likely exposure scenarios) to the federal MCLs.

In accordance with the recommendation from the 2008 Five-Year Review, building LP-20 has undergone a vapor intrusion investigation. The results of the risk evaluation (CH2M HILL, 2012b) indicated that the indoor air risks to current industrial workers in Building LP-20 are less than USEPA target levels based on the data collected during this VI investigation. Potential uncertainties about future risks and hazards were recommended to be addressed through monitoring every 5 years during the Five-year Review process. Additionally, it was recommended that the current LUCs at Site 20 be modified throughout the remedial action to maintain current building uses, prevent activities that would compromise the integrity of the building foundation and/or slab, and prevent construction of additional structures at the site without further evaluation and/or implementation of mitigation measures until the groundwater remedial action is completed.

Groundwater samples collected in 2012 will be summarized in the forthcoming 2012 LTM Report; the results will be considered in the LTM SAP being developed for NSN. The Team determined that additional monitoring wells, sampling, and evaluation is necessary to address uncertainties at the site based upon the existing monitoring well network (CH2M HILL, 2013b).

2.1.7 Site 22—Camp Allen Storage Yard

The CASY operated from the 1940s until 1995, salvaging and processing scrap materials generated at NSN. The CASY is located between Area A and Area B of the CALF Site, as shown on **Figure 2-8**. The CASY activities have included storage and management of waste oils, used chemicals, and scrap industrial and commercial equipment. Metal smelting, various recycling activities, and miscellaneous burning also occurred at the CASY. In addition, the facility was used to store acids, paint thinners, solvents, pesticides, and transformers. A polychlorinated biphenyl (PCB) spill occurred at the CASY in 1989, when a transformer was damaged by a forklift. The PWC responded to the spill and conducted a preliminary cleanup at that time. When operations ceased in 1995, the buildings, incinerators, and rail lines were demolished.

The Virginia Department of Transportation has implemented a plan to extend the I-564 intermodal connector to the Norfolk International Terminals. The highway expansion will require that local utilities, Navy-owned ballfields, and, potentially, a rail line be relocated. As a result, ballfields have been constructed on the site to replace those that will be taken as part of the highway expansion.

A Preliminary Assessment/Site Inspection (PA/SI) was completed for the CASY (Baker, 1994a), and the investigation results indicated that the surface and subsurface soil were contaminated with PCBs, pesticides, and metals. Additional data were generated during the RI (Baker, 1999) and showed that semivolatile organic compounds (SVOCs), pesticides, PCBs, and metals had impacted surface and subsurface soil; surface water samples collected in storm drains contained arsenic; sediment samples indicated the presence of arsenic, pesticides, and PCBs; and, antimony, arsenic, and iron were present in groundwater. Based on the exposure scenarios evaluated in the HHRA, no potentially carcinogenic or noncarcinogenic human health risks were identified.

The initial remedial action at CASY consisted of the NTCRA and offsite disposal of metals- and PCB-contaminated soils. A PCB removal action began in August of 1998. Additional delineation of site contaminants in 2001 identified six metals hotspots throughout the site. As an interim measure, the Navy began removal of the hotspot soils in conjunction with the ongoing PCB removal action. The hotspot and PCB-contaminated soil removal continued

through 2001, with the ultimate excavation of more than 16,000 yd³ of material. The removal action achieved the soil PCB cleanup goals; however, the additional soil analytical data showed that the aerial extent of metals contamination was more widespread than previously estimated. It was estimated that approximately 29,000 yd³ of soil remained at the site above the metals cleanup goals. Based upon the more comprehensive confirmation sampling and anticipated future land use of the site, the remedial measures for the site were re-evaluated. The Navy determined that the placement of a soil cover was more cost-effective than removal of the metals-contaminated soils, and the Team reached consensus on this course of action in March 2002.

The soil cover and the cover for the sediments in the pond were completed in June 2004. The final ROD addressing the soil and sediment at the site and encompassing the overall soil and sediment cleanup strategy for the site was signed by USEPA in September of 2004 (Baker, 2004). The ROD identifies the risks to the human health and ecological receptors exposed to soil and sediment, establishes the Remedial Action Objectives (RAOs), and defines the LUCs for the CASY. In accordance with the closeout procedures for NPL, a *Remedial Action Completion Report* for IRP Site 22 was signed by the Navy in January 2009 (CH2M HILL/Baker, 2009). Quarterly site inspections continue to be completed to assess the enforcement of the LUCs. Because of the close proximity of Site 22 to Site 1, groundwater beneath the sites underlying Areas A and B, as well as the Site 22 (CASY) (which is located between Areas A and B), is being managed and addressed as a single unit.

2.1.8 Site 23—LP-20 Plating Shop

As shown on **Figure 2-7**, Building LP-20 is one of many large buildings located northwest of the NAS main runway. Building LP-20 includes the cleaning shop, motor pool, plating shop, and offices (detailed on **Figure 2-9**). In the past, the building was used as an engine overhaul facility in which jet engines were disassembled and worked on. Currently, the building is used as a motor pool and office space.

Site 23, the LP-20 Plating Shop, is located on the west side of the building. Previous activities in the shop included disassembling, stripping, and replating metal parts. The shop contained seven process pits extending beneath the concrete slab floor, which were used for cleaning, stripping, and plating engine parts. The process tanks and equipment were also located in pits. The floor and pits were lined with corrosion-resistant brick tiles. The shop also contained a drainage system for the collection of wastewater from the pits and delivery to the industrial WWTP.

During a 1989 site visit, VDEQ observed violations of the Virginia Hazardous Waste Management Regulations. Violations included hazardous waste stored in its generator container accumulation areas in excess of 90 days, hazardous waste stored in tanks without interim status or a permit, and containers not clearly marked as hazardous waste. Violations also included the lack of inspection records and notification of exact locations of all existing accumulation areas.

An enforcement order was issued in December 1990. Under RCRA, the Clean Closure Plan and Contingency Plan were completed in 1993 and approved by VDEQ in September 1994. The Navy requested a modification of the plans in order to conduct a risk-based closure. Multiple phases of investigation were conducted for partial implementation of the Risk-Based Closure Plan (Versar, 1997). The investigation included the collection of soil, concrete, and groundwater and the analysis for VOCs, cyanide, and eight metals. The RA indicated unacceptable industrial risk at 17 soil locations, but no unacceptable risks from exposure to the plating shop concrete floors. Groundwater was recommended to be addressed under a post-closure monitoring program. Final closure was not achieved; however, partial closure, including the removal of tanks, occurred and most of the plating facility piping was either decontaminated or disposed as hazardous waste. In September 2000, a revised Clean Closure Plan was submitted to VDEQ. The scope of the revised plan included the removal of the concrete floor and approximately 3 feet of soil in the plating shop. In addition, the plan included soil sampling of the remaining soils in the shop area, as well as the plating sumps and select locations along the industrial wastewater piping system. If the soil samples exceeded established risk-based threshold limits, an RA would be conducted. Following the sampling activities, the plan called for general cleanup and decontamination of the plating shop and the removal or rerouting of underground utilities beneath the plating shop.

In July 2003, the Navy decided to move the site from the RCRA to the CERCLA program. A PA/SI is the first step in evaluating a site under CERCLA; however, in November 2003 the NSN Tier I Partnering Team determined that the existing documents completed under the RCRA program can be used in lieu of a formal PA/SI. The Team then joint-scoped additional soil investigation activities. The additional investigation was conducted in December of 2004. The results of the investigation showed that there were concentrations of one VOC, SVOCs, and metals above the residential and industrial RBCs.

In May 2005, the NSN Tier I Partnering Team agreed to conduct an interim removal action to address the site soils. The Team also agreed that the groundwater beneath Site 23 was being treated as part of Site 20. A final EE/CA was submitted in December 2006, summarizing the soil removal action (a new concrete floor to serve as a cover). The construction activities associated with the interim action were initiated in June of 2006. In September 2008, a Proposed Plan for Site 23 proposed the implementation of LUCs to effectively limit site access and to protect against human exposure to unacceptable risk in the soil at the site. The ROD for Site 23 was finalized in September 2008, implementing LUCs as the remedy. The RD was finalized in July of 2009 to implement LUCs and maintenance actions, including periodic inspections and reporting to ensure that residential development, or any other development that is inconsistent with the specific RAO and selected remedy, will not be allowed on the site and that the concrete cover will be properly maintained until contaminant levels diminish so as to allow unrestricted use and unlimited exposure.

Quarterly site inspections are conducted to verify the implementation of the LUCs. Groundwater associated with Site 23 and Site 20 is considered one hydrogeologic unit and is currently being remediated as part of Site 20.

2.2 Solid Waste Management Units

The SWMUs are described in this section. These SWMUs are listed as SSAs or AOCs in the FFA (see Sections 1.4.3.4 and 1.4.3.5). The following site descriptions include physical characteristics, previous investigations, detected contaminants, and future remediation plans for each site. The objectives of the investigations are to determine the extent of contamination at each SWMU, to develop and evaluate economically feasible remedial alternatives for remedial action at contaminated SWMUs, and to closeout qualified sites. A ROD for SWMUs 12 and 16 has been completed, which supported no action; therefore, SWMUs 12 and 16 are not included in this section (CH2M HILL, 2005).

