



Naval Facilities Engineering Systems Command Mid-Atlantic
Norfolk, Virginia

Final

**Site Management Plan
Fiscal Years 2021-2025**

Naval Station Norfolk
Norfolk, Virginia

December 2020



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Prepared for NAVFAC Mid-Atlantic
by CH2M HILL, Inc.
Virginia Beach, Virginia
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Contents

Acronyms and Abbreviations.....	vii
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 and Physical Description.....	1-1
1.3.2 Facility History and Mission.....	1-2
1.3.3 Operations and Process Descriptions.....	1-2
1.4 Environmental Setting	1-2
1.5 Environmental History.....	1-3
1.5.1 Topography and Surface Water Hydrology	1-3
1.5.2 Environmental Restoration Program.....	1-3
1.5.3 Previous Investigations.....	1-4
1.5.4 Site Classification	1-4
1.5.5 Preliminary Closeout Report	1-4
2 Site Descriptions	2-1
2.1 Environmental Restoration Program Sites	2-1
2.1.1 Site 1 (OU 1)—Camp Allen Landfill	2-1
2.1.2 Site 2 (OU2)—Naval Magazine Slag Pile	2-4
2.1.3 Site 3 (OU3)—Q-Area Drum Storage Yard	2-6
2.1.4 Site 6 (OU6 and OU7)—Construction Debris Landfill	2-8
2.1.5 Site 18 (OU 14)—Former Naval Magazine Waste Storage Area.....	2-10
2.1.6 Site 20 (OU4)—Building LP-20	2-12
2.1.7 Site 22 (OU8)—Camp Allen Storage Yard	2-14
2.1.8 Site 23 (OU10)—Building LP-20 Plating Shop	2-16
2.2 Solid Waste Management Units	2-17
2.2.1 Solid Waste Management Unit 14 (OU13)—Q-50 Satellite Accumulation Area.....	2-17
2.3 Sites with PFAS Contaminants.....	2-18
3 Site Management Plan Schedules.....	3-1
3.1 Team Partnering at Naval Station Norfolk.....	3-1
3.2 Environmental Restoration Program Site Project Schedules	3-1
4 References.....	4-1

Appendixes

A	CERCLA Process Activities
B	Screening, Categorizing, and Prioritization of Sites at Naval Station Norfolk

Tables

1-1	Status Summary of Environmental Restoration Sites
1-2	Status Summary of Solid Waste Management Units
1-3	Additional No Further Action Sites
1-4	Status Summary of Federal Facility Agreement Areas of Concern

- 2-1 Summary of Relevant Documents and Milestones for Site 1
- 2-2 Summary of Constituents of Concern at Site 1
- 2-3 Summary of Relevant Documents and Milestones for Site 2
- 2-4 Summary of Constituents of Concern at Site 2
- 2-5 Summary of Relevant Documents and Milestones for Site 3
- 2-6 Summary of Constituents of Concern at Site 3
- 2-7 Summary of Relevant Documents and Milestones for Site 6
- 2-8 Summary of Constituents of Concern at Site 6
- 2-9 Summary of Relevant Documents and Milestones for Site 18
- 2-10 Summary of Constituents of Concern at Site 18
- 2-11 Summary of Relevant Documents and Milestones for Site 20
- 2-12 Summary of Constituents of Concern at Site 20
- 2-13 Summary of Relevant Documents and Milestones for Site 22
- 2-14 Summary of Constituents of Concern at Site 22
- 2-15 Summary of Relevant Documents and Milestones for Site 23
- 2-16 Summary of Constituents of Concern at Site 23
- 2-17 Summary of Relevant Documents and Milestones for SWMU 14
- 2-18 Summary of Constituents of Concern at SWMU 14
- 3-1 Active Projects for Fiscal Years 2021 to 2025 (October 2020 to September 2025)

Figures

- 1-1 Base Map with Site Locations and Current Cleanup Status
- 2-1 Site 1 - Camp Allen Landfill
- 2-2 Site 2 - Naval Magazine Slag Pile
- 2-3 Site 3 - Q-Area Drum Storage Yard
- 2-4 Site 6 - CD Landfill
- 2-5 Site 18 - Former Naval Magazine Storage Area
- 2-6 Site 20 - Building LP-20 Area
- 2-7 Site 22 - Camp Allen Salvage Yard
- 2-8 Site 23 - Building LP-20 Plating Shop
- 2-9 SWMU 14 - Satellite Accumulation Area

Acronyms and Abbreviations

AOC	area of concern
AS	air sparge
CALF	Camp Allen Landfill
CASY	Camp Allen Salvage Yard
CD	construction debris
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH2M	CH2M HILL, Inc.
COC	constituent of concern
DCE	dichloroethene
DD	Decision Document
DPVE	dual-phase vacuum extraction
EE/CA	Engineering Evaluation/ Cost Analysis
ERP	Environmental Restoration Program
FFA	Federal Facility Agreement
FS	Feasibility Study
FY	fiscal year
GAC	granular activated carbon
HHRA	Human Health Risk Assessment
IAS	Initial Assessment Study
IDW	investigation-derived waste
IR	Installation Restoration
LTM	long-term monitoring
LUC	land use control
MCL	maximum contaminant level
N/A	not applicable
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NFA	No Further Action
NPL	National Priorities List
NSN	Naval Station Norfolk
NTCRA	non-time-critical removal action
OU	operable unit
PA	Preliminary Assessment
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFA	Resource Conservation and Recovery Act Facility Assessment

RI	Remedial Investigation
ROD	Record of Decision
RRR	Relative Risk Ranking
SBGR	subgrade biogeochemical reactor
SI	Site Investigation
SMP	Site Management Plan
SVE	soil vapor extraction
SWMU	solid waste management unit
TCE	trichloroethene
Team	Partnering Team
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
VI	vapor intrusion
VOC	volatile organic compound
yd ³	cubic yard(s)

Introduction

This document is the Site Management Plan (SMP) for fiscal years (FYs) 2021 to 2025 for Naval Station Norfolk (NSN), located in Norfolk, Virginia. This report has been prepared by CH2M HILL, Inc. (CH2M) for use by the Department of the Navy (Navy), United States Environmental Protection Agency (USEPA) Region 3, and the Virginia Department of Environmental Quality (VDEQ).

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 use in planning, scheduling, and setting priorities for environmental remedial response activities conducted at NSN. This SMP focuses on upcoming activities planned for FY 2021 and identifies any additional activities that are planned through FY 2025. 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 3 and NSN was finalized in February 1999 (USEPA and Navy, 1999). Because NSN has a final FFA in place, USEPA’s role at NSN sites is less extensive than at NPL sites that do not have FFAs. However, 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.

This 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 2021 and prospective activities are provided for years up through FY 2025.

1.2 Format of the Site Management Plan

This SMP consists of four 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 classifications.
- **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.
- **Section 4—References**, provides a list of documents used in preparing this plan.

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 northwestern portion of the City of Norfolk, Virginia. The location of environmental sites currently undergoing investigations and remediation at 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, on the east by the City of Norfolk, and on the south by Naval Support Activity Hampton Roads and 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.

1.3.2 Facility History and Mission

NSN began operations in 1917, when the 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 amount of land under Navy control was 792 acres. An additional 143 acres of land were acquired in 1918 and officially commissioned as Naval Air Station 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 included 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 (**Figure 1-1**).

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

The mission of NSN is to support the operational readiness of the United States Atlantic Fleet, providing facilities and services to enable mission accomplishment.

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

NSN is in the outer Atlantic Coastal Plain Physiographic Province, which is characterized by low elevations and gently sloping relief. NSN 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 consist of unconsolidated fine sands and silts of low to moderate permeability. The lower 20 to 40 feet consist 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 NSN. 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 Topography and Surface Water Hydrology

Elevations at NSN range from sea level at the northern and western boundaries to approximately 15 feet above sea level 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.

Most 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. Because of 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 above sea level (A.T. Kearney, 1992). Therefore, the portions of NSN adjacent to Willoughby Bay and the Elizabeth River are within the 100-year floodplain.

1.5.2 Environmental Restoration Program

In 1975, the Department of Defense 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 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, the Comprehensive Environmental Response, Compensation, and Liability Act (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.

The Department of Defense'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**.

Because NSN is on the NPL, 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 CERCLA process (after the environmental cleanup activities are complete).

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 (Team) consists of Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic, USEPA Region 3, VDEQ, CH2M, 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 of ERP sites. **Appendix B** discusses how the Team applied the CERCLA process (**Appendix A**) for sites identified at NSN.

1.5.3 Previous Investigations

The following basewide investigations were completed through the ERP:

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

1.5.4 Site Classification

1.5.4.1 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 because of contamination from past hazardous materials handling and operations. Eighteen potentially contaminated sites (Sites 1 through 18) were identified based on information obtained from historical records, photographs, site inspections, and personnel interviews. 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 6 of the 18 sites posed sufficient threats to human health or the environment to warrant further evaluation in a Confirmation Study (ESE, 1983). Several of the IAS sites were re-designated under the RFA. Subsequent to the IAS, the Navy added five more sites to the Installation Restoration Program (Sites 19 through 23) identified through historical information. The status of IAS sites and RFA designations are summarized in **Table 1-1**. The ERP sites at NSN that have been investigated and are currently undergoing remediation are described in more detail in **Section 3**, and the locations of these sites are shown on **Figure 1-1**.

1.5.4.2 Solid Waste Management Units

In March 1992, an RFA was completed for NSN (A.T. Kearney, Inc. 1992). This study was a basewide inventory of existing SWMUs and other areas of concern (AOCs). A total of 274 SWMUs and 10 AOCs were tentatively identified in this study. The September 1994 USEPA Photographic Interpretation Center study of aerial photography identified 37 potential waste disposal areas. Of the sites identified by the RFA and USEPA Photographic Interpretation Center study, 148 were identified as potentially contaminated. The RRR-Phase I Report provided sampling results for 45 of the 148 identified sites (Baker, 1996a). Of the sites sampled as part of the RRR-Phase I Report, the Navy identified 25 for additional evaluation and possible investigation.

The current status of all SWMUs investigated at NSN is summarized in **Table 1-2**. SWMU 14, which is further discussed in **Section 2**, is the only SWMU currently undergoing remediation.

1.5.4.3 No Further Action Sites

The remaining 148 sites previously identified were individually evaluated during the NFA negotiations between the Navy and USEPA. The Team determined that NFA is required for the 105 sites, as detailed in **Table 1-3**.

1.5.4.4 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 to the screening process and be investigated as Site Screening Areas, or whether the information under review supports an NFA determination (USEPA and Navy, 1999). Descriptions of the NFA determination for each of the eight AOCs are presented in **Table 1-4**.

1.5.5 Preliminary Closeout Report

A Preliminary Closeout Report summarizing the investigations and remedies at each site was signed by USEPA in September 2010. The Report documented construction completion for USEPA and changed NSN's classification on the NPL.

Table 1-1. Status Summary of Environmental Restoration Sites
Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk

Site	OU/RFA Designations	PA or IAS	SI or CS	EE/CA	Work Plans	RI	FS	PRAP	Closeout Report	ROD/DD	RD	RA Construction Phase	RA Ops Phase	Comments
Remedy in Place (Ongoing O&M and LTM)														
Site 1 – Camp Allen Landfill	OU 01	1983*	1988*		1991	1994	1994	1995		1995, 2010	1996, 2005	1997		Removal action (soil) completed January 1995 at Site 1 Area B. Construction of groundwater pump-and-treat and dual-phase vapor extraction (DPVE) systems completed (although DPVE system is no longer in operation). Long-term monitoring (LTM) to evaluate system effectiveness was initiated in 1999. Performed volatile organic compound groundwater plume delineation for Area B in January 2008. Remedy reaffirmed September 2010. Area B vapor intrusion (VI) investigation of Building MCA-600 was completed in January 2014. Reconstruction of the new Camp Allen Elementary School was completed in Fiscal Year (FY) 2019. The school is located near Area B and was constructed with a vapor mitigation system within the foundation. The most recent round of LTM sampling was completed in January 2020, and the next LTM sampling is scheduled for the second quarter of FY 2021. Remedial Action Optimization Investigation was initiated in FY 2020.
Site 2 – Naval Magazine Slag Pile - All Media	OU 02	1983*	1988*		1996, 1998	1998	1998	1999		2000	1999, 2005	1999		Sediments removed in December 1999. Annual post-closure monitoring conducted from 2000 to 2004. Following 2004, groundwater sampling conducted once every 5 years. Remedial Action Completion Report completed May 2007. The next LTM sampling is scheduled for FY 2022.
Site 3 – Q-Area Drum Storage Yard	OU 03	1983*	1988*		1991	1996	1996	1996		1996, 2010	1996, 2005	1998		Construction of Air Sparge/Soil Vapor Extraction (AS/SVE) system completed as site remedy. Long-term monitoring to evaluate the effectiveness of treatment system was instituted in 1999. Remedy reaffirmed September 2010. AS/SVE systems turned off in July 2013 per Partnering Team decision. Remedial Process Optimization ongoing. LTM sampling was most recently completed in February 2020, and the next LTM sampling is scheduled for the second quarter of FY 2021.
Site 6 – Construction Debris (CD) Landfill	OU 06	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 Virginia Solid Waste Management Regulations (VSWMR) corrective action finalized in April 2006. VSWMR permit revoked by Virginia Department of Environmental Quality in May 2013. LTM continuing once every 5 years to support each Five-Year Review. The next LTM sampling is scheduled for FY 2022.
Site 6, OU1 – Sediments	OU 06							1996		1996	1996, 2005	1999		
Site 6, OU2 – Landfill Cap	OU 07							1998		1998	1999, 2005	1999		
Site 18 – Former Naval Magazine Hazardous Waste Storage Area	OU 14 RFA M-26	1983	2002, 2003	2008	2001, 2003, 2004, 2005					2010	2010	2008		Non-time-critical removal action completed 2008 and 2010 (amendment injections for enhanced reductive dechlorination). ROD signed August 2010 documenting continued enhanced bioremediation with groundwater monitoring and land use controls (LUCs) as selected remedy. RD for LUCs finalized August 2010. Performance monitoring period was completed in April 2013. The most recent LTM results (February 2020) identified per- and polyfluoroalkyl substances (PFAS) in the IDW, indicating a PFAS SI will be conducted at the site. The need for additional injections will be based on the SI results. The next LTM sampling is scheduled for the second quarter of FY 2021.