2.2.1 Solid Waste Management Unit 14—Q-50 Satellite Accumulation Area

The Q-50 Satellite Accumulation Area (SWMU 14) is located in the northeast corner of NSN, as shown on **Figure 2-10**. SWMU 14 consisted of a concrete storage pad surrounded by a grass-covered field. The pad served as a 90-day hazardous waste accumulation area where wastes generated through various waste streams were processed (sampled, identified, labeled, and packaged) before being shipped for eventual disposal. The original concrete pad for the accumulation area has since been removed. A new pad was installed west of the original location and is used for temporary storage of investigation-derived waste materials.

In addition to the accumulation area, the peninsula at Sewell's Point is a man-made landmass formed from two distinct periods of fill activities. The first landfill activities began in the early 1950s, when the channels were dredged to allow for construction of the northernmost series of piers at the site. The resulting dredge material was used to create much of the land at Sewell's Point. The second period of filling occurred between 1974 and 1978, when the eastern portion of the site was formed from the disposal of construction debris. This landfill was later designated as Site 9, the Q-Area Landfill, and reportedly used for the disposal of non-hazardous construction debris. Site 9 was originally designated for NFA in the *Site 9 Q-Area Landfill Close-Out Report, Naval Base, Norfolk, Norfolk, Virginia* (Baker, 1997). However, because Site 9 and SWMU 14 are co-located, the Site 9 soil and groundwater are being evaluated as part of an RI to determine the potential impact of contamination from SWMU 14.

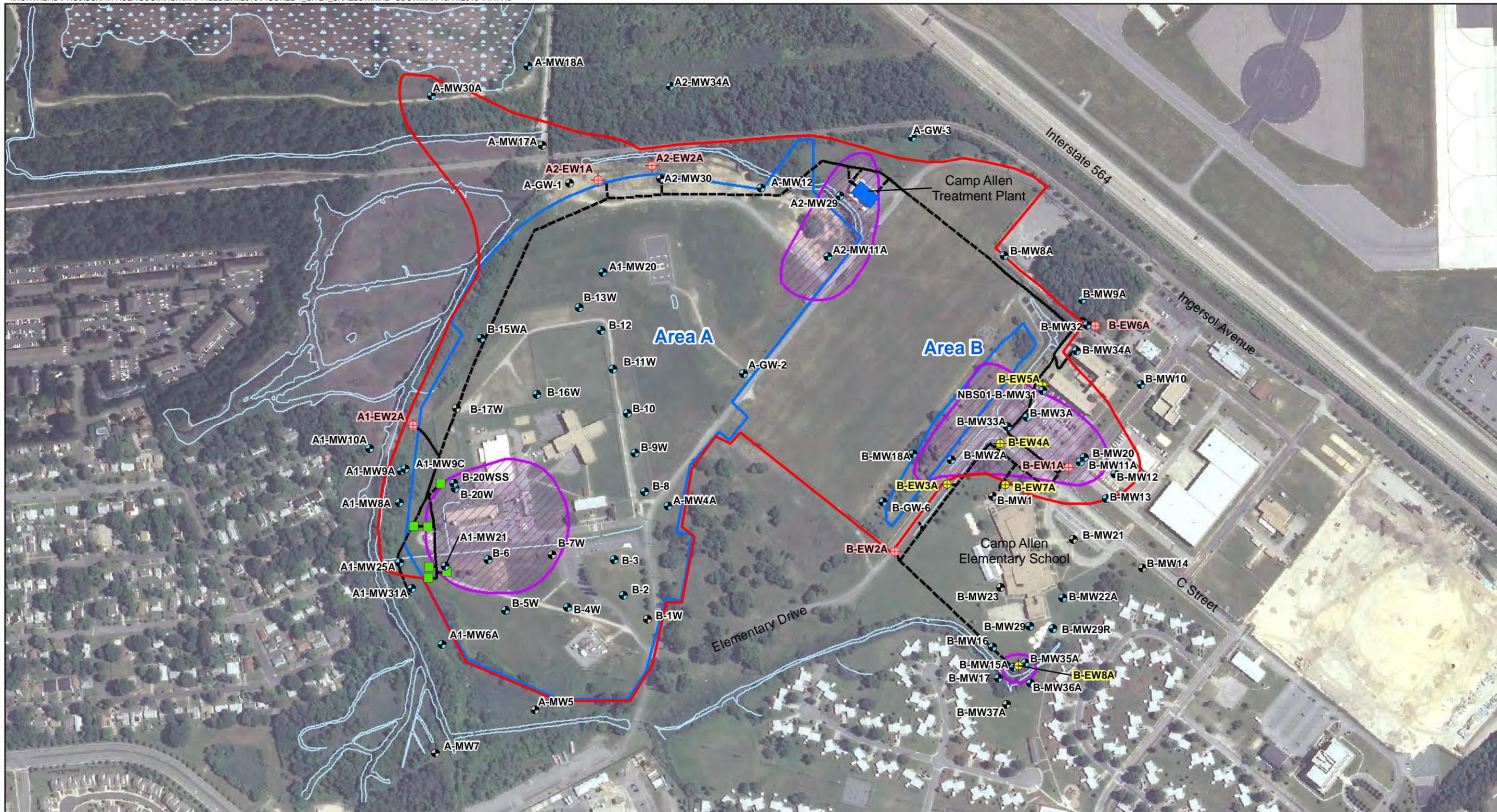
Sampling and analysis of the surface soil were performed in 1995 during the RRR study. Additional surface soil and groundwater sampling was performed in 1996 during the Phase II RRR study. VOCs, SVOCs, pesticides, and PCBs were detected in the soil and groundwater (Baker, 1996e).

An SWMU Supplemental Investigation conducted in July 1998 (CH2M HILL, 1998d) detected several VOCs, SVOCs, PCBs, and metals in the groundwater at levels above the RBCs. As a result of these findings, three phases of RIs were conducted in 1999, 2000, and 2001 to assess the extent of the fill material and groundwater impacts. In order to fill data gaps identified by the Team, additional investigations were completed in December 2002. The results of all the investigations are presented and discussed in the final SWMU 14 RI Report (CH2M HILL, 2004c). As a result of the RI, it was recommended that the ERA progress into the Step 4 phase.

Replacement of the revetment along the shoreline in the area of the site to repair storm damage from a hurricane was completed in late 2005. As a result of the revetment construction activities, the Step 4 ERA was delayed.

In September 2006, a Trident Probe investigation was conducted to determine if there were preferential groundwater transport pathways from SWMU 14 to Willoughby Bay and to sample pore water from areas identified as potential discharge locations. The results of the Trident Probe survey indicated that there was not a definitive preferred groundwater discharge pathway from SWMU 14 into Willoughby Bay. Based on the survey conclusions, the Team determined that further ecological evaluation was not warranted.

In March 2008, an EE/CA was prepared for an NTCRA at SWMU 14. The objective of the NTCRA was to mitigate potential unacceptable human health risk from exposure to contaminated surface soil, subsurface soil, and subsurface debris at SWMU 14 by constructing an asphalt cover. The supporting Action Memorandum was signed April 8, 2008. Construction activities were initiated in early June 2008 and were completed in January 2009. The Focused FS was finalized in July 2009 (CH2M HILL, 2009), followed by completion of the Proposed Plan in September 2009, recommending LUCs to prevent exposure to soil by human receptors. The ROD was signed in August 2010 to document LUCs as the selected remedy. As documented in the ROD, potential risks associated with groundwater are deemed acceptable and no action for groundwater was required; however, the LUC objectives for SWMU 14 prohibit the withdrawal of groundwater. SWMU 14 is inspected quarterly to verify the enforcement of LUCs.