Table 1-1. Status Summary of Environmental Restoration Sites
Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk

Site	OU/RFA Designations	PA or IAS	SI or CS	EE/CA	Work Plans	RI	FS	PRAP	Closeout Report	ROD/DD	RD	RA Construction Phase	RA Ops Phase	Comments
Site 20 – Building LP-20 Site	OU 10 RFA M-9/M-10	1991	1991		1994	1995	1996	1996		1996, 2010	1997, 2005	1998		Construction of AS/SVE system to address total petroleum hydrocarbons and chlorinated solvents in groundwater completed as site remedy. Remedy enhancement (groundwater extraction) was constructed in 2010 (not currently operating because of excessive maintenance requirements). The AS/SVE system was shut down in 2013. Based on remedy evaluation and Remedial Process Optimization in FY 2016, a field investigation and bench-scale test for a subgrade biogeochemical reactor (SBGR) was recommended. The pilot-scale test of the SBGR is scheduled for FY 2021. A VI investigation for the Site 20 buildings was initiated in FY 2019. The results of the investigation resulted in a Rapid Response Action of installing air purifying units to reduce the indoor air concentration of TCE in an office in LP-26. The LTM sampling was most recently completed in February 2020, and the next LTM sampling is scheduled for the second quarter of FY 2021.
Site 22 – Camp Allen Salvage Yard	OU 08 RFA C-14	1994	1994	1999, 2002	1996	1999	2002	2002		2004	2002, 2004	2002, 2009		An NCTRA was implemented at the Site in 1998 to remove polychlorinated biphenyl (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. Site groundwater is monitored under Site 1. The most recent round of LTM sampling was completed in January 2019, and the next LTM sampling is scheduled for the second quarter of FY 2021.
Site 23 – Building LP-20 Plating Shop	OU 10 RFA M-29		2005	2006	2004			2008		2008	2009			Final EE/CA completed December 2006. Construction for the interim action was implemented in June 2007 to construct a concrete cover (new floor). Site inspections are completed quarterly to confirm that the LUCs and institutional controls are being implemented.
Response Complete/NFA														
Site 4 – P-71 Transformer Storage	RFA M-5	1983*	1988 ^a		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 ^b 1998 ^c	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					
Site 8 – Asbestos Landfill	RFA L-4	1983							2001					
Site 9 – Q-50 Area Landfill	RFA L-5	1983							2001					Site 9 was incorporated as part of the Q-50 Satellite Accumulation Area (Solid Waste Management Unit 14) where an RI was completed in 2004 (Table 1-2).
Site 10 – Apollo Fuel Disposal Sites	RFA M-23	1983	2001		2001				2002					
Site 12 – Alleged Mercury Disposal Site	RFA M-35	1983							2001					
Site 13 – Past Wastewater Outfalls	RFA TP 10/ M 45													Recommended for No Further Action (NFA) in Federal Facility Agreement (FFA) (USEPA and Navy, 1999)
Site 14 – Oil Spill Piers 4, 5, and 7	RFA M 24													Recommended for NFA in FFA (USEPA and Navy, 1999)
Site 15 – Oil Spill Piers 20, 21, and 22														Recommended for NFA in FFA (USEPA and Navy, 1999)
Site 16 – Chemical Fire Building X-136		1983	2001		2001				2002					

Table 1-1. Status Summary of Environmental Restoration Sites
Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk

Site	OU/RFA Designations	PA or IAS	SI or CS	EE/CA	Work Plans	RI	FS	PRAP	Closeout Report	ROD/DD	RD	RA Construction Phase	RA Ops Phase	Comments
Site 17 – Chemical Fire Building SDA-215	RFA C-25/AOC E	1983							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				1998					PCB-contaminated soil removal action completed in March 1998.

^aRefers to *Initial Assessment Study, Sewells Point Naval Complex, Norfolk, Virginia* (ESE, 1983)

^bRefers to *Installation Restoration Program Investigation - Interim Report* (Malcolm Pirnie, 1988)

^cCH2M HILL SI completed February 1998

Notes:
The Basewide Preliminary Assessment for PFAS is in progress, and sites listed in this table may be identified as potential PFAS source areas as a result of this evaluation.

CS	Confirmation Study	OU	Operable Unit
DD	Decision Document	PA	Preliminary Assessment
EE/CA	Engineering Evaluation/Cost Analysis	PFAS	per- and polyfluoroalkyl substances
FS	Feasibility Study	PRAP	Proposed Remedial Action Plan
IAS	Initial Assessment Study	RA	Remedial Action/Removal Action
LTM	Long-term Monitoring	RD	Remedial Design
NFA	No Further Action	RFA	Resource Conservation and Recovery Act Facility Assessment
O&M	operations and maintenance	RI	Remedial Investigation
Ops	Operations	ROD	Record of Decision
		SI	Site Inspection

Table 1-2. Status Summary of Solid Waste Management Units
Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk

	SWMU	OU/RFA Designations	Phase I RRR ^a	Phase 2 RRR ^b	Work Plans	PA/SI	SI/SSI ^c	RI/FS	EE/CA	Closeout Report	ROD/DD	RD	RA Construction	Comments
	Response Complete/NFA													
1	SP-2B Accumulation Area	RFA C-83	1996	1996			1996							No further action under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) based on SI Report.
2	Building Z-309 Ash Hopper Storage Area	RFA M-13/ M-14	1996	1996						2000				
3	Building Z-309 Oil/Lubricant Storage Area	RFA AOC B	1996	1996						2000				
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										Recommended for No Further Action (NFA) in Federal Facility Agreement (FFA) (USEPA and Navy, 1999). No further action based on RRR report.
6	Building V-28 Waste Pit	RFA M-31	1996		1996, 2001	1996	1998, 1999			2002				
7	LF-18 Aircraft Ramp	EPIC WDA-3	1996	1996										Recommended for NFA in FFA (USEPA and Navy, 1999). No further action based on RRR report.
8	Fire Fighting School	EPIC WDA-20	1996		1996	1996	1999			2001				
9	LP-200/MAC Terminal	EPIC WDA-28/29	1996		1998	1998	1999			2001				
10	LP-200/MAC Terminal/East	EPIC WDA-31/32/35	1996	1996	1998	1998	1999			2001				
11	Old Weapons Station Entrance	EPIC WDA-33/34	1996	1996										Recommended for NFA in FFA (USEPA and Navy, 1999). No further action based on RRR report.
12	Disposal Area near Naval Magazine-37	OU 09 EPIC WDA-36	1996	1996	1998	1998		2004			2005			
13	Disposal Area PWC Operations, near Naval Magazine-71	EPIC WDA-37	1996	1996										Recommended for NFA in FFA (USEPA and Navy, 1999). No further action based on RRR report.
14	Q-50 Satellite Accumulation Area	OU 13 RFA C-17	1996	1996	1998	1998		2004, 2009	2008		2010	2010	2008	The Final Proposed Plan was submitted August 2009. RD for land use controls (LUCs) completed August 2010. Limited action Remedial Action Completion Report signed September 2010. Quarterly inspections completed to confirm LUCs are implemented.
15	W-130 Accumulation Area	RFA C-27	1996	1996										Recommended for NFA in FFA (USEPA and Navy, 1999). No further action based on RRR report.
16	Naval Magazine 37 Accumulation Area	OU 09 RFA C-54	1996	1996	1998	1998		2004			2005			No further action.
17	Surface Disposal Area; Waste Generated from SP-10 Maintenance		1996	1996										No further action based on RRR report.

Table 1-2. Status Summary of Solid Waste Management Units
Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk

	SWMU	OU/RFA Designations	Phase I RRR^a	Phase 2 RRR^b	Work Plans	PA/SI	SI/SSI^c	RI/FS	EE/CA	Closeout Report	ROD/DD	RD	RA Construction	Comments
18	Surface Disposal Area; Waste Generated from V-88 Lab		1996	1996										No further action based on RRR report.
19	Surface Disposal Area; Waste 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 Building LF-60 Helicopter Maintenance		1996	1996			1999							No further action based on RRR report.
24	Building LF-53 Trenches	RFA M-39	1996	1996										Recommended for NFA in FFA (USEPA and Navy, 1999). 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 Naval Magazine-140/141	EPIC WDA-21	1996	1996										Recommended for NFA in FFA (USEPA and Navy, 1999). No further action based on RRR report.
27	Mason Creek Embankment	EPIC WDA-30	1996	1996										Recommended for NFA in FFA (USEPA and Navy, 1999). No further action based on RRR report.
28	Probable Solid Waste Disposal South of CEP 201	EPIC WDA-11	1996		1998	1998				2000				
29	Solid Waste Disposal Area/CD-3/CD-4	EPIC WDA-12	1996	1996										Recommended for NFA in FFA (USEPA and Navy, 1999). No further action based on RRR report.
30	Sludge Fill Disposal Area/Marshy Area South of Runway	EPIC WDA-15/16/17	1996	1996										Recommended for NFA in FFA (USEPA and Navy, 1999). 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				
33	Debris Piled at Seawell	EPIC WDA-6	1996		1998	1998				2000				
34	Solid Waste Disposal Area CEP 200	EPIC WDA-7	1996		1998	1998	1999			2000				
35	Solid Waste Disposal Area CEP 196/Resolute Embankment	EPIC WDA-8	1996		1998	1998	1999			2000				
36	Stormwater Drainage System	RFA M-44												No further action under CERCLA.
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				
39	Open Dump and Disposal Area near Boundary of Camp Allen Landfill	EPIC WDA-18/19					2000			2001				
40	MCA-603 Pits	EPIC WDA-22			1998	1998				2000				

Table 1-2. Status Summary of Solid Waste Management Units
Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk

	SWMU	OU/RFA Designations	Phase I RRR ^a	Phase 2 RRR ^b	Work Plans	PA/SI	SI/SSI ^c	RI/FS	EE/CA	Closeout Report	ROD/DD	RD	RA Construction	Comments
41	Disposal Area, CA-99 Golf Course	EPIC WDA-23			1998	1998	1999			2000				
42	CEP 201 Area	EPIC WDA-9	1996	1996	1998	1998	1999			2000				

^aRefers to *Initial Assessment Study, Sewells Point Naval Complex, Norfolk, Virginia* (ESE, 1983)

^bRefers to *Installation Restoration Program Investigation - Interim Report* (Malcolm Pirnie, 1988)

^cCH2M HILL SI completed February 1998.

Notes:
The Basewide Preliminary Assessment for PFAS is in progress, and sites listed in this table may be Identified as potential PFAS source areas as a result of this evaluation.

AOC	area of concern	PWC	Public Works Center
CD	construction debris	RA	Remedial Action
DD	Decision Document	RD	Remedial Design
EE/CA	Engineering Evaluation/Cost Analysis	RFA	Resource Conservation and Recovery Act Facility Assessment
EPIC	EPA Photographic Interpretation Center	RI	Remedial Investigation
FS	Feasibility Study	ROD	Record of Decision
NFA	No Further Action	RRR	relative risk ranking
OU	operable unit	SI	Site Investigation
PA	Preliminary Assessment	SSI	Supplementary Site Investigation
PFAS	per- and polyfluoroalkyl substances	SWMU	solid waste management unit
		UST	underground storage tank

Table 1-3. Additional No Further Action Sites*Site Management Plan, Fiscal Years 2021 to 2025, 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

Table 1-3. Additional No Further Action Sites

Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk

Site	Site Description	Reason for No Further Action
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 Trenches (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 USEPA Region 3
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 USEPA Region 3
RFA O-7	CEP-188 Building	Oil/Water Separator; Managed under IWMP
RFA O-8	LF-38 Building	Oil/Water Separator; Demolition complete

Table 1-3. Additional No Further Action Sites*Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk*

Site	Site Description	Reason for No Further Action
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 3
RFA O-23	LP-20 Building	Oil/Water Separator; Managed under IWMP
RFA O-24	LP-22 Building	Oil/Water Separator; Demolition complete – FY 1998
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 – FY 1998
RFA O-30	LP-78 Building	Oil/Water Separator; Demolition complete – FY 1997
RFA O-31	LP-167 Area 1	Oil/Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region 3
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 3
RFA O-35	LP-167 Area 5	Oil/Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region 3
RFA O-36	LP-167 Area 6	Oil/Water Separator; Managed under IWMP
RFA O-37	LP-176 Building	Oil/Water Separator; Demolition complete – FY 1998
RFA O-43	SP-38 Building	Oil/Water Separator; Managed under IWMP
RFA O-45	SP-296 Hangar	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 3
RFA O-50	V-15 Building	Oil/Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region 3
RFA O-51	V-27 Area 1	Oil/Water Separator; Inactive due to BRAC closure of NSN tenants

Table 1-3. Additional No Further Action Sites

Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk

Site	Site Description	Reason for No Further Action
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 – FY 1997
RFA O-59	W-6 Building	Oil/Water Separator; Managed under IWMP
RFA O-60	Firefighting School	Oil/Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region 3
RFA O-61	Firefighting School	Oil/Water Separator; Demolition complete – FY 1992
RFA O-62	Firefighting School	Oil/Water Separator; Demolition complete – FY 1992
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	Firefighting 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

Table 1-3. Additional No Further Action Sites*Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk*

Site	Site Description	Reason for No Further Action
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 – FY 1997
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
RFA TP-6	Firefighting School Wastewater Pit	Oil/Water Separator; Demolition complete – FY 1999
RFA W-4	Q-50	Oil/Water Separator; Documentation of integrity and functionality inspections on file with the USEPA Region 3
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

Table 1-3. Additional No Further Action Sites

Site Management Plan, Fiscal Years 2021 to 2025, Naval Station Norfolk

Site	Site Description	Reason for No Further Action
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:

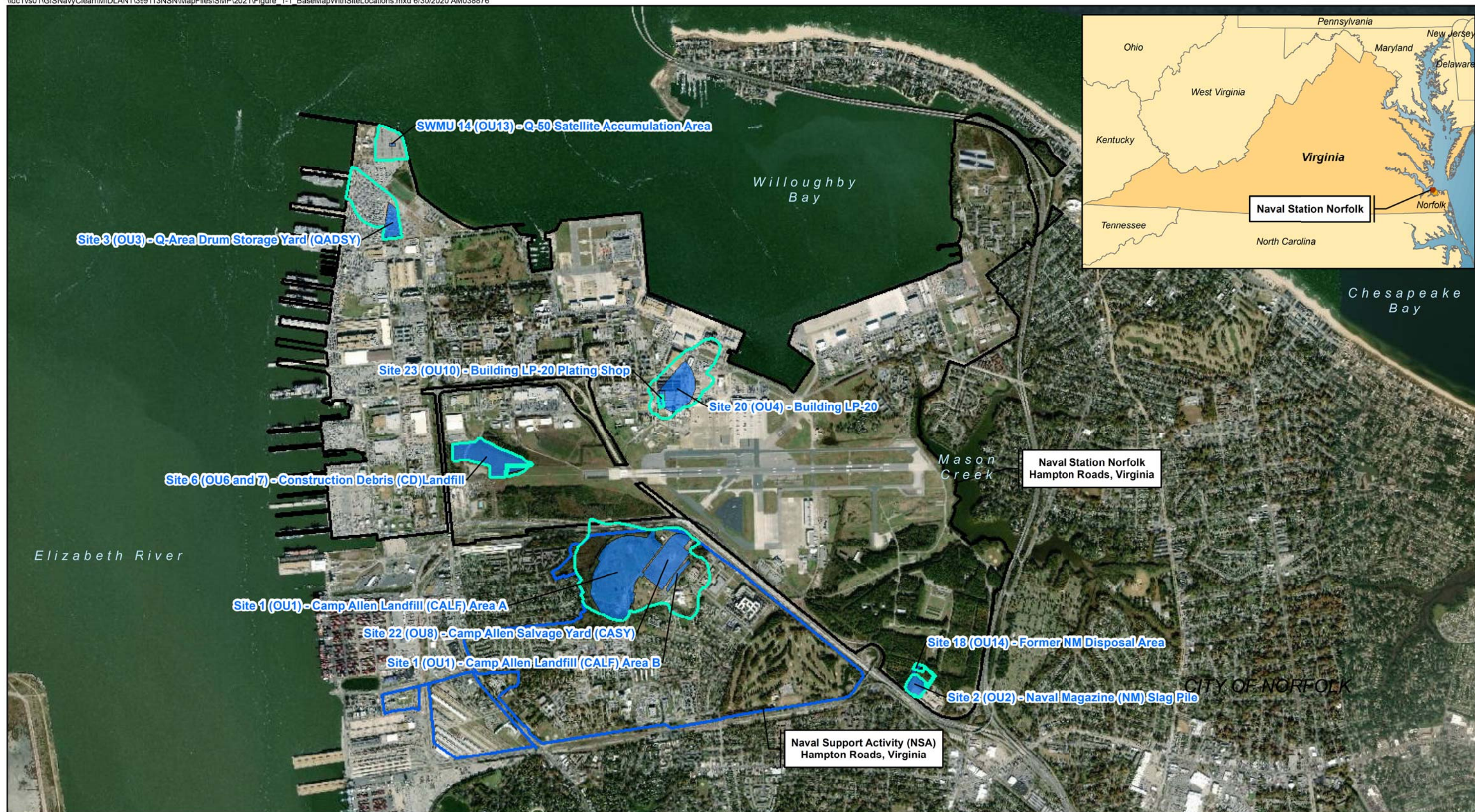
AOC = area of concern
 AST = aboveground storage tank
 BRAC = Base Realignment and Closure
 EPIC = EPA Photographic Interpretation Center
 FY = fiscal year
 IWMP = Industrial Wastewater Management Plan
 NSN = Naval Station Norfolk
 RFA = Resource Conservation and Recovery Act Facility Assessment
 RRR = relative risk ranking
 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.
 SWMU = solid waste management unit
 O/WS = oil/water separator
 USEPA = United States Environmental Protection Agency
 UST = underground storage tank

Table 1-4. Status Summary of Federal Facility Agreement Areas of Concern
Site Management Plan, Fiscal Years 2021 to 2025, 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 CEP 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.
		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	Refer to Table 1-2 for status
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.

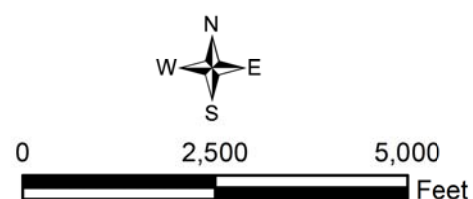
Notes:

AOC = area of concern
 CD = construction debris
 EPIC = EPA Photographic Interpretation Center
 RFA = Resource Conservation and Recovery Act Facility Assessment
 SWMU = solid waste management unit



Legend

- Remedial/Removal Action in Progress (Under Five Year Review)
- Land Use Control Area (2019)
- NSA Hampton Roads
- Naval Station Norfolk



Imagery Source: Esri 2018

Figure 1-1
Base Map with Site Locations
and Current Cleanup Status
 FY2021 Site Management Plan
 Naval Station Norfolk
 Norfolk, Virginia

ch2m

Site Descriptions

This section provides information regarding the ERP sites (Section 2.1) and SWMUs (Section 2.2) at NSN that have been investigated and are currently undergoing remediation, and per- and polyfluoroalkyl substances (PFAS) basewide investigations that are on-going (Section 2.3). The locations of the sites that are currently undergoing remediation are shown on **Figure 1-1**.

2.1 Environmental Restoration Program Sites

Sections 2.1.1 through 2.1.8 provide site-specific descriptions of ERP Sites 1, 2, 3, 6, 18, 20, 22, and 23. The following descriptions include a site summary, site description and history along with a table listing past activities, and a table listing the known COCs in each site medium. In addition, the current status of each site is briefly discussed.

2.1.1 Site 1 (OU 1)—Camp Allen Landfill

Site 1 Summary	
Status:	Remedial action operation and optimization
Current Installation Restoration (IR) Activities:	Remedy optimization stage of investigation
Media Investigated:	Soil, groundwater, surface water, sediment, subslab vapor, indoor air
Removal and Remedial Actions:	Soil and debris removal action completed in FY 1995; groundwater extraction and treatment began in 1998; sediment removal of Bousch Creek was completed in 2008; land use controls (LUCs) in place for groundwater
Media Closed:	Not applicable (N/A)
Waste and/or Debris Present Onsite:	Buried debris present onsite

2.1.1.1 Site Description and History

The Camp Allen Landfill (CALF) site includes two distinct areas: Area A, the 45-acre landfill, and Area B, the 2-acre fire disposal area. CALF is located within the Naval Support Activity Hampton Roads, as shown on **Figure 2-1**. 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 the Camp Allen Salvage Yard (CASY) (Site 22), including drums containing various chemicals, were buried in 1971 in trenches at Area B.

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 Surficial/Columbia aquifer (the shallow water table aquifer) and the Yorktown aquifer (the deep groundwater aquifer) in Areas A and B. The presence of contamination in the deeper Yorktown aquifer is thought to be caused by the presence of a discontinuous confining layer between the two aquifers beneath much of the CALF area.

Table 2-1 provides a list of relevant documents and past activities for Site 1.

Table 2-1. Summary of Relevant Documents and Milestones for Site 1

Document Title/Milestone	Summary
Remedial Investigation/ Feasibility Study (Baker, 1994)	<p>The purpose of the Remedial Investigation (RI) was to determine the extent and degree of potential contamination associated with Areas A and B through investigation of subsurface and surface soil, sediment, surface water, groundwater, and air. Findings indicated that contamination from prior disposal practices at Areas A and B has affected the aforementioned media to various degrees.</p> <p>During the Feasibility Study (FS), remedial alternatives were developed to address VOC contaminants in subsurface soil and groundwater and inorganic contaminants in surface water and sediment in Areas A and B.</p>
Soil and Debris Removal Action at Site 1 Area B (OHM, 1995)	<p>A non-time-critical removal action (NTCRA) was implemented at Area B in May 1994 and completed in January 1995 to remove the primary source areas of contamination. Approximately 11,500 tons of waste were removed, and the final SI occurred February 16, 1995.</p>
Decision Document (Baker, 1995a)	<p>Signed in July 1995, the Decision Document (DD) required localized treatment of soil and groundwater using dual-phase vacuum extraction (DPVE) system and a groundwater extraction and treatment system to remediate groundwater underlying Areas A, B, and CASY.</p> <p>Continuous operation of the groundwater extraction and treatment system began in November 1998 and includes extraction wells 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). The DPVE system was installed and began operation in May 1998 to address a known hotspot in Area A. The extracted groundwater was pumped into a groundwater treatment system.</p> <p>Based on the evaluation of 2008 long-term monitoring (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.</p>
Ecological Risk Assessment (CH2M, 2006b)	<p>Sediment in Bousch Creek that was considered to be associated with Site 1 was determined to potentially pose ecological risk.</p>
2007 Area B Delineation Investigations (CH2M, 2008e)	<p>In 2007, additional soil and groundwater sampling were completed in the vicinity of Area B to delineate VOC contamination around monitoring wells B-MW3A and B-MW11A. Results indicated that natural attenuation appeared to be occurring at the site; however, the rate of degradation could not be estimated because of interference with the pump-and-treat system. As a result, it was recommended that pumping from extraction wells in this vicinity be discontinued for a period of 2 to 3 years while semiannual monitoring was completed to demonstrate whether natural attenuation is occurring (CH2M, 2008e).</p>
Engineering Evaluation/Cost Analysis and Action Memorandum (CH2M, 2007a, 2007b)	<p>In the Engineering Evaluation/Cost Analysis (EE/CA), the proposed NTCRA for Site 1 was evaluated. The supporting Action Memorandum was approved as the DD for the NTCRA in October 2007, and construction activities were completed in 2008.</p>
Construction Closeout Report (AGVIQ and CH2M, 2008c)	<p>A sediment removal action was completed to remove sediment within the upper reaches of Bousch Creek that posed an unacceptable ecological risk.</p>
Proposed Plan and ROD (Navy, 2010)	<p>The Proposed Plan and ROD reaffirmed remedial actions and LUCs for Areas A and B and CASY previously documented in the DD.</p>
2012 Area B Delineation Investigations	<p>Additional investigation of Area B was completed in 2012 to determine whether contamination in the area of B-MW16 was migrating toward Navy residential housing to the southwest. Groundwater results indicated that concentrations of chlorinated VOCs exceeded the maximum contaminant level (MCL) at multiple locations in the vicinity of the housing area. The report summarizing the results was never finalized; however, additional investigation is needed to delineate the full extent of contamination in groundwater.</p>
Long-term Monitoring Reports (CH2M, 2014)	<p>The 2014 long-term monitoring (LTM) report identified PFAS in several monitoring wells. However, the extent of PFAS constituents has not been delineated, and the data have not been evaluated to determine whether the PFAS levels render them constituents of concern (COCs).</p>

Table 2-1. Summary of Relevant Documents and Milestones for Site 1

Document Title/Milestone	Summary
Clean Water Lens Investigation	The Camp Allen Elementary School, which is located within the LUC area, was demolished and reconstructed in 2018 at the location shown on Figure 2-1 . A vapor mitigation system was incorporated into the expansion of the school as a precautionary measure to prevent the potential for future vapor intrusion (VI) from groundwater site-related VOC COCs. The VI mitigation system includes an engineered barrier system as well as a passive subslab venting system constructed with the infrastructure to allow for easy conversion to an active, fan-driven system, if required.
Five-Year Review Report (CH2M, 2019a)	The most recent Five-Year Review confirmed that the remedy in place is protective in the short term; however, to ensure the remedy is protective in the long term, a remedial action optimization was recommended to contain the COC plumes within the site and to remediate potential source areas to effectively reduce the COC concentrations within a reasonable timeframe.