Legend

- Shallow Monitoring Well
- Shallow Monitoring Well not included in LTM
- ⊕ Active Shallow Extraction Well
- ⊕ Inactive Shallow Extraction Well
- DPVE Well
- ▨ Historical Shallow Aquifer VOC Plume Used to Define LUC Boundary

- Piping for Groundwater Treatment System
 - - - Piping for Groundwater Treatment System (assumed location)
 - ▭ Land Use Control Area
 - ▭ Site Boundary
 - Surface Water Features
- Reference: Final Remedial Design for Land Use Controls for Site 1, April 2007

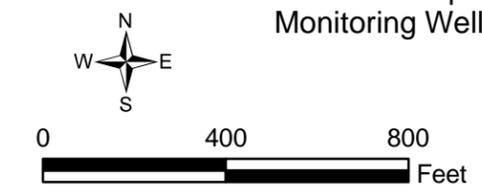
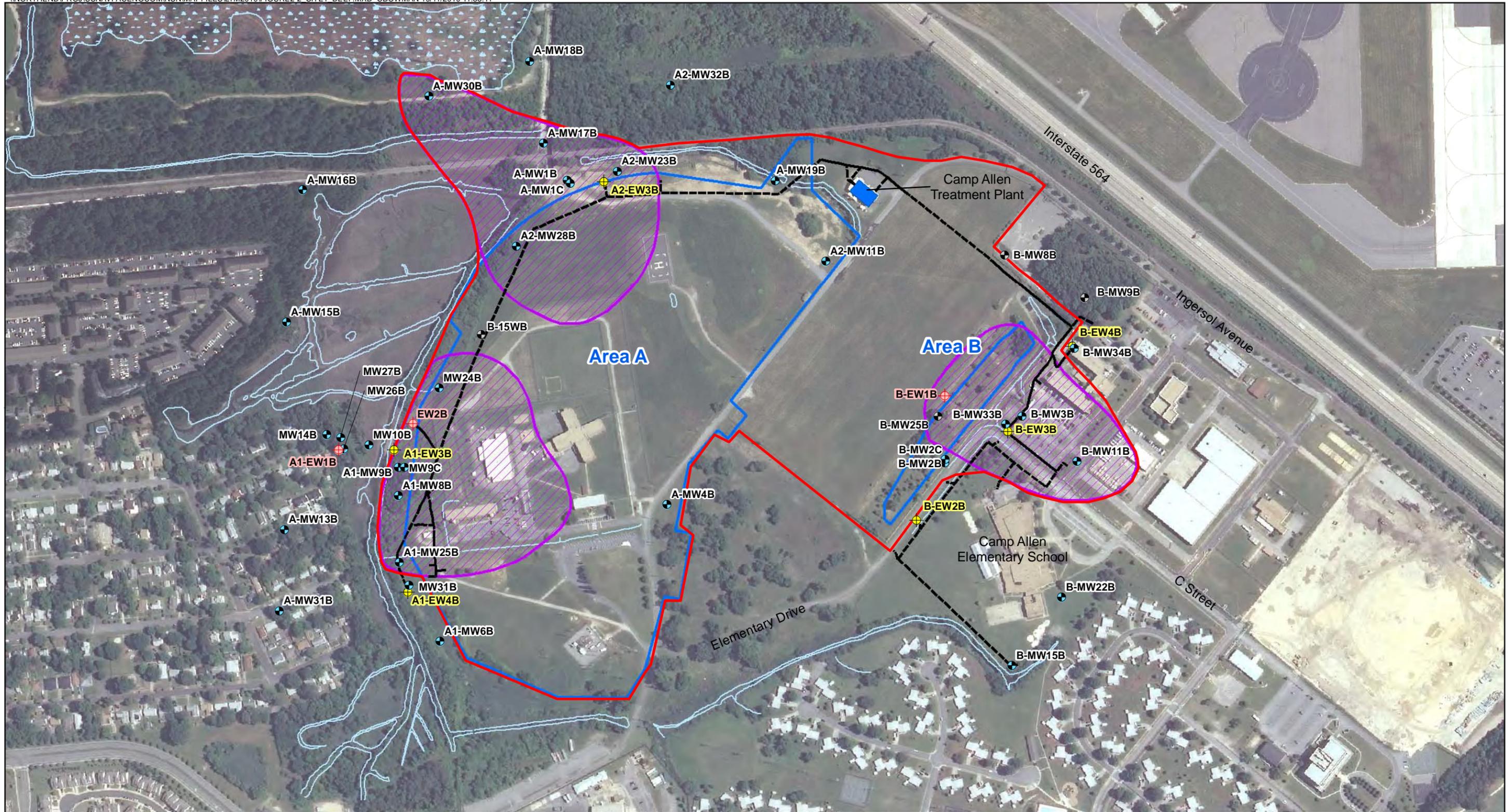


Figure 2-1
 Site Map - Shallow Aquifer Treatment System,
 Monitoring Well Network, and Groundwater Plumes
 Site 1 - Camp Allen Landfill
 Naval Station Norfolk
 Norfolk, Virginia



- Legend**
- Deep Monitoring Well
 - Deep Monitoring Well not included in LTM
 - ⊕ Active Deep Extraction Well
 - ⊕ Inactive Deep Extraction Well
 - ▨ Historical Deep Aquifer VOC Plume Used to Define LUC Boundary

- Piping for Groundwater Treatment System
- - - Piping for Groundwater Treatment System (assumed location)
- ▭ Land Use Control Area
- ▭ Site Boundary
- Surface Water Features

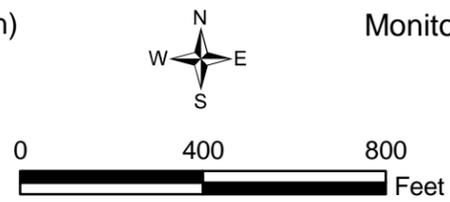
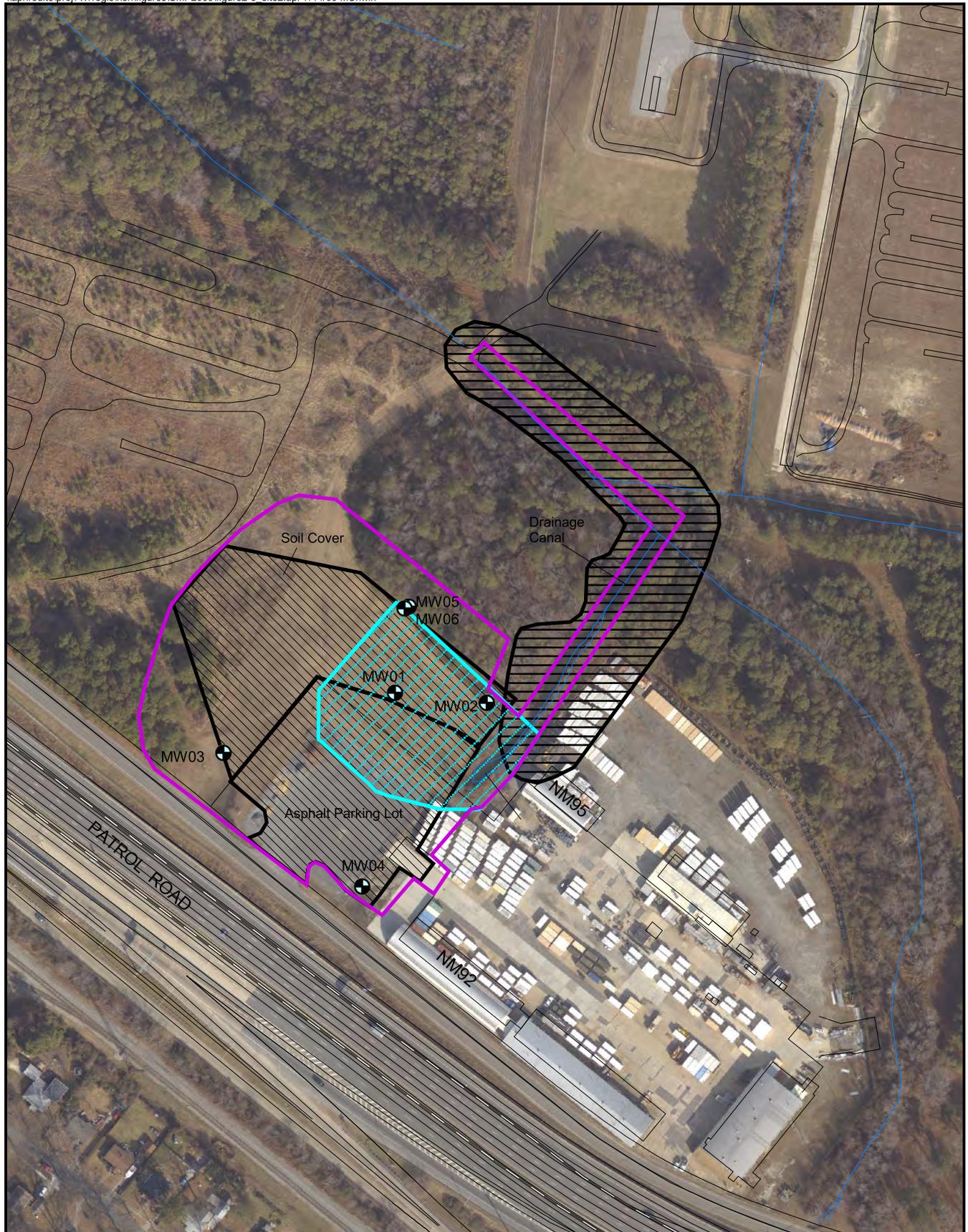


Figure 2-2
 Site Map - Deep Aquifer Treatment System,
 Monitoring Well Network, and Groundwater Plumes
 Site 1 - Camp Allen Landfill
 Naval Station Norfolk
 Norfolk, Virginia

Reference: Final Remedial Design for Land Use Controls for Site 1, April 2007.