2.1.1.2 Site 1 COCs

Identified COCs for each medium at Site 1 are summarized in **Table 2-2**.

Table 2-2. Summary of Constituents of Concern at Site 1

Medium	Potential Risk	COC
Groundwater	Human Health	1,2-DCA, tetrachloroethene (PCE), 1,2-DCE, vinyl chloride, dioxin/furans, benzene
Soil	Human Health	Arsenic, cadmium, manganese
Surface Water	Ecological Risk	PCBs
Sediment	Ecological Risk	PCBs, arsenic, cadmium, metals
Indoor Air	None Identified	

Notes:

DCA = dichloroethane

DCE = dichloroethane

PCB = polychlorinated biphenyl

2.1.1.3 Current and Future Activities

The Basewide PFAS Preliminary Assessment (PA), which will include further evaluation of Site 1, is anticipated to be finalized in FY 2021, and additional investigation activities will be scoped following finalization of the PA. Additional investigation is recommended for PFAS at Site 1 to further assess the extent of contamination in the groundwater and complete human health risk assessments (HHRAs). In addition, sampling has been completed since August 2018 at the treatment plant to assess whether the granular activated carbon (GAC) units are effectively removing PFAS from the influent to the plant. The detection of elevated PFAS levels in the effluent of the GAC units resulted in the temporary shutdown of the treatment plant from March through May of 2020 to replace the GAC. The system has been back online since the end of May 2020. Monthly sampling will continue while the treatment plant is online.

A Remedial Action Optimization Investigation was proposed to accomplish the following: (1) further delineate the extent of the COC plumes, (2) assess the extent of dioxin/furans recently identified within the groundwater, and (3) evaluate remedial alternatives to expedite the reduction of COCs detected in the groundwater. The fieldwork for this investigation was initiated in June 2020 and the report is scheduled to be submitted for regulatory review in the third quarter of FY 2021. The next LTM sampling event is scheduled for the second quarter of FY 2021.

2.1.2 Site 2 (OU2)—Naval Magazine Slag Pile

Site 2 Summary

Status:	Remedy in Place
Current IR Activities:	Five-Year Review LTM
Media Investigated:	Groundwater, soil, surface water, sediment
Removal and Remedial Actions:	Sediment removal action completed in FY 1999 Asphalt and soil cover completed in FY 2000, LTM, LUCs
Media Closed:	Soil, surface water, sediment
Waste and/or Debris Present Onsite:	Buried debris present onsite

2.1.2.1 Site Description and History

The Naval Magazine Slag Pile (**Figure 2-2**) is a 1-acre disposal area for slag generated by an aluminum smelting operation during the 1950s and 1960s. The slag is a residual cindery material formed from the fusion of flux materials, 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 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 planted. Prior to remediation activities, the surface of the site consisted of a gravel parking lot and an open grassy field.

Table 2-3 provides a list of relevant documents and past activities for Site 2.

Table 2-3. Summary of Relevant Documents and Milestones for Site 2

Document Title/Milestone	Summary
Initial Assessment Study (ESE, 1983)	The potential for site contamination from metals, including chromium, cadmium, and zinc, was identified in the 1983 IAS.
Remedial Investigation (Malcolm Pirnie, 1988)	Trace amounts of inorganics were detected in surface soil, surface water, and sediment samples taken during the 1988 RI. However, the samples were taken after site regrading and placement of gravel surfacing. Because these activities disturbed the surface soil, the analytical results may not be representative of potential subsurface contamination at the site.
Remedial Investigation and Feasibility Study (CH2M, 1998a, 1998c)	During the 1998 RI conducted at the site, it was concluded that the disposal activities had affected 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 consisted 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 were conducted in February 1998 to delineate the contamination limits for a sediment removal action.
Proposed Remedial Action Design (CH2M, 1999)	The final remedial design for the sediment removal program was submitted, and approximately 2,000 cubic yards (yd ³) of sediment were removed in November 1999.

Table 2-3. Summary of Relevant Documents and Milestones for Site 2

Document Title/Milestone	Summary
Record of Decision (CH2M, 2000a)	The final ROD was completed in December 2000. In February 2000, an asphalt and soil cover remedy were placed over the site. The ROD called for the collection of sediment, surface water, and groundwater samples for Target Analyte List metals analysis. The first five rounds of sampling were completed annually from 2000 to 2004. In 2004, statistical analysis results indicated that the concentrations of site risk drivers ^a were decreasing in groundwater. In addition, the concentrations of site risk drivers 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 frequency of once every 5 years, and sediment and surface water LTM sampling be discontinued.
Long-term Monitoring Reports (CH2M, 2008f, 2014, 2017)	In preparation for the 2008 Five-Year Review (CH2M, 2008d), sediment samples collected during the 2007 LTM event were analyzed for lead. The results indicated that concentrations were below the established cleanup goal, and no further sediment sampling was required following this event. Site 2 wells were sampled and analyzed for total and dissolved inorganics during the 2012 LTM event, and thallium and arsenic were detected at concentrations above their respective MCLs. The 2016 LTM event included the sampling of five Site 2 monitoring wells for total and dissolved metals. Although exit strategies for LTM at Site 2 were evaluated in 2018, the NSN Partnering Team decided to continue with the existing 5-year LTM plan because of contaminated soils remaining in place and the MCL exceedances for thallium and arsenic.
Five-Year Review Report (CH2M, 2019a)	The most recent Five-Year Review Report confirmed that the remedy is protective of human health and the environment; however, as long as contaminated soils remain in place, groundwater monitoring will continue every 5 years to ensure the remedy is protective over the long term.

^a The ROD did not identify COCs. Total and dissolved metals are risk drivers at Site 2.

2.1.2.2 Site 2 COCs

Identified COCs for each medium at Site 2 are summarized in **Table 2-4**.

Table 2-4. Summary of Constituents of Concern at Site 2

Medium	Potential Risk	COC
Groundwater	Human Health	Total and dissolved metals ^a
Soil	Human Health	Aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, nickel
Surface Water	Ecological	Aluminum, cadmium, copper, iron, lead, silver, zinc
Sediment	Ecological	Aluminum, silver, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, chromium, iron, lead, nickel, selenium, thallium, vanadium, zinc
Indoor Air	None Identified	N/A

^a The ROD did not identify COCs. Total and dissolved metals are risk drivers at Site 2.

2.1.2.3 Current and Future Activities

The Fourth Five-Year Review Report (CH2M, 2019a) concluded that the remedy implemented at Site 2 is protective of human health and the environment. The following actions will continue at the site: (1) quarterly site inspections will be conducted to confirm that LUCs are being implemented, and (2) LTM of groundwater will be conducted every 5 years to assess the trends in COC concentrations over time. The next LTM monitoring event will be outlined in an LTM Sampling and Analysis Plan and is scheduled to be completed in FY 2022.

2.1.3 Site 3 (OU3)—Q-Area Drum Storage Yard

Site 3 Summary

Status:	Remedy in place
Current IR Activities:	Remedial phase LTM
Media Investigated:	Groundwater and soil
Removal and Remedial Actions:	Pre-NPL soil removal in 1987 Air sparge (AS)/soil vapor extraction (SVE) discontinued in FY 2013
Media Closed:	N/A
Waste and/or Debris Present Onsite:	N/A

2.1.3.1 Site Description and History

The Q-Area Drum Storage Yard, shown on **Figure 2-3**, was previously a compound that occupied approximately 5 acres in the northwestern corner of the NSN near the carrier piers. This area of NSN was created by dredging operations in the early 1950s as the Base expanded. The Q-Area Drum Storage Yard 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.

Table 2-5 provides a list of relevant documents and past activities for Site 3.

Table 2-5. Summary of Relevant Documents and Milestones for Site 3

Document Title/Milestone	Summary
Pre-NPL Soil Removal	In 1986, Navy fire inspectors expressed concern with the oil-saturated soils at the northern end of the storage area. On the basis of a potential fire hazard, the top 6 inches of soil were excavated from an area of 4,240 square yards (totaling approximately 750 yd ³ of soil removed) in the northern section and disposed of offsite in 1987. Following the removal action, this area of the storage yard was paved. The removal action was documented in the subsequent RI (ESE, 1996a).
Remedial Investigation/ Feasibility Study (ESE, 1996a)	The RI/FS for this site revealed that the soil was contaminated with 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 affected the most. Some low VOC levels were also detected in the deep (Yorktown aquifer) wells, which may have resulted from the lack of a confining layer between the two aquifers (Surficial/Columbia and Yorktown) in this area. The general extent of the groundwater plume was estimated to affect approximately 29 acres beneath the fleet parking area west of the site. The Q-Area Drum Storage Yard was subdivided into AOC 1 and AOC 2 to reflect that the yard contained two areas of high VOC concentrations.
Decision Document (ESE, 1996b)	The DD for the site was signed in November 1996 and called for remediation by AS/SVE. A pilot treatability study was performed prior to the system being constructed. Several monitoring wells were sampled for VOCs in 1998 to provide baseline water quality data before the remediation system was started. The remediation system began operation in August 1998.

Table 2-5. Summary of Relevant Documents and Milestones for Site 3

Document Title/Milestone	Summary
AOC 1 Closeout Strategy Agreement	In July 2002, the Team agreed to a closeout strategy for AOC 1, including the accelerated remediation proximal to CMW-101 to address high concentrations of vinyl chloride, followed by continued monitoring, and ultimately the shutdown and dismantling of the system. The accelerated remediation was accomplished by installation of a new 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, concentrations of vinyl chloride in well CMW-101 decreased to below the detection limit in February 2005. Subsequent monitoring events indicated relatively low vinyl chloride concentrations that exceeded the cleanup goal (0.08 microgram per liter), so the 2002 closeout strategy was suspended.
AOC 2 Closeout Strategy	A closeout strategy for AOC 2 was implemented in June 2006 with the installation of an additional AS well proximal to CMW-202 to treat TCE and vinyl chloride. However, LTM data indicated that VOC concentrations continued to exceed the cleanup goals.
Proposed Plan and Record of Decision (Navy, 2010)	The remedy selected by the 1996 DD (ESE, 1996b) was reaffirmed by the Proposed Plan and ROD for Sites 1, 3, 18, and 20, which was signed in September 2010. The groundwater cleanup goals, based on the risk-based values presented in the DD (ESE 1996b) (based on the most likely exposure scenarios), continued to serve as the cleanup goals because the risk-based goals were more protective than the respective MCLs.
Long-term Monitoring Reports (CH2M, 2020a, 2020b)	The 2018 LTM Report indicated that COC concentrations exceeded their cleanup goals in seven monitoring wells; however, the concentrations were relatively low and mostly within an order of magnitude of the cleanup goals. The report identified two separate COC plumes onsite (Figure 2-3). Data collected during the 2019 ^a LTM event indicated that COC concentrations exceeded their cleanup goals in nine monitoring wells. In addition, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) concentrations in investigation-derived waste (IDW) were above the USEPA Tap Water Regional Screening Levels (RSLs) (based on a hazard quotient of 0.1); therefore, Site 3 will be further evaluated in the forthcoming Basewide PFAS PA. Currently, 1,4-dioxane is monitored with site COCs during LTM events; however, concentrations have remained below the preliminary remediation goals.
Five-Year Review Reports	Based on Team discussion of the groundwater data collected in 2012, the systems at AOC 1 and AOC 2 were shut down in June 2013 while annual LTM continues to assess remedy effectiveness and identify opportunities for future optimization. The Fourth Five-Year Review Report concluded that the remedy implemented at Site 3 is protective of human health and the environment (CH2M, 2019a). The following actions will continue at the site: (1) quarterly site inspections will be conducted to confirm implementation of the LUCs, and (2) LTM of groundwater will be conducted every year to assess the trends in COC concentrations.

^a Because of schedule delays, the 2019 LTM event was completed in January 2020.

2.1.3.2 Site 3 COCs

Identified COCs for each medium at Site 3 are summarized in **Table 2-6**.

Table 2-6. Summary of Constituents of Concern at Site 3

Medium	Potential Risk	COC
Groundwater	Human Health	1,1-DCE, PCE, TCE, vinyl chloride, carbon tetrachloride, chloroform
Soil	Human Health	1,1-DCE, PCE, TCE, vinyl chloride, 1,4-dioxane, carbon tetrachloride, chloroform
Surface Water	N/A	N/A
Sediment	N/A	N/A
Indoor Air	N/A	N/A

2.1.3.3 Current and Future Activities

The draft LTM Report is scheduled to be submitted for regulatory review in the first quarter of FY 2021. The next LTM sampling event and LTM Sampling and Analysis Plan are scheduled for the second quarter of FY 2021.