LEGEND

-  Monitoring Well Locations
-  Site Boundary
-  Areas of Sediment Removal
-  Area of Soil / Asphalt Cover
-  Approximate Location of Slag Pile Area

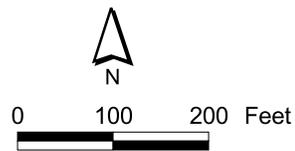
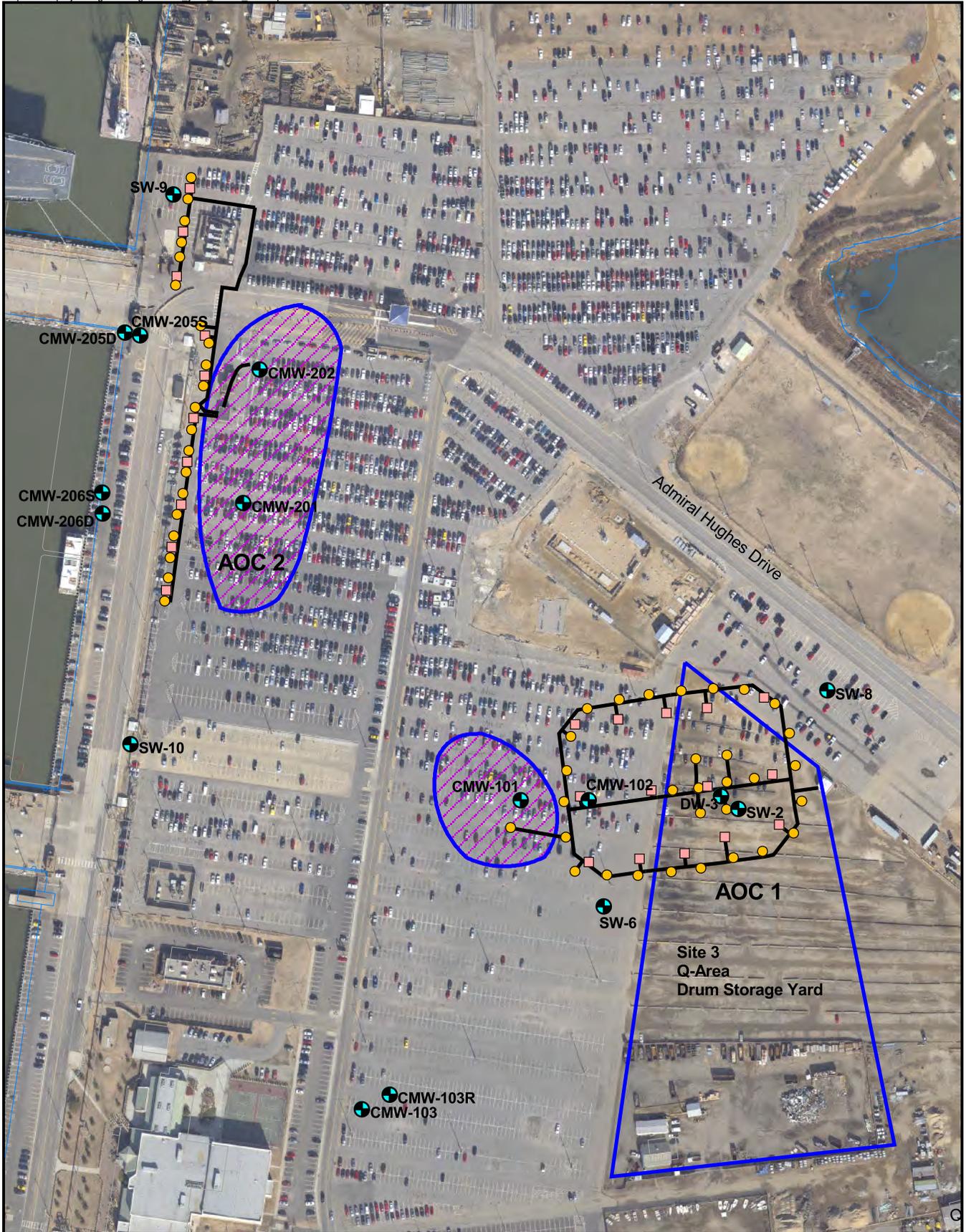


Figure 2-3
Site Map
Site 2- NM Slag Pile
Naval Station Norfolk
Norfolk, Virginia



LEGEND

- Air Sparge Wells
- Soil Vapor Extraction Wells
- Piping for AS/SVE Systems
- Land Use Control Area

- Monitoring Wells
- Shallow Aquifer Groundwater Plume



0 125 250 Feet

Figure 2-4
 Site Map
 Site 3 - Q-Area Drum Storage Yard
 AOC 1 and AOC 2
 Naval Station Norfolk
 Norfolk, Virginia



- Legend**
- ⊕ New Piezometer/Monitoring Well
 - Existing Monitoring Well
 - Drainage Ditch
 - Areas of Sediment Removal
 - Soil Cap - Remedial System Caps/Covers
 - Land Use Control Area
 - Installation Boundary

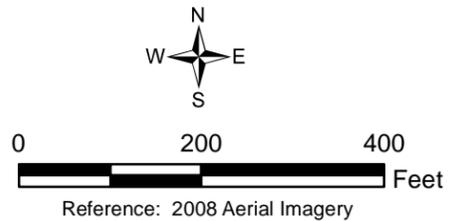
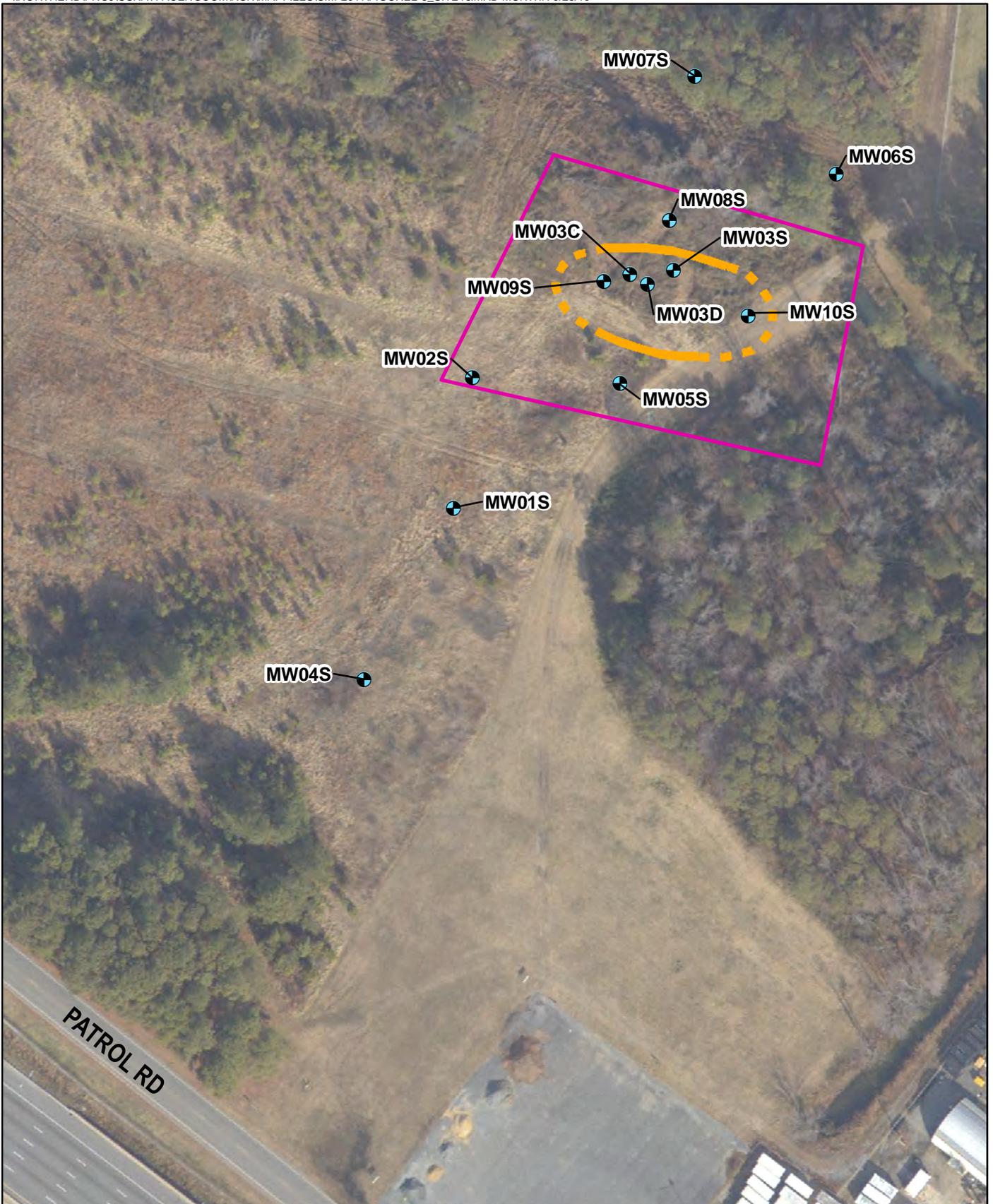


Figure 2-5
Site Map
Site 6 - CD Landfill
 Naval Station Norfolk
 Norfolk, Virginia



Legend

-  Monitoring Well
-  Land Use Control Boundary
-  Estimated VOC Plume (July 2009)
(Dashed where inferred)

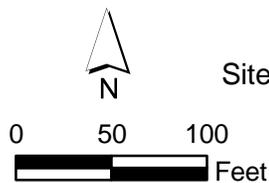
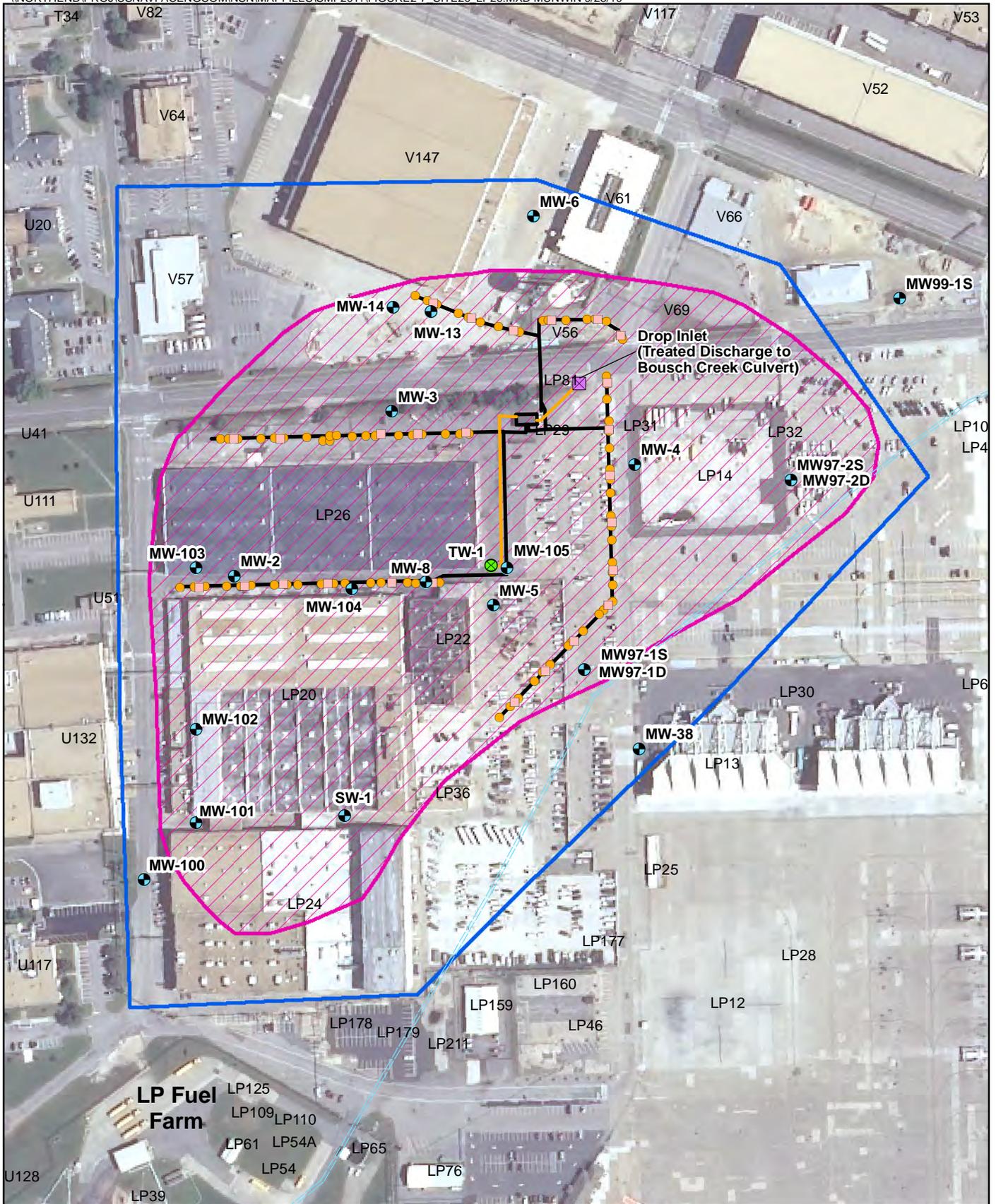


Figure 2-6
Site Map
Site 18 - Former Naval Magazine Storage Area
Naval Station Norfolk
Norfolk, Virginia



Legend

- Monitoring Wells
- Air Sparge Wells
- Soil Vapor Extraction Wells
- Piping for AS/SVE Systems
- Drop Inlet
- Extraction Well
- Estimated Plume (February 2010)
- Land Use Control Area
- Groundwater Extraction System Piping
- Bousch Creek Culvert

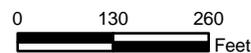
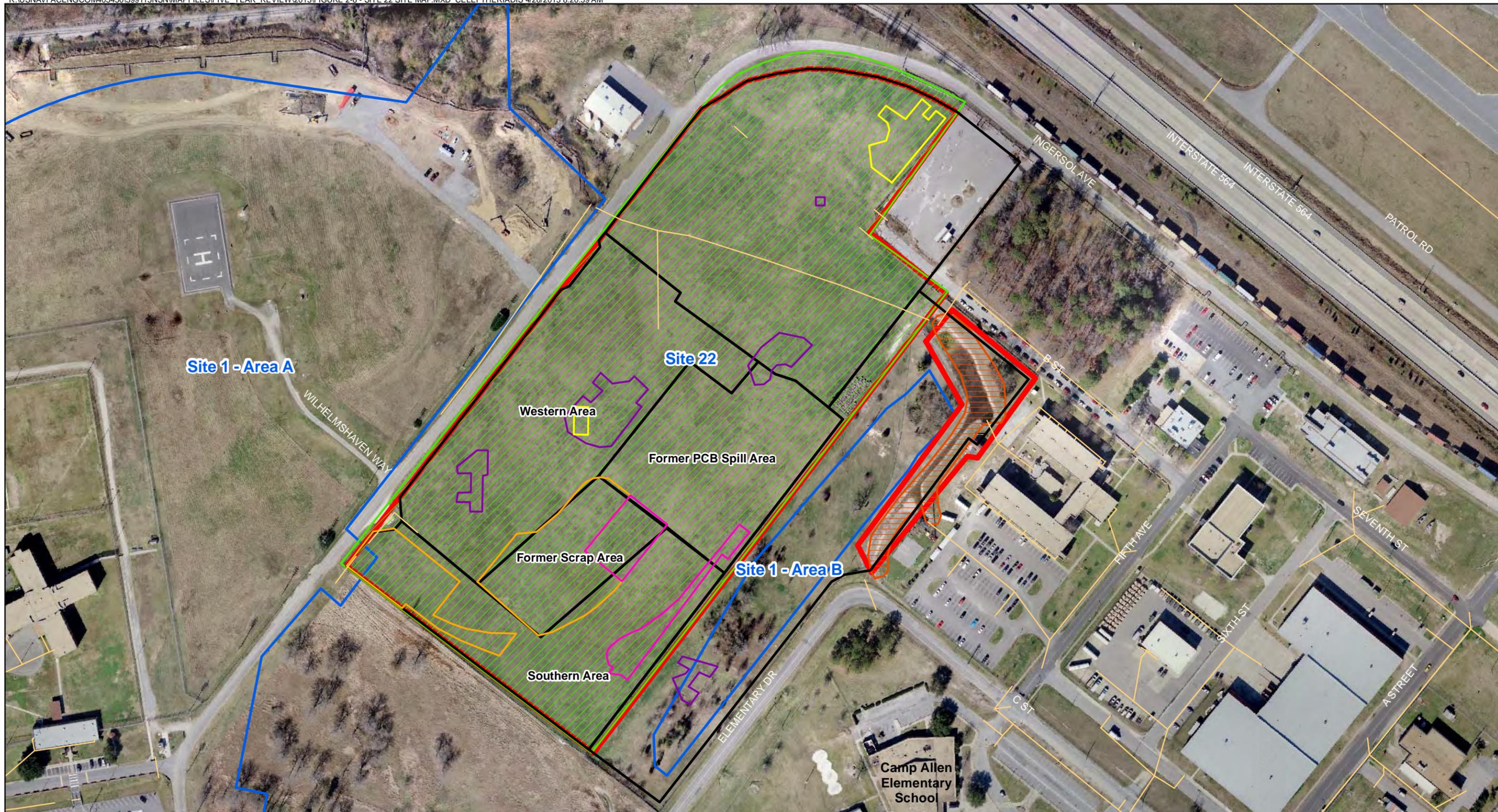


Figure 2-7
Site Map
Site 20 - LP-20 Site
Naval Station Norfolk
Norfolk, Virginia



- Legend**
- Storm Sewer Line
 - ▭ PCB Contaminated Soil Removed in 1998
 - ▭ PCB/Metals Contaminated Soil Removed in 2001
 - ▭ Metals 'Hot Spot' Soil Removed (0-4 Foot)
 - ▭ Metals 'Hot Spot' Soil Removed (0-1.5 Foot)
 - ▭ Sediment Cover
 - ▭ Soil Cover
 - ▭ Former Area
 - ▭ LUC Boundary
 - ▭ Site Boundary