2.1.4 Site 6 (OU6 and OU7)—Construction Debris Landfill

Site 6 Summary	
Status:	Remedy in place
Current IR Activities:	Five-year Review LTM
Media Investigated:	Groundwater, soil, and sediment
Removal and Remedial Actions:	Sediment removal action, synthetic cap, LTM, LUCs
Media Closed:	N/A
Waste and/or Debris Present Onsite:	Buried debris present onsite

2.1.4.1 Site Description and History

The Construction Debris (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 2-4**. 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 southeastern corner of the site was regraded to allow for runway expansion at the Naval Air Station. 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.

Table 2-7 provides a list of relevant documents and past activities for Site 6.

Table 2-7. Summary of Relevant Documents and Milestones for Site 6

Document Title/Milestone	Summary
Remedial Investigation/ Baseline Risk Assessment (Baker, 1995b)	The RI was completed in three separate rounds of sampling. Soil, sediment, groundwater, and surface water samples were collected. The results of the RI/Baseline Risk Assessment were used to prepare the FS (Baker, 1996b).
Feasibility Study (Baker, 1996b)	The FS was prepared in July 1996 to address contaminated media at the CD Landfill site. Potential risks associated with contaminants in the soil, sediments, groundwater, and 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.

Table 2-7. Summary of Relevant Documents and Milestones for Site 6

Document Title/Milestone	Summary
Decision Document (Baker, 1996c)	A 1996 DD for the contaminated sediments (designated as OU 1) at the CD Landfill outlined a removal action for sediments that exceeded the Effects Range–Median levels. Removal of heavy metal- and pesticide-contaminated sediments was partially completed in fall 1997 but was postponed during the winter because of inclement weather. When the OU2 (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 was not considered a hazardous waste and it was agreed that the site would be closed under Virginia Solid Waste Management Regulations.
Proposed Remedial Action Plan (Baker, 1998a)	The Proposed Remedial Action Plan identified the preferred alternative, a synthetic flexible liner-capping system with groundwater monitoring and institutional controls, for the CD Landfill.
Record of Decision (Baker, 1998b)	The final ROD was issued on September 28, 1998. The construction of the landfill cap was completed in December 1999.
Post-Closure Monitoring Report (AGVIQ and CH2M, 2004)	As a requirement of Virginia Solid Waste Management Regulations (Part D of 9 Virginia Administrative Code 20-80-270), the CD Landfill was part of the NSN LTM program for the first 4 years of monitoring as discussed in the 2003 Post-closure Monitoring Report and in the 2004 First Determination Report for Site 6 (CH2M, 2004a).
Long-term Monitoring Reports (CH2M, 2006a; CH2M, 2017)	<p>Following the post-closure monitoring, LTM was initiated in 2005.</p> <p>The LTM network includes eight monitoring wells, which are sampled every 5 years for site COCs. If COCs are detected at concentrations exceeding the MCLs or risk-based alternate concentration limits, or if COC concentrations have increased, then the NSN Partnering Team will determine the appropriate action and modify the existing remedy if, warranted.</p> <p>In May 2013, the VDEQ Landfill Permit was revoked and the NSN Partnering Team agreed that any subsequent oversight, including the LTM program, would be conducted under the CERCLA program by the NSN Partnering Team.</p> <p>The last monitoring event was completed in 2016 and the data showed that only one of the groundwater samples contained a COC (arsenic) at concentrations above the MCL (CH2M, 2017). However, the arsenic concentration was lower than the concentration previously detected at the same location in 2007. In addition, there were no other exceedances of the MCLs. As a result, no modifications to the remedy or the LTM program are warranted at this time.</p>
Human Health Risk Assessment (CH2M, 2013b)	An HHRA was conducted using 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 whether contaminants detected in groundwater warrant further evaluation. The report concluded that potential contact with groundwater by future adult and child residents may result in reasonable maximum exposure and central tendency exposure noncarcinogenic hazards and carcinogenic risks above USEPA's acceptable risk range. Groundwater elevations indicated groundwater flow to the east at the site.
Five-Year Review Report (CH2M, 2019a)	The Fourth Five-Year Review Report concluded that the remedy implemented at Site 6 is protective of human health and the environment. The following actions will continue at the site: (1) quarterly site inspections will be conducted to confirm implementation of the LUCs, and (2) LTM of groundwater will be conducted every 5 years to assess the trends in COC concentrations.

2.1.4.2 Site 6 COCs

Identified COCs for each medium at Site 6 are summarized in **Table 2-8**.

Table 2-8. Summary of Constituents of Concern at Site 6

Medium	Potential Risk	COC
Groundwater	Human Health	PCBs, arsenic, antimony, beryllium, chlorobenzene
Soil	Human Health	Arsenic, beryllium, lead, manganese, antimony, cadmium, chromium, copper, nickel, vanadium, zinc
Surface Water	Ecological	Dieldrin, 4,4-dichlorodiphenyldichloroethane, cobalt, copper, iron, manganese, nickel
Sediment	Ecological	Semivolatile organic compounds, 4,4-dichlorodiphenyltrichloroethane, PCBs, arsenic, cadmium, chromium, copper, lead, nickel, mercury, zinc
Indoor Air	None Identified	N/A

2.1.4.3 Current and Future Activities

The next LTM monitoring event is scheduled to be completed in FY 2022.

2.1.5 Site 18 (OU 14)—Former Naval Magazine Waste Storage Area

Site 18 Summary	
Status:	Remedy in place
Current IR Activities:	Remediation phase LTM
Media Investigated:	Groundwater, soil, and sediment
Removal and Remedial Actions:	Emulsified oil/ zero-valent iron injections
Media Closed:	Soil and sediment
Waste and/or Debris Present Onsite:	Buried debris present onsite

2.1.5.1 Site Description and History

The former Naval Magazine Storage Area (**Figure 2-5**) 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.

Table 2-9 provides a list of relevant documents and past activities for Site 18.

Table 2-9. Summary of Relevant Documents and Milestones for Site 18

Document Title/Milestone	Summary
Expanded Site Investigation (CH2M, 2004b)	The Final Expanded SI Report for Site 18 concluded that soil and sediment were no longer to be considered media of concern, and investigations were focused on VOCs in groundwater. Based on the analytical data and a preliminary monitored natural attenuation evaluation, it was determined that there was evidence of biodegradation of TCE at Site 18.

Table 2-9. Summary of Relevant Documents and Milestones for Site 18

Document Title/Milestone	Summary
Engineering Evaluation/Cost Analysis and Action Memorandum (CH2M, 2008a, 2008c)	An EE/CA was finalized in March 2008, detailing an interim groundwater remedial action focused on a VOC hotspot. In April 2008, an Action Memorandum recommended the implementation of enhanced reductive dechlorination to mitigate the potential human health risk. An interim remedial action of amendment injections in the area of the MW03 cluster, and extending to MW10, was completed in July 2008 in accordance with the work plan (AGVIQ and CH2M, 2008b).
Performance Monitoring Report (AGVIQ and CH2M, 2009)	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 amendment injection to encourage further reduction of VOCs in groundwater.
Action Memorandum Addendum (CH2M, 2010a)	In May 2010, an additional injection was implemented in accordance with an Addendum to the 2008 Action Memorandum. Performance monitoring was conducted through March 2013 to evaluate the effectiveness of the injection. Groundwater monitoring demonstrated that the VOCs in groundwater were reduced by more than 90 percent.
Record of Decision (Navy, 2010)	Site 18 is included in the NSN ROD for Sites 1, 3, 18, and 20, which was signed in September 2010. The selected remedy documented by the ROD was continued enhanced bioremediation with groundwater monitoring and LUCs. It was anticipated that additional injections may be necessary if cleanup goals were not met in a reasonable timeframe, in accordance with the ROD.
Five-Year Review Report (CH2M, 2019a)	The Fourth Five-Year Review Report evaluated the effectiveness of the NSN site remedies that are currently active and concluded that the remedy in place at Site 18 is currently protective of human health and the environment in the short term due to the potential presence of PFAS.

2.1.5.2 Site 18 COCs

Identified COCs for each medium at Site 18 are summarized in **Table 2-10**.

Table 2-10. Summary of Constituents of Concern at Site 18

Medium	Potential Risk	COC
Groundwater	Human Health	Cis-1,2-DCE, 1,1-DCE, TCE, vinyl chloride
Soil	None Identified	N/A
Surface Water	None Identified	N/A
Sediment	None Identified	N/A
Indoor Air	None Identified	N/A

2.1.5.3 Current and Future Activities

The 2019 and 2020 LTM data indicated that only one of the six monitoring wells sampled had a detection of one COC (vinyl chloride) at a concentration above its cleanup goal. However, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) were detected in the IDW at concentrations above the USEPA Tap Water RSLs (based on a hazard quotient of 0.1). Site 18 will be further evaluated in the Basewide PFAS PA, which is anticipated to be finalized in FY 2021, and the SI for PFAS will be scoped following finalization of the PA. The next LTM sampling event is scheduled for the second quarter of FY 2021.

2.1.6 Site 20 (OU4)—Building LP-20

Site 20 Summary	
Status:	Remedy in place
Current IR Activities:	Remedial action optimization and remediation phase LTM
Media Investigated:	Groundwater
Removal and Remedial Actions:	AS/SVE
Media Closed:	N/A
Waste and/or Debris Present Onsite:	N/A

2.1.6.1 Site Description and History

As shown on **Figure 2-6**, Building LP-20 is one of many large buildings located northwest of the Naval Air Station main runway. Currently, the building houses the Public Works Center 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, facilities for X-ray work, cleaning and blasting, and a metal-plating operation. Waste products generated from these activities were conveyed to the industrial wastewater treatment plant via underground piping. In addition, a large fuel storage area (Fuel Farm) is 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 underground storage tanks at the site. These investigations determined that significant amounts of free product (petroleum) and chlorinated solvents were present.

Table 2-11 provides a list of relevant documents and past activities for Site 20.

Table 2-11. Summary of Relevant Documents and Milestones for Site 20

Document Title/Milestone	Summary
Remedial Investigation and Feasibility Study (Baker, 1995c, 1996b)	The RI and FS summarizing the previous investigation data were completed in 1995 and 1996, respectively. The data generated during the RI indicated that VOCs were the primary COCs detected within groundwater in the area. Specifically, chlorinated VOCs were detected in the vicinity of Buildings LP-20 and LP-26. In addition, petroleum products were present within the groundwater east of Building LP-22 and south of Building LP-179. Vinyl chloride, 1,1-DCE, 1,2-DCE, 1,2-DCA, TCE, and benzene were detected in the shallow aquifer (Columbia). Vinyl chloride, 1,2-DCE, and TCE were also detected in the deep aquifer (Yorktown).
Decision Document (Baker, 1996d)	The DD (Baker, 1996d) for Site 20 required that contamination at the site be treated to reduce the potential risk 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 goal levels. 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.

Table 2-11. Summary of Relevant Documents and Milestones for Site 20

Document Title/Milestone	Summary
Long-term Monitoring Plan (CH2M, 1998b)	The treatment system began operating on April 14, 1998. The shallow aquifer AS/SVE system consisted of 31 AS wells and 21 SVE 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.
Long-term Monitoring Reports (CH2M, 2000b; AGVIQ and CH2M, 2005, 2007a, 2007b, 2008a, 2011; CH2M, 2013a, 2014, 2015, 2016, 2017, 2019a, 2020a, 2020b)	<p>The first round of LTM was performed in February 1999, after approximately 10 months of system operation, and annual LTM has continued since. Monitoring currently consists of annual sampling of shallow and deep monitoring wells to track the levels of contaminants at the site and to determine whether these constituents are migrating offsite or into the deep aquifer.</p> <p>Based on LTM data through 2013, the AS/SVE system was turned off (but maintained in an operable condition) in 2013, and LTM continued.</p> <p>The 2014 LTM identified PFAS in several monitoring wells. However, the extent of PFAS constituents has not been delineated, and the data have not been evaluated to determine whether the PFAS should be designated as COCs. The 2019 and 2020 LTM data showed that groundwater samples from 10 of 18 wells screened in the shallow aquifer and 4 of 8 samples from the wells screened in the deep aquifer contained concentrations that exceeded the cleanup goals for one or more COCs. Since active groundwater remediation was discontinued in 2013, the COC concentrations within the shallow aquifer have remained relatively stable; however, the COC concentrations continue to exceed the cleanup goals.</p>
Proposed Remedial Action Plan and Record of Decision (Navy, 2010)	The remedy selected by the DD was reaffirmed in the Proposed Plan and ROD for Sites 1, 3, 18, and 20 (ROD signed September 2010). The groundwater cleanup goals were revised from the risk-based values presented in the 1996 DD (Baker, 1996d) (based upon the most likely exposure scenarios) to the federal MCLs.
Remedy Optimization	Following recommendations from the Remedial Process Optimization 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 in August 2010. The groundwater that was extracted contained high concentrations of VOCs, successfully reducing the mass of VOCs remaining in groundwater at Site 20. However, high iron concentrations in groundwater caused scaling in the air stripper, which had to be taken offline to perform maintenance. Additionally, the extraction system captured residual petroleum, oil, and lubricants from an adjacent site, which clogged the filter bags. Because of the operational issues requiring significant maintenance activities, the extraction system ceased operation in 2011.
Five-Year Review Report (CH2M, 2019a)	The Fourth Five-Year Review Report concluded that the remedy at Site 20 is currently protective of human health and the environment in the short term. Exposure pathways that could pose an unacceptable risk are being controlled through LUCs. In order for the remedy to be protective over the long term, the following actions need to be undertaken: (1) conduct a VI investigation to assess whether the vapors from the underlying COC plumes pose an unacceptable risk to human health, (2) complete the installation of a pilot-scale subgrade biogeochemical reactor (SBGR) and conduct 1 year of performance monitoring to assess whether the SBGR can reduce the COC concentrations to meet the remedial action objectives, and (3) evaluate SBGR effectiveness in treating the 1,4-dioxane and consider potential modifications necessary for full-scale deployment. In addition, conduct an expanded PA/SI to further characterize the nature and extent of PFAS constituents on-site. ¹
Vapor Intrusion Investigation (CH2M, 2019b)	The VI investigation was completed in 2019 and identified elevated levels of VOCs within the indoor air at Office 120 inside Building LP-26. As a result, two air purifying units have been installed and air monitoring has been ongoing to keep indoor air concentrations of TCE below acceptable risk-based guidelines.

¹ The basewide PFAS investigation is further discussed in **Section 2.3**.

2.1.6.2 Site 20 COCs

Identified COCs for each medium at Site 20 are summarized in **Table 2-12**.

Table 2-12. Summary of Constituents of Concern at Site 20

Medium	Potential Risk	COC
Groundwater	Human Health	1,2-DCA, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, benzene, TCE, vinyl chloride
Soil	Human Health	Arsenic, beryllium, benzo(a)pyrene
Surface Water	N/A	N/A
Sediment	N/A	N/A
Indoor Air	N/A	N/A

2.1.6.3 Current and Future Activities

To expedite the reduction of COC concentrations in groundwater, an alternative remediation strategy involving a subgrade biogeochemical reactor (SBGR) will be pilot-tested at Site 20. The SBGR is scheduled to be installed during the first quarter of 2021, and quarterly SBGR performance monitoring will be conducted for 1 year. To supplement the SBGR, enhanced in situ bioremediation substrate injections into existing air sparge wells are also planned to be completed in FY 2021 and will include one year of performance monitoring. Prior to the injections, the SVE system will be put back into operation and monitoring will be conducted to ensure that the system mitigates VI in Building LP-26. The next LTM sampling event is scheduled for the second quarter of FY 2021.

Site 20 will be further evaluated for PFAS in the Basewide PFAS PA, which is anticipated to be finalized in FY 2021, and further investigation for PFAS will be scoped following finalization of the PA.

2.1.7 Site 22 (OU8)—Camp Allen Storage Yard

Site 22 Summary	
Status:	Remedy in place
Current IR Activities:	Remediation phase LTM
Media Investigated:	Groundwater, soil, and sediment
Removal and Remedial Actions:	Soil removal action, soil cover, and LUCs
Media Closed:	Soil and sediment
Waste and/or Debris Present Onsite:	Buried debris present onsite

2.1.7.1 Site Description and History

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 (Site 1), as shown on **Figure 2-7**. 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 Public Works Center 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.

Table 2-13 provides a list of relevant documents and past activities for Site 22.

Table 2-13. Summary of Relevant Documents and Milestones for Site 22

Document Title/Milestone	Summary
Record of Decision (Baker, 2004)	<p>A removal action of PCB-contaminated soils began in August 1998. Additional delineation of site contaminants in 2001 identified six metals hotspots throughout the site (Baker, 2004). As an interim measure, the Navy began removal of the hotspot soils in conjunction with the ongoing PCB removal action. The 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 indicated that the areal extent of metal contamination was more widespread than previously estimated. It was estimated that approximately 29,000 yd³ of soil remained at the site, with concentrations exceeding the cleanup goals for metals. Based on the more comprehensive confirmation sampling and anticipated future land use of the site, the remedial action objectives (RAOs) 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 Team agreement on this approach was obtained in March 2002.</p> <p>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, encompassing the overall soil and sediment cleanup strategy for the site, was signed by USEPA in September 2004 (Baker, 2004). The ROD identifies the risks to human health and ecological receptors exposed to soil and sediment, establishes the RAOs, and defines the LUCs for the CASY.</p>
Remedial Action Completion Report (CH2M and Baker, 2009)	In accordance with the closeout procedures for NPL sites, a Remedial Action Completion Report for Site 22 was signed by the Navy in January 2009. Quarterly site inspections continue to be completed to assess the enforcement of the LUCs. Because of the proximity of Site 22 to Site 1, groundwater is being managed and addressed as a single unit.
Long-term Monitoring Reports (CH2M, 2020a)	The 2018 LTM Report indicates that the groundwater directly downgradient from Site 1 Area B and Site 22 has exhibited increases of COC concentrations for the last few years, indicating that either of these areas may be a source of the detected COCs.
Five-Year Review Report (CH2M, 2019a)	The Fourth Five-Year Review Report concluded that the remedy in place for Site 22 is currently protective of human health and the environment in the short term due to the potential presence of PFAS.

2.1.7.2 Site 22 COCs

Identified COCs for each medium at Site 22 are summarized in **Table 2-14**.

Table 2-14. Summary of Constituents of Concern at Site 22

Medium	Potential Risk	COC
Groundwater	N/A ^a	
Soil	Human Health	Arsenic, antimony, iron, lead, PCBs
Surface Water	None Identified	
Sediment	Ecological	Pesticides, PCBs, metals
Indoor Air	None Identified	

^a Groundwater at Site 22 is currently managed as one unit with groundwater at Site 1.

2.1.7.3 Current and Future Activities

Based on the 2018 LTM Report, the Remedial Action Optimization Investigation for Site 1 includes a source characterization (including a geophysical survey and soil investigation, direct push technology groundwater sampling) to identify the potential source of COCs within Site 22 (CH2M, 2020a). The investigation was initiated in June 2020 and the final report is scheduled to be submitted for regulatory review in the third quarter of FY 2021.

The FY 2021 LTM groundwater monitoring of Site 1 will assess the groundwater quality in the vicinity of Site 22. The next Five-Year Review of the site remedy will be completed in FY 2024. Site 22 will be further evaluated for

PFAS in the Basewide PFAS PA, which is anticipated to be finalized in FY 2021, and further investigation for PFAS will be scoped following finalization of the PA.

2.1.8 Site 23 (OU10)—Building LP-20 Plating Shop

Site 23 Summary	
Status:	Remedy in place
Current IR Activities:	Remediation phase LTM
Media Investigated:	Groundwater, subslab vapor, indoor air, and soil
Removal and Remedial Actions:	Soil removal action, concrete cover, and LUCs
Media Closed:	Soil
Waste and/or Debris Present Onsite:	N/A

2.1.8.1 Site Description and History

Site 23, the former Plating Shop, is located on the western side of Building LP-20 (**Figure 2-8**). In May 2005, the NSN 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.

Table 2-15 provides a list of relevant documents and past activities for Site 23.

Table 2-15. Summary of Relevant Documents and Milestones for Site 23

Document Title/Milestone	Summary
Engineering Evaluation/Cost Assessment (CH2M, 2006c)	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.
Proposed Remedial Action Plan and Record of Decision (CH2M, 2009b; Navy, 2008)	In September 2008, a Proposed Plan for Site 23 presented 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 Remedial Design was finalized in July 2009 to implement LUCs and maintenance actions, including periodic inspections and reporting to ensure that residential development, or any other development inconsistent with the specific RAOs and selected remedy, would not be allowed on the site and that the concrete cover would be properly maintained until contaminant levels diminished 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.
Vapor Intrusion Investigation (CH2M, forthcoming)	Because of the presence of elevated VOC concentrations in the groundwater beneath Site 23, a VI investigation was completed in January 2019 and during summer 2019 as discussed in Section 2.1.6 .
Five-Year Review Report (CH2M, 2019a)	The Fourth Five-Year Review Report concluded that the remedy at Site 23 is protective of human health and the environment in the short term due to the potential presence of PFAS.

2.1.8.2 Site 23 COCs

Identified COCs for each medium at Site 23 are summarized in **Table 2-16**.

Table 2-16. Summary of Constituents of Concern at Site 23

Medium	Potential Risk	COC
Groundwater	N/A ^a	
Soil	Human Health	Semivolatile organic compounds, arsenic, cadmium, chromium, lead, nickel
Surface Water	None Identified	N/A
Sediment	None Identified	N/A
Indoor Air	None Identified	N/A

^a Groundwater at Site 23 is currently managed as one unit with groundwater at Site 20.

2.1.8.3 Current and Future Activities

In order for the remedy to be protective over the long term, the Basewide PA for potential PFAS sources is being conducted to further evaluate Site 23. The Basewide PFAS PA is anticipated to be finalized in FY 2021, and the SI for PFAS will be scoped following finalization of the PA. In addition, quarterly site inspections will continue to be conducted to ensure LUCs are maintained, and groundwater LTM at Sites 20 and 23 will be conducted annually to assess the trends of COC concentrations. The next LTM event is scheduled for FY 2021.

2.2 Solid Waste Management Units

SWMU 14 is the only SWMU at NSN with a remedy (LUCs). All other SWMUs have been closed out and require no action. The following SWMU description includes a summary, site description and history along with a table describing past activities at SWMU 14, and a table listing the known COCs in each site medium. In addition, the current status of SWMU 14 is briefly discussed.

2.2.1 Solid Waste Management Unit 14 (OU13)—Q-50 Satellite Accumulation Area

SWMU 14 Summary	
Status:	Remedy in place
Current IR Activities:	LUC inspections
Media Investigated:	Groundwater, soil, sediment, and surface water
Removal and Remedial Actions:	Asphalt cover and LUCs
Media Closed:	Soil, sediment, and surface water
Waste and/or Debris Present Onsite:	N/A

2.2.1.1 Site Description and History

The Q-50 Satellite Accumulation Area (SWMU 14) is located in the northeastern corner of NSN, as shown on **Figure 2-9**. 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 by various operations 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 CERCLA IDW materials.

Table 2-17 provides a list of relevant documents and past activities for SWMU 14.

Table 2-17. Summary of Relevant Documents and Milestones for SWMU 14

Document Title/Milestone	Summary
Engineering Evaluation/Cost Analysis and Record of Decision (CH2M, 2008b)	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.
Focused Feasibility Study (CH2M, 2009a)	The Focused FS was finalized in July 2009.
Proposed Remedial Action Plan and Record of Decision (CH2M, 2010b)	The Proposed Plan was completed 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 were deemed acceptable, and no action for groundwater was required; however, the LUC objectives for SWMU 14 prohibit the withdrawal of groundwater.

2.2.1.2 SWMU 14 COCs

Identified COCs for each medium at SWMU 14 are summarized in **Table 2-18**.

Table 2-18. Summary of Constituents of Concern at SWMU 14

Medium	Potential Risk	COC
Groundwater	None Identified ^a	
Soil	Human Health	Iron, thallium, vanadium, antimony, benzo(a)pyrene
Surface Water	N/A	N/A
Sediment	N/A	N/A
Indoor Air	N/A	N/A

^a Although the RI indicated potential unacceptable risks associated with potable use of groundwater, a further evaluation of the groundwater by USEPA suggested that groundwater does not pose an unacceptable risk. Arsenic was the only contaminant found in an aerial extent large enough to be considered a plume. The arsenic data exceed the current MCL; however, the arsenic level is within an acceptable risk range based upon USEPA's Office of Solid Waste and Emergency Response Directive 9355.0-30. Based upon maximum concentrations of arsenic in groundwater and site-specific conditions, the groundwater MCL exceedances were considered acceptable at SWMU 14.

2.2.1.3 Current and Future Activities

SWMU 14 is inspected quarterly to verify the enforcement of LUCs. The Fourth Five-Year Review Report concluded that the remedy at SWMU 14 is protective of human health and the environment. As a result, quarterly site inspections will continue to be conducted to ensure that LUCs are maintained. If the quarterly inspections identify any breaches in the concrete pad or soil cover, the information will be presented to the NSN Partnering Team to discuss whether any mitigation measures are needed to maintain protectiveness.