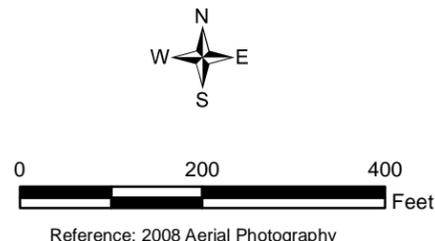


Figure 2.8
Site Map
 Site 22 - Camp Allen Salvage Yard
 Naval Station Norfolk
 Norfolk, Virginia



Legend
[Blue Outline] Land Use Control Area

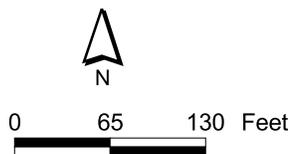


Figure 2-9
Site Map
Site 23 - Building LP-20 Plating Shop
Naval Station Norfolk
Norfolk, Virginia



Legend

- Estimated Extent of Site 9 Landfill
- Asphalt Cover
- LUC Boundary
- Bioretention Areas



0 100 200
Feet

Figure 2-10
Site Map
SWMU 14 - Q-50 Satellite Accumulation Area
Naval Station Norfolk
Norfolk, Virginia

Site Management Plan Schedules

This section presents project-specific schedules for sites that are or potentially will be active in FY 2014. Project-specific schedules for active projects will be updated periodically in the SMP. Potentially active projects for FY 2013, for which site-specific schedules have been developed, are summarized **Figure 3-1**. In addition to LTM, investigation activities planned for FY 2013 and FY 2014 consist of the collection of groundwater samples and installation of new monitoring wells at Sites 1 and 20, and a supplemental VI sampling event at Site 1.

3.1 Team Partnering at Naval Station Norfolk

In October 1996, NAVFAC Mid-Atlantic convened an environmental partnership among the Navy, USEPA, VDEQ, and Navy subcontractors. In addition, the partnership created the RAB to keep members of the community informed of base ERP activities. The partnership is implementing an approach to site remediation referred to as streamlined oversight. The implementation of the streamlined oversight process has promoted a higher degree of communication, understanding, and cooperation among all of the involved groups.

The following scheduling assumptions represent an ideal flow of work for sites that are addressed through the conventional cleanup approach. These assumptions do not account for how the streamlined oversight process may affect schedules and potentially affect the sequence of tasks, as the partnership evaluates project progress on an accelerated basis, and expedites the decision-making process. The goal of the streamlined oversight process is to increase the efficiency of the regulatory review processes of implementation, decision-making, reporting, and other environmental regulatory documentation, and to achieve significant savings of time and funding. To date, the streamlined oversight process is estimated to have saved over \$7 million in remediation costs and 36 months in the cleanup schedule.

3.2 Scheduling Assumptions

Assumptions regarding duration of field investigations, laboratory analyses, data validation, document preparation, document review, and RD/remedial action are discussed as follows. The investigation work anticipated to be completed is at Sites 1 and 20. The only remaining field work to be done at other sites is LTM sampling.

3.2.1 Field Investigation and Laboratory Analysis and Validation

The time required for large field investigations depends on the size and complexity of the site and the overall scope of the field investigation (such as the types of field investigation activities and number of sampling rounds). Generally, field investigations require from 2 to 6 months to complete.

A 30-day turnaround time was assumed for laboratory analysis. The standard turnaround time for Naval Facilities Engineering Support Center -approved laboratories under the current Navy Comprehensive Long-term Environmental Action–Navy (CLEAN) Contract is 28 days. A 14-day duration was assumed for validation of laboratory data.

3.2.2 Data Gap Analysis and Supplemental Investigations

The schedules in this SMP reflect the fact that once the results of an investigation have been evaluated and draft (or draft final) reports have been submitted, it is common for data gaps to be identified that will need to be filled before risk management decisions can be made and remedial or removal alternatives can be defined. In fact, it is rare that all pertinent questions for RA and the nature and extent of contamination are answered in a single phase of investigation. In past SMPs, the schedules for RI/FS projects did not account for multiple phases of investigation and were, therefore, unrealistically short. For the purposes of this SMP, it is assumed that data gap

analyses and supplemental investigations will be performed following the review of both the draft and draft final reports.

3.3 Installation Restoration Program Site Project Schedules

Project-specific schedules for IRP projects that are or potentially will be active in FY 2014 are presented on **Figure 3-1**.

TABLE 3-1

Active Projects for FY 2014 and FY 2015

*(October 2013-September 2015)***Naval Station Norfolk**

Active Projects for FY 2013 and 2014	Estimated Milestone
Site 1, Site 3, Site 20 - Continue meetings for LTM/O&M subgroup to optimize the system and reduce O&M costs as well as accelerating remediation.	FY 2014
Site 2 – None	None
Site 3-AOC 1 - Evaluate the groundwater concentrations with AS system not operating, evaluate close-out strategy, and determine the future LTM program.	4 th Quarter FY 2014
Site 3-AOC 2 - Evaluate the groundwater concentrations with AS system not operating, evaluate close-out strategy, and determine the future LTM program.	4 th Quarter FY 2014
Site 1, Site 3, Site 20 - Complete annual LTM report	3 rd Quarter FY 2014 and 3 rd Quarter FY 2015
Site 6 - Groundwater monitoring to support 2018 Five Year Review	3 rd quarter FY 2014
Site 18 – Establish LTM program for groundwater to assess remedy effectiveness	2 nd Quarter FY 2014
Site 20 – Remedy Remedial Process Optimization/Enhancement	1 st Quarter FY 2014
Update Draft Site Management Plan in accordance with FFA.	3 rd Quarter FY 2014 and 3 rd Quarter FY 2015
Complete Site Inspections/reporting for active ROD sites.	1 st , 2 nd , 3 rd , and 4 th Quarters of FY 2014 and FY 2015

TABLE 3-2
Document Preparation Durations
Naval Station Norfolk

Document	Duration (Months) ¹
AOC Close-Out Document	1
SSP Work Plan	1
SSP Report	1-2
Preliminary Assessment/Site Inspection	2
Engineering Evaluation/Cost Analysis	1-2
RI/FS Work Plans	2
Remedial Investigation Report	3-4
Supplemental Investigation Work Plans	2
Supplemental Investigation Report	3-4
Feasibility Study	3-4
Proposed Plan	2
Record of Decision	2
Preliminary/Conceptual Remedial Design	2
Pre-Final Remedial Design	2
Final Design	1-2
Treatability Study Work Plan	2
Treatability Study Report	1-2
Removal Action Work Plan	2
Removal Action Completion Report	1-2

¹ Durations represent estimated time required to complete Draft Documents.

FIGURE 3-1
 Project-Specific Schedules FY 2013
 Naval Station Norfolk, Norfolk, Virginia

Site Description	Jun 13	Jul 13	Aug 13	Sep 13	Oct 13	Nov 13	Dec 13	Jan 14	Feb 14	Mar 14	Apr 14	May 14	Jun 14	Jul 14	Aug 14	Sep 14	Oct 14
Site 1- Camp Allen Landfill		Area B Source Area Evaluation	Site Inspection Report Draft LUC RD	Water Level Measurements	Draft Final LUC RD	Vapor Intrusion Sampling Quarterly LUC Inspection Final LUC RD	Vapor Intrusion Sampling Optimization Study		Quarterly LUC Inspection	LTM GW Sampling, Water Level Measurements	Laboratory Analysis Annual Site Inspection Report	Data Validation Quarterly LUC Inspection			Quarterly LUC Inspection	Water Level Measurements	
Site 2- NM Slag Pile			Site Inspection Report Draft LUC RD		Draft Final LUC RD	Quarterly LUC Inspection Final LUC RD			Quarterly LUC Inspection		Annual Site Inspection Report	Quarterly LUC Inspection			Quarterly LUC Inspection		
Site 3- Q Area Drum Storage Yard			Site Inspection Report Draft LUC RD		Draft Final LUC RD	Quarterly LUC Inspection Final LUC RD	Optimization Study		Quarterly LUC Inspection LTM Groundwater Sampling	Laboratory Analysis	Data Validation Annual Site Inspection Report	Quarterly LUC Inspection			Quarterly LUC Inspection		
Site 6- CD Landfill		Permit Closure	Site Inspection Report			Quarterly LUC Inspection			Quarterly LUC Inspection		Annual Site Inspection Report	Quarterly LUC Inspection			Quarterly LUC Inspection		
Site 18 - Former NM Disposal Area	Laboratory Analysis	Data Validation Performance Monitoring Report / LTM Recommendations	Site Inspection Report			Quarterly LUC Inspection			Quarterly LUC Inspection		Annual Site Inspection Report	Quarterly LUC Inspection			Quarterly LUC Inspection		
Site 20- LP 20 Area	Data Gap Investigation		Site Inspection Report Draft LUC RD		Draft Final LUC RD	Data Gap Investigation TM Vapor Intrusion Sampling Quarterly LUC Inspection Final LUC RD	Vapor Intrusion Sampling Optimization Study		LTM Groundwater Sampling Quarterly LUC Inspection	Laboratory Analysis	Data Validation Annual Site Inspection Report	Quarterly LUC Inspection			Quarterly LUC Inspection		
Site 22- Camp Allen Salvage Yard			Site Inspection Report Draft LUC RD		Draft Final LUC RD	Quarterly LUC Inspection Final LUC RD			Quarterly LUC Inspection		Annual Site Inspection Report	Quarterly LUC Inspection			Quarterly LUC Inspection		
Site 23 - LP-20 Plating Shop			Site Inspection Report Draft LUC RD		Draft Final LUC RD	Quarterly LUC Inspection Final LUC RD			Quarterly LUC Inspection		Annual Site Inspection Report	Quarterly LUC Inspection			Quarterly LUC Inspection		
SWMU 14 Q-50 Accumulation Area			Site Inspection Report			Quarterly LUC Inspection			Quarterly LUC Inspection		Annual Site Inspection Report	Quarterly LUC Inspection			Quarterly LUC Inspection		
Basewide	Draft Five-Year Review, Draft SMP		Draft Final SMP	Draft Final-Five Year Review	Final SMP	Final Five-Year Review							Draft SMP		Draft Final SMP		Final SMP