2.3 Sites with PFAS Contaminants

In October 2014, the Assistant Secretary of the Navy, Energy, Installations, and Environment issued a statement requiring evaluation of sites with the potential for PFAS contamination under the Defense ERP. As a result of the site review, the following sites were identified for further evaluation of PFAS:

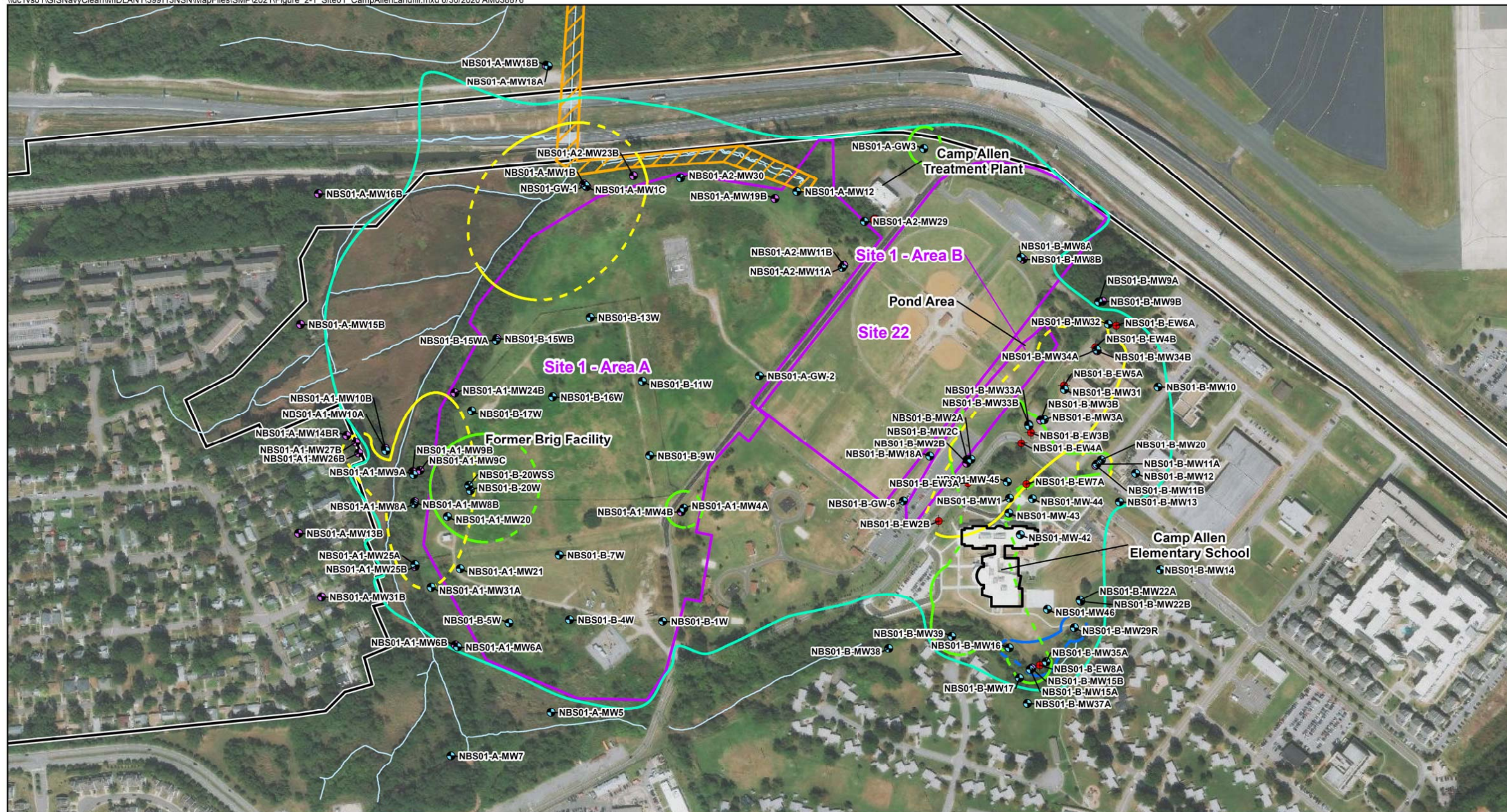
- Site 1 – CALF
- Site 22 – Salvage Yard
- Site 23 – LP-20 Plating Shop
- SWMU 6 – Building V-28 Waste Pit

- SWMU 8 – Firefighting School
- Site 16 – Chemical Fire Building X-136
- Site 17 – Chemical Fire Building SDA-21
- Area of Interest (AOI) 01 – LP/V Area PFAS Operable Unit (OU) Spill Response
- AOI 02 – Pier Area PFAS OU Spill Response
- AOI 03 – Landfill Area PFAS OU Spill Response
- AOI 04 – Sewells Point Area PFAS OU Spill Response

The PFAS investigation is being conducted under CERCLA. PFAS have been identified as chemicals of emerging concern that could have been historically released. PFAS are primarily associated with the use of aqueous film-forming foam used during firefighting and fire-training activities; however, they are also present in a variety of pesticides, paints, cleaners, and waxes. PFAS are environmentally persistent and can be present in environmental media long after a release. There are currently no legally enforceable federal or Virginia drinking water standards for PFAS constituents.

The Fourth Five-Year Review Report (CH2M, 2019a) identified Site 1 (CALF), Site 18, Site 22 (CASY), and Site 20 (Building LP-20, which includes Site 23 - LP-20 Plating Shop), as having the potential for historical PFAS releases. In 2014, groundwater at these sites was sampled for PFAS (CH2M, 2015). PFAS compounds PFOA and PFOS were detected at concentrations exceeding the USEPA tap water risk-based screening levels at Sites 1, 20, 22, and 23. In addition, the IDW associated with groundwater LTM sampling at Sites 3 and 18 was sampled for PFAS during the 2019 LTM event, and concentrations of both PFOA and PFOS exceeded the USEPA Tap Water RSLs.

To provide a more comprehensive assessment of the potential impacts from PFAS at NSN, the Basewide PFAS PA, which includes comprehensive review of historical documents to identify potential PFAS source areas in addition to the sites previously identified, was initiated in FY 2019. The report is anticipated to be finalized in FY 2021. Based on the recommendations in the PA, site-specific SIs are anticipated to begin in FY 2021. Because of the large number of potential PFAS source areas, the sites recommended for further investigation will be prioritized based on Partnering Team concurrence.



- Legend**
- Columbia Aquifer Monitoring Well
 - Yorktown Aquifer Monitoring Well
 - Extraction Wells
 - Treatment Plant Discharge Point
 - Surface Water Features
 - ▭ Bousch Creek Sediment Removal Action (2008)
 - ▭ Site Boundary
 - ▭ Land Use Control Area (2020)
 - ▭ Installation Boundary
 - ▭ COC Plume Extent: 2018-2019 (dashed where inferred)
 - ▭ Upper Columbia Aquifer
 - ▭ Lower Columbia Aquifer
 - ▭ Yorktown Aquifer

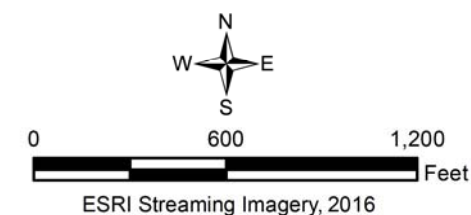
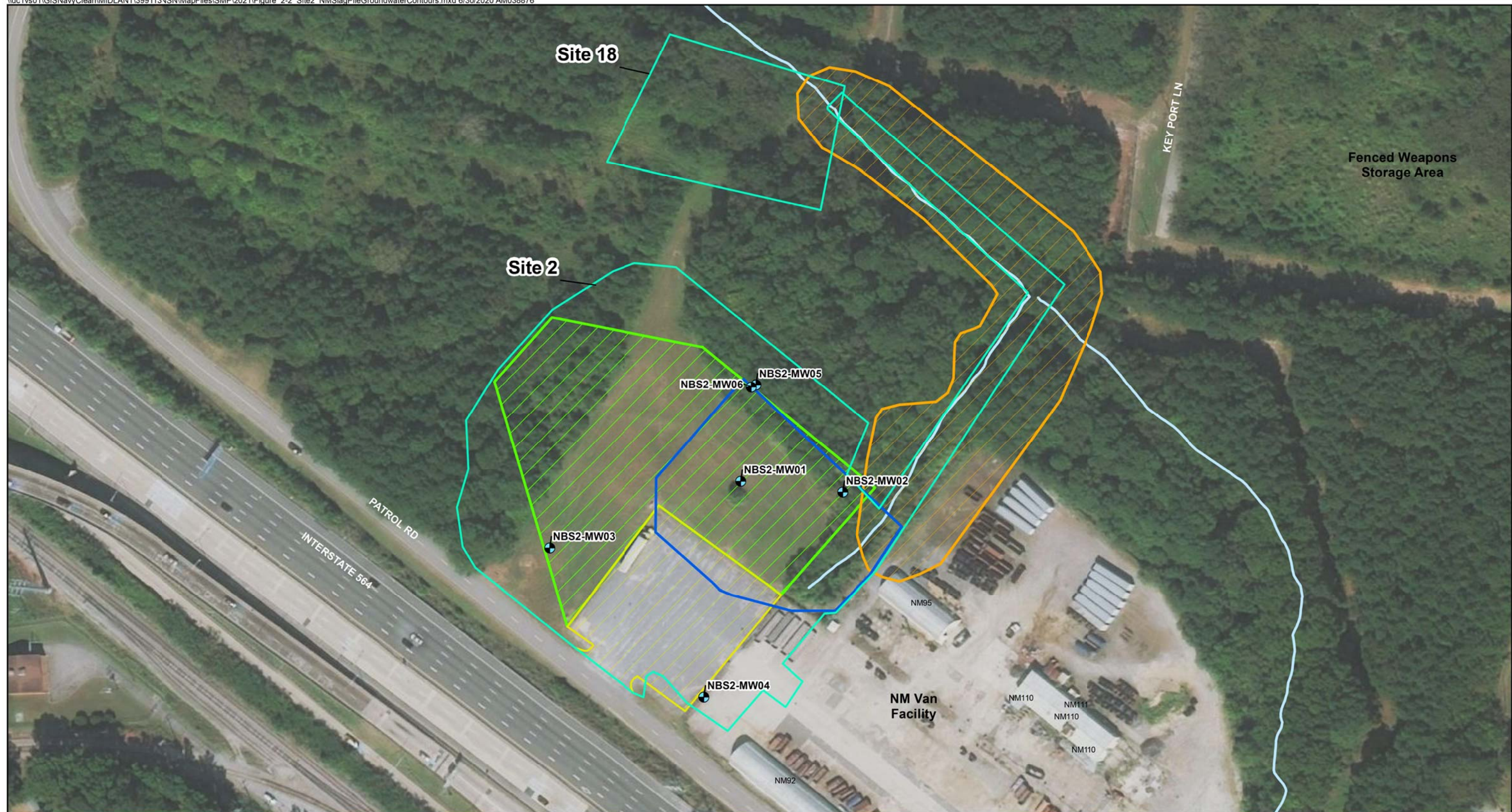


Figure 2-1
Site 1 - Camp Allen Landfill
FY2021 Site Management Plan
Naval Station Norfolk
Norfolk, Virginia



- Legend**
- Monitoring Well
 - Surface Water
 - Area of Sediment Removal
 - Area of Soil Cover
 - Approximate Location of Slag Pile
 - Area of Asphalt Cover
 - Land Use Control Area (2020)

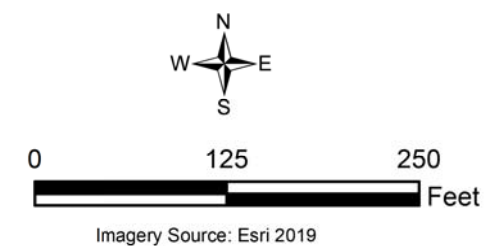


Figure 2-2
Site 2 - NM Slag Pile
FY2021 Site Management Plan
Naval Station Norfolk
Norfolk, Virginia



Legend

- Monitoring Well
- Air Sparge Well (AS)
- Piping for AS System
- Topographic Contour (2ft Interval)
- Land Use Control Area (2020)
- Site Boundary
- Installation Boundary

VOC Isocontours (dashed where inferred)

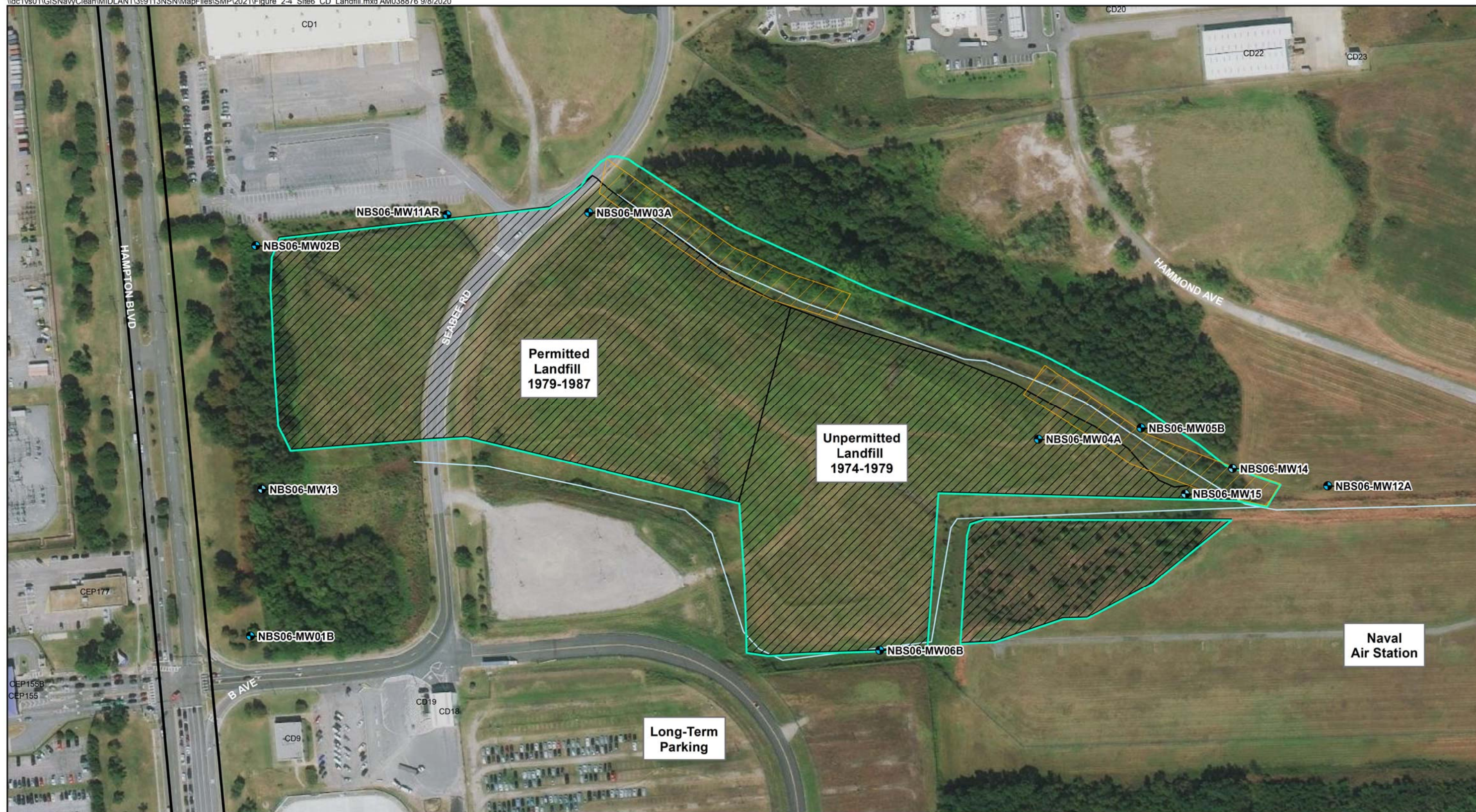
- 1,1-Dichloroethene greater than 7 µg/L
- TCE greater than 5 µg/L
- Vinyl Chloride greater than 2 µg/L



0 300 600
Feet

Imagery Source: Esri 2019

Figure 2-3
Site 3 - Q-Area Drum Storage Yard
FY2021 Site Management Plan
Naval Station Norfolk
Norfolk, Virginia



Legend

- Existing Piezometer/Monitoring Well
- Drainage Ditch
- Areas of Sediment Removal
- Land Use Control Area (2020)
- Engineered Landfill Cover
- Installation Boundary

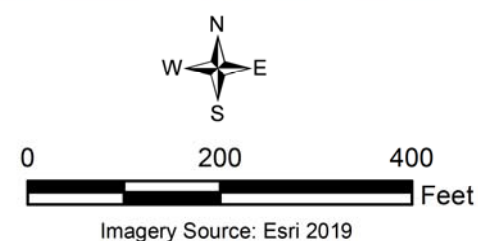
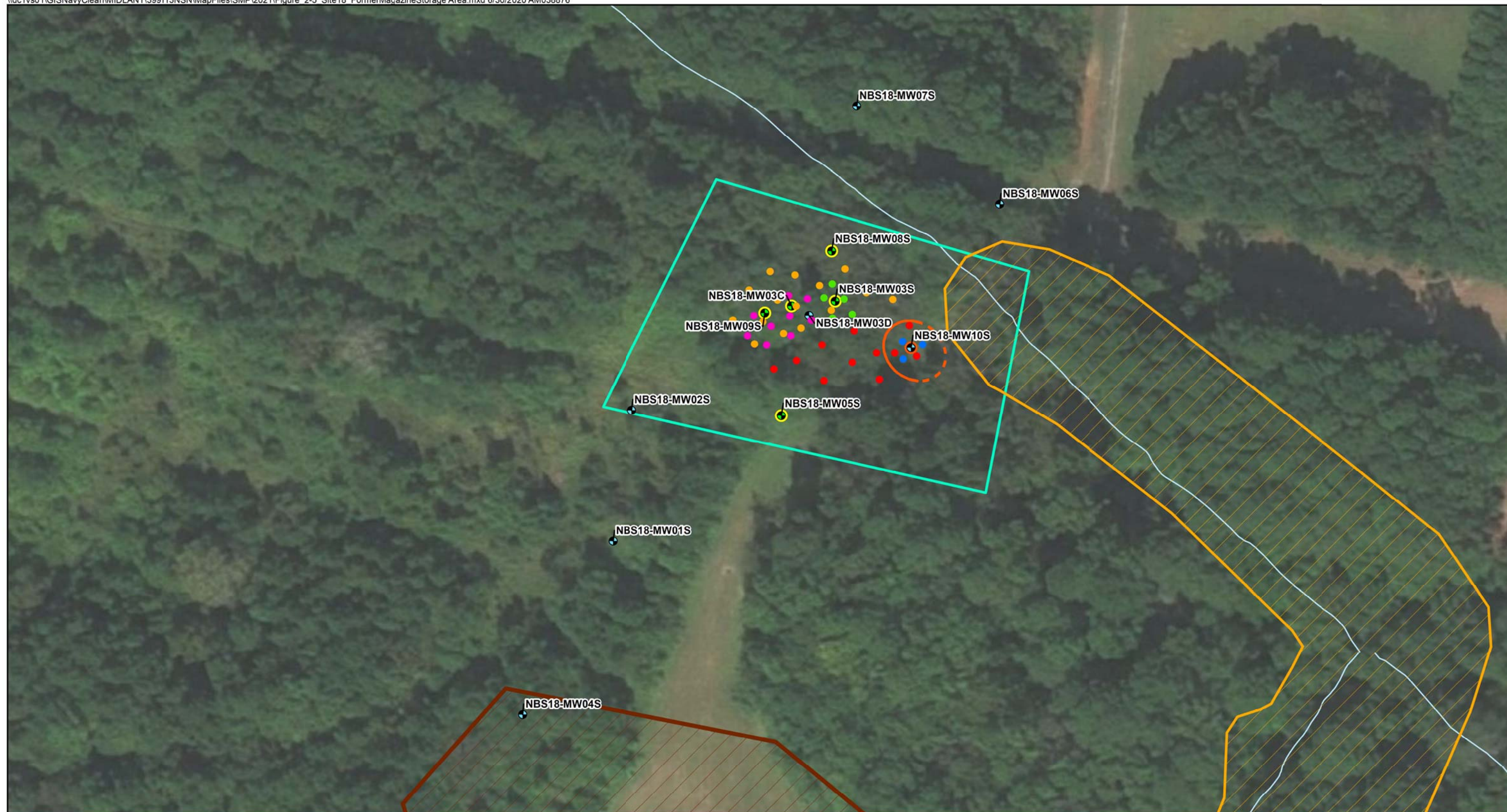


Figure 2-4
Site Map
Site 6 - CD Landfill
FY2021 Site Management Plan
 Naval Station Norfolk
 Norfolk, Virginia



Legend

- 2020 LTM Monitoring Well
- 2020 LTM Monitoring Well where COC exceeded cleanup goal
- Existing Monitoring Well
- 2008 DPT Injection Location (6 to 16 feet below ground surface)
- 2008 DPT Injection Location (12 to 22 feet below ground surface)
- 2010 Supplemental DPT Injection Location (16 to 22 feet below ground surface)
- 2010 Supplemental DPT Injection Location (3 to 13 feet below ground surface)
- 2010 Supplemental DPT Injection Location (7 to 14 feet below ground surface)
- Surface Water Features
- Land Use Control Area (2020)
- Site 2 Area of Sediment Removal
- Site 2 Area of Soil Cover
- COC Exent (dashed where inferred)
- Columbia Aquifer

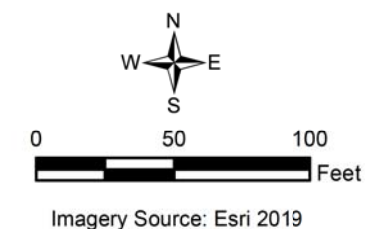
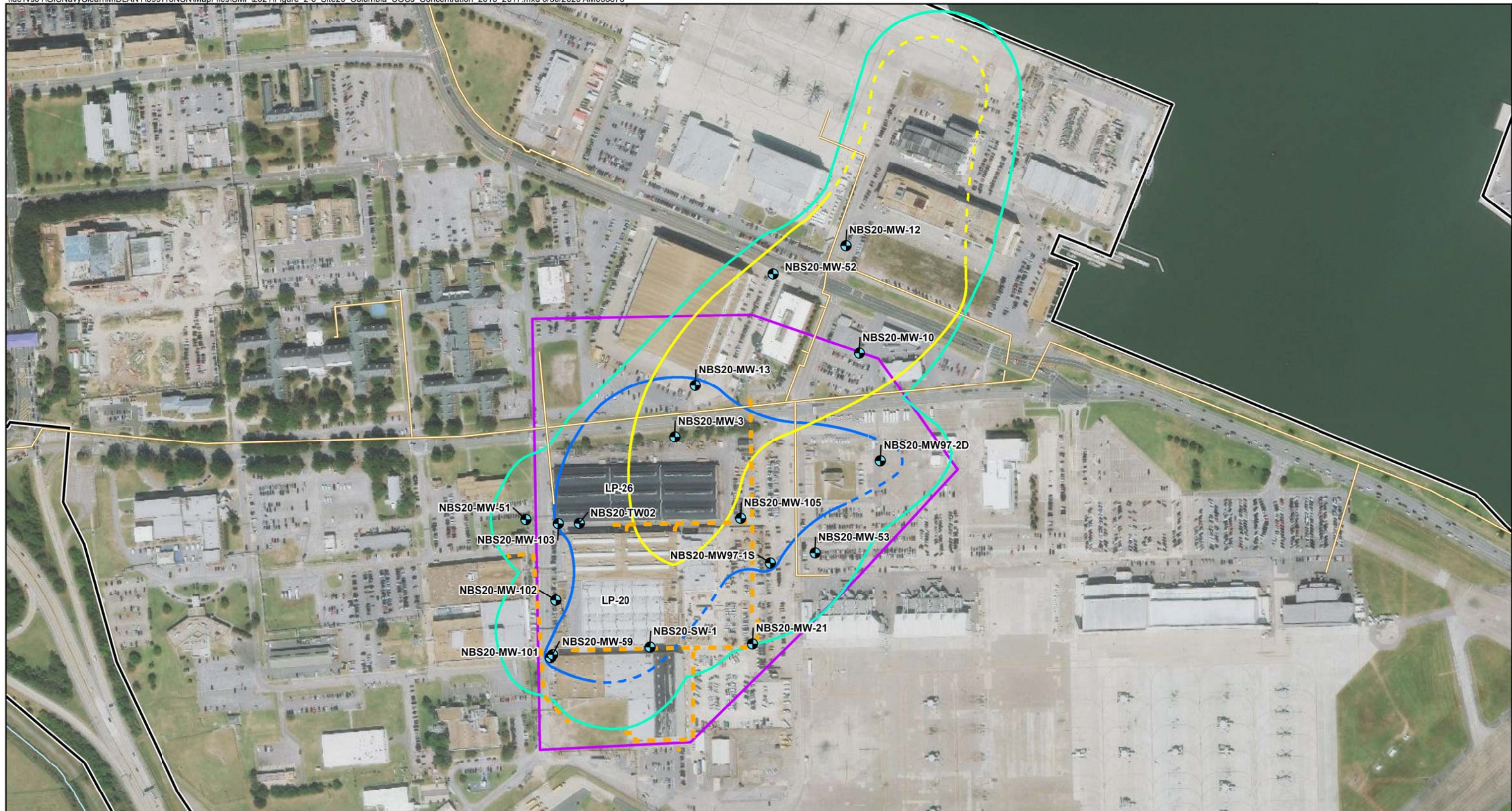


Figure 2-5
Site 18 - Former Naval Magazine Storage Area
 FY2021 Site Management Plan
 Naval Station Norfolk
 Norfolk, Virginia



- Legend**
- | | |
|------------------------------|------------------|
| Monitoring Well (Columbia) | COC Plume Extent |
| Site Boundary | Columbia Aquifer |
| Land Use Control Area (2020) | Yorktown Aquifer |
| Gas Main Line | |
| Industrial Waste Sewer Line | |
| Surface Water Features | |
| Installation Boundary | |

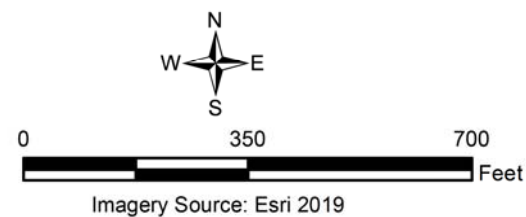