SECTION 4

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Appendix A
Screening, Categorizing, and
Prioritization of Sites at NSN

Screening, Categorizing, and Prioritizing Sites at Naval Station Norfolk

Federal Facilities Agreement

On February 18, 1999, the USEPA Region III and the Department of the Navy entered into a FFA for NSN. One of the objectives of the FFA is to define a site-screening process (SSP) intended to provide a simplified investigative method to identify SSAs and AOCs for evaluation and determine whether RIs are required for these areas.

Determining Site Screening Areas

If the USEPA or Navy determines that an area on NSN, which has not been previously identified as a SSA, poses a threat to public health or the environment, the other party shall be notified. The parties will then have 45 days from the notification to discuss the site conditions and determine if the site shall be addressed under the FFA as a SSA.

Establishing a Site Screening Area

Any site that is established as a SSA will be added to the list in Appendix B of the FFA as an additional SSA. This may lead to an investigation and possible remediation in accordance with the requirements of the FFA. For any new SSAs, the Navy shall include in the next Draft Amended SMP a proposed time schedule for the submittal of a SSP Work Plan. This schedule shall be approved in accordance with Section XI of the FFA.

Site Screening Process

The Navy shall submit to the USEPA a SSP Work Plan, which outlines the activities necessary to determine if there has been a release of hazardous constituents to the environment. The scope of work shall be mutually agreed to by the USEPA and the Navy. The SSP Work Plan shall also include a schedule for the submittal of the SSP report, which will be incorporated into the Site Management Plan. The SSP shall also include the following:

1. Upon conclusion of a SSP, the Navy shall submit to the USEPA a draft SSP Report which shall provide the basis for a determination that either:
 - RI/FS be performed on the area addressed by the SSP
 - The area does not pose a threat to the environment and therefore, the area should be removed from further study under the FFA
2. Within 60 days of receipt of the final SSP Report, the USEPA and the Navy will determine if the SSA(s) will require a RI/FS.
3. For those SSAs which the USEPA and Navy agree do not warrant an RI/FS, the Navy shall prepare a DD that reflects that agreement. The agreement is to be signed by all the Project Managers.
4. For those SSAs that are to proceed with a RI/FS, OUs will be established. A schedule for the submission of the RI/FS Work Plan(s) is to be developed and incorporated into the next update of the SMP.

Areas of Concern

For those areas that have been identified as AOCs, the Navy and USEPA will go through a screening process as detailed below:

1. A document evaluation will be undertaken to review existing documentation and assessing information concerning the handling of hazardous waste at each AOC. The evaluation could also include (if agreed to by both USEPA and the Navy) discrete sampling without developing a work plan.
2. Based on the document evaluation, the Project Managers will decide which AOCs will proceed to the SSP as SSAs and which AOCs will require NFA.

3. For those AOCs that will not proceed to the SSP, the Navy shall prepare, with USEPA assistance, a brief AOC closeout document. The USEPA shall provide a response to the Navy within 30 days of receipt of the supporting documentation.
4. Those AOCs, which are not agreed upon by USEPA and the Navy to be closed out, will proceed to the SSP. These sites will have schedules established for submittal of SSP work Plans. The schedules will be incorporated into the SMP.

Site Screening Process Tools

Although the FFA provides an outline of the SSP for closing out SSA, the FFA does not provide a detailed process for site screening. As a result, The Tier I Partnering Team has developed several tools for rapidly screening a site to determine whether the site will require a full RI/FS or if it can be removed from further study. The following section describes the screening tools utilized at NSN.

Relative Risk Ranking

The DoD developed a relative risk framework to evaluate the potential risk posed by a site in relation to other sites. The relative risk evaluation of NSN sites will be performed to give each of the sites a relative risk designation. Relative risk is a management tool that uses actual media concentrations, potential exposure, and potential migration to indicate which sites may pose a risk to human health and the environment. Based on the relative risk results, the Navy can focus available resources for study and remediation on the sites ranked “high.”

This version of the SMP does not update the prior ranking of the sites at NSN. The decision to defer the re-ranking of sites is based on the fact that the sites discussed in this SMP are either undergoing remediation, are in an active site characterization phase, or have been closed out based on a determination of no significant risk to human health or the environment. It is anticipated that the sites undergoing site characterization will be re-ranked in a future update of the SMP. The framework for future ranking is provided below.

The primary factors considered in the relative risk methodology are human health and ecological risks associated with exposure to constituents at the site. The site ranking is based on the best information available at the time the report is submitted. The relative risk model is both quantitative and qualitative in nature.

To initially categorize the sites, contaminant hazard factors (CHF) for human health and ecological risk are calculated based on available chemical data at the time the ranking is performed for each site. The CHF values are determined by dividing the maximum detected concentration of particular compounds in the environmental media (groundwater, soil, surface water, and sediment) by the appropriate corresponding screening value. To perform this analysis, the most up-to-date version of the relative risk-ranking model should be used.

For the quantitative screening analysis, human health risk will be evaluated assuming that the groundwater is used as drinking water (both ingestion and inhalation exposure scenarios will be included in the drinking water determination). To be conservative, soil ingestion will be assumed under a residential-use scenario. Ecological risk will be determined for the aquatic environment only (surface water and sediment), because benchmark values for terrestrial ecological risk are not readily available.

Once the quantitative assessment is complete, a qualitative assessment addressing potential exposure pathways and potential contaminant transport will be performed. This analysis will be conducted to ensure that sites where human or ecological exposure to the contaminated media exists and the potential for contaminant migration is significant will be ranked higher than sites with less potential to impact human health and the environment. This analysis will be performed by qualitative analysis of the CHF, receptor factors (exposure potential), and migration pathway factors (contaminant transport potential), as described in the following sections.

A detailed description of the procedures and equations used to complete the relative risk ranking of the sites at NSN is included in the *1999-2000 Site Management Plan, Naval Station Norfolk*.

Aerial Photo Analysis

The September 1994 an EPIC study of aerial photography identified 37 potential WDAs at NSN. This study provided a useful tool for identifying potential SSAs for further investigation by ascertaining such potential indicators of contamination as disturbed areas, ponded liquids, excavated areas, fill areas, stressed vegetation and discolored soils.

However, a more detailed review of additional aerial photos and field verification can also provide supporting documentation for removing sites from further study. Examples of this photographic documentation include demonstrating that the disturbed areas are associated with new building construction activities, confirming that ponded areas are attributed to natural drainage patterns, and illustrating from historical photos that disturbed areas occurred over a short period of time.

Geoprobe Sampling

The use of direct push soil and groundwater sampling techniques, such as the Geoprobe®, can provide a rapid, cost-effective alternative to traditional sampling techniques. These techniques offer the following advantages over traditional sampling methods: the need for the installation of permanent wells may be reduced or eliminated, the generation of IDW is minimized, the effort to achieve decontamination is reduced, the mobility is much easier than with drilling equipment, and the collection of samples can be conducted much more rapidly.

Although the Geoprobe data generally provide representative soil analytical data, the groundwater data can be used only on a qualitative basis for RAs because:

- The data cannot be reproduced as is the case with well data
- Metals data may not be representative due to the high turbidity of the samples

However, the data generated from the Geoprobe investigations can be used to provide a conservative assessment of the nature and extent of soil and groundwater contamination at a particular site. Confirmation data may be required with the installation of monitoring wells; however, the number of wells will likely be significantly reduced.

Streamlined Risk Assessments

Several sites were identified where the available data indicated that the sites seemed to pose minimal risk to human health or the environment. However, a quantitative risk evaluation was warranted before a determination could be made on whether the sites could be closed as NFA sites, or classified as a SSA for further investigation. Conversely, the slight exceedances above the risk-based criteria did not justify a full-scale RA for these sites. Therefore, a streamlined RA process has been applied to these sites, which is described below.

Concentrations of detected chemicals were compared to the following current USEPA screening and regulatory screening criteria for each sample matrix: RBCs for residential and industrial soil, USEPA tap water RBCs and MCLs for groundwater, and the USEPA Region III Biological Technical Assistance Group (BTAG) screening values for surface water and sediment. The SWMUs were initially categorized based on the comparison to screening and regulatory criteria (comparison criteria).

In addition, the maximum, minimum, arithmetic mean, and median concentrations for the contaminants exceeding the comparison criteria were calculated using the detected concentrations from all samples collected during the RRR Study and the SWMU Supplemental Investigation. Although these values were not used in determining the recommendations for each SWMU, this evaluation was performed to identify the detected range for contaminants exceeding the comparison criteria.

Appendix B
CERCLA Process Activities

CERCLA Process Activities

As previously discussed in Section 1, NSN was listed on the USEPA CERCLA NPL on April 1, 1997. The Base is being investigated through the IRP. Because the Navy structured the IRP to be consistent with the terminology and structure of the CERCLA Program, the placement of NSN on the CERCLA NPL has had a limited effect on the cleanup processes that were already established. The CERCLA cleanup process is described below. The IRP at NSN is being implemented in accordance with applicable federal and state environmental regulations and requirements.

The FFA developed for NSN by USEPA Region III and the Navy will assist the Navy to meet the provisions of CERCLA, RCRA, and applicable state law. The FFA will establish a procedural framework and provide detailed guidance on all phases of the remedial process from investigation through remedial action. The FFA also incorporates the effects of team partnering on the remediation process. The modified remedial process, incorporating the provisions of the FFA, is discussed in this section.

CERCLA Process

CERCLA RI/FS Process

The CERCLA RI/FS process refers to the process of site investigation and remedial action that is used for CERCLA sites.

The objectives of the CERCLA RI/FS process are to evaluate the nature and extent of contamination at a site, and to identify, develop, and implement appropriate remedial actions in order to protect human health and the environment. The RI/FS process includes the following major elements:

- RI
- RA
- FS
- PRAP
- ROD or DD

These steps ultimately lead to either implementation of a Remedial Design (RD)/Remedial Action or the decision to take no action at the site. Where NFA is required at a site, a no-action ROD would be signed and the site removed from the program.

The RI, RA, FS, and PRAP documents are maintained in information repositories for review by the public. A formal public comment period and a public meeting (if required) generally follow the issuance of the final PRAP. Public comments received on the final PRAP are addressed as part of the Responsiveness Summary in the ROD. Subsequent to completion of the ROD, RD/Remedial Action activities are initiated. In accordance with CERCLA, remedial action is required to begin within 15 months of the final ROD.

Removal Action Process

Removal actions are implemented to cleanup or remove hazardous substances from the environment at a site in order to mitigate the spread of contamination. Removal actions may be implemented at any time during the RI/FS process.

Removal actions are classified as either time-critical or non-time-critical. Actions taken immediately to mitigate an imminent threat to human health or the environment, such as the removal of corroded or leaking drums, are classified as time-critical removal actions. Removal actions that may be delayed for 6 months or more without significant additional harm to human health or the environment are classified as non-time-critical removal actions.

For non-time-critical removal actions, an EE/CA is prepared rather than the more extensive FS. An EE/CA focuses only on the substances to be removed rather than on all contaminated substances at the site. It is possible for a

removal action to become the final remedial action if the RA results indicate that no further remedial action is required in order to protect human health and the environment.

A non-time-critical soil removal action was completed at Area B of CALF in 1994; however, this was not considered a final remedy for the site. A soil removal action also was completed in the Q-Area that involved the removal of 750 yd³ of petroleum-contaminated soil from the northwest corner of the site to allow construction of a parking lot. In addition, a soil removal action was completed in the NM Area (Taussig Can Area) in 1979 with the approval of the Commonwealth of Virginia.

A soil removal action was completed at the Building W-316 site that involved the removal of PCB-contaminated soil and a removal action was completed at the SP-2B Accumulation Area that involved the removal of lead-contaminated soil. NTCRAs have been completed for pesticide-contaminated soil at the Pesticide Disposal site, metals and PCB-contaminated soil at the CASY, lead-contaminated sediment at the NM Slag Pile, and metals and pesticide-contaminated sediment at CD Landfill.

NTCRAs have been completed at four sites in 2007 and 2008. These sites (along with section within this SMP where details are provided) are:

- Upper Reaches of Bousch Creek (as associated with Site 1) – Section 2.1.1
- Site 18 – Section 2.1.5
- Site 23 – Section 2.1.8
- SWMU 14 – Section 2.1.1

Remedial Action Process

Remedial actions may be considered interim remedial actions (IRA) or final remedial actions. Interim remedial actions are implemented to provide temporary mitigation of human health risks or to mitigate the spread of contamination in the environment. Similar to removal actions, they may be implemented at any time during the RI/FS process. An IRA is implemented to attain applicable or relevant and appropriate requirements (ARARs) to the extent required by CERCLA or the National Contingency Plan (NCP). It is also consistent with and contributes to the efficient performance of a final remedial action taken at an area or OU. Examples of IRAs include installation of a pump-and-treat system for product recovery from the groundwater or installation of a fence to prevent direct contact with hazardous materials.

For IRAs, a Focused FS (FFS) is prepared rather than the more extensive FS. As with the removal action, an IRA may become the final remedial action if the RA results indicate that no further remedial action is required in order to protect human health and the environment. In this case, a no-action ROD would be signed and the site removed from the program upon completion of the IRA.

Following the more extensive FS process, a preliminary/conceptual RD, a pre-final RD, and then a final RD are developed for final remedial action at an area or OU. After completion of the remedial action at each area or OU, a Remedial Action Completion Report will be prepared. If necessary, a LTM Plan and an Operation and Maintenance (O&M) Plan will also be prepared for each remedial action site.

Remedial actions have been constructed at three sites at NSN: CALF, the LP-20 site, and QADSY. A groundwater extraction and treatment system and DPVE system became operational at CALF in July 1997. An AS/SVE system to address chlorinated solvents in the groundwater at LP-20 started operations on April 14, 1998. An AS/SVE system to address TPH and chlorinated solvents in the groundwater started operations at the QADSY in AOC 2 and AOC 1 on August 18, 1998 and August 20, 1998, respectively. Baseline monitoring, supplemental testing, and LTM are currently performed at all three sites (CH2M HILL, 2007b).

Treatability Studies

Treatability studies are performed to assist in the evaluation of a potentially promising remedial technology. The primary objectives of treatability testing are:

- To provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the FS
- To support the RD of a selected alternative

Treatability studies may be conducted at any time during the RI/FS process. The need for a treatability study is generally identified during the FS.

Treatability studies may be classified as either bench-scale (laboratory study) or pilot-scale (field studies). Bench-scale studies are often sufficient to evaluate performance for technologies that are well developed and tested. For more innovative technologies, pilot tests may be required to obtain the desired information. Pilot tests simulate the physical and chemical parameters of the full-scale process, and are designed to bridge the gap between bench-scale and full-scale operations.

Pilot-scale treatability studies had been conducted at the CALF site to evaluate air stripping and DPVE technologies. Additionally, SVE and air sparging pilot-scale treatability studies were completed at the Q-Area Drum Storage Area and LP-20 site.

FFA CERCLA Integration Process

AOC Evaluation

Sites identified as AOCs in the FFA, will undergo a document evaluation. This document evaluation will involve a thorough review of existing or easily obtainable documentation and information on the identified sites. If the Navy and USEPA agree, the evaluation could include obtaining discrete samples from the AOC without the development of a work plan. If both parties do not agree, the AOC evaluation process will continue without the performance of sampling.

The document evaluation will also involve assessing information concerning the handling of hazardous wastes at each AOC, the actions taken at each AOC, or actions that will be occurring under other regulatory programs at each AOC. Based on the AOC evaluation, a decision will be made by the management team regarding which AOCs will proceed to the Site Screening Process as SSAs and which AOCs will require NFA and can be closed out. For those AOCs requiring NFA, an AOC closeout document will be prepared.

Site Screening Process

The SSP refers to the process described in the FFA that will be used to identify whether SSAs should proceed into the RI/FS process under CERCLA. SSAs are those areas that may pose a threat to public health, welfare, or the environment. SSAs can be identified by either the Navy or USEPA. Upon identification of an SSA, a SSP work plan will be prepared outlining the activities necessary to determine if there have been releases of hazardous substances, pollutants, contaminants, hazardous waste, or other hazardous constituents to the environment. After investigation activities have been performed, a SSP report will be prepared. The report provides the basis for a determination that either:

- A RI/FS be performed at the SSA
- The area does not pose a threat to public health, welfare, or the environment and therefore should be removed from further study

For SSAs that do not warrant an RI/FS under CERCLA, a brief decision document will be prepared and signed by all project managers on the management team.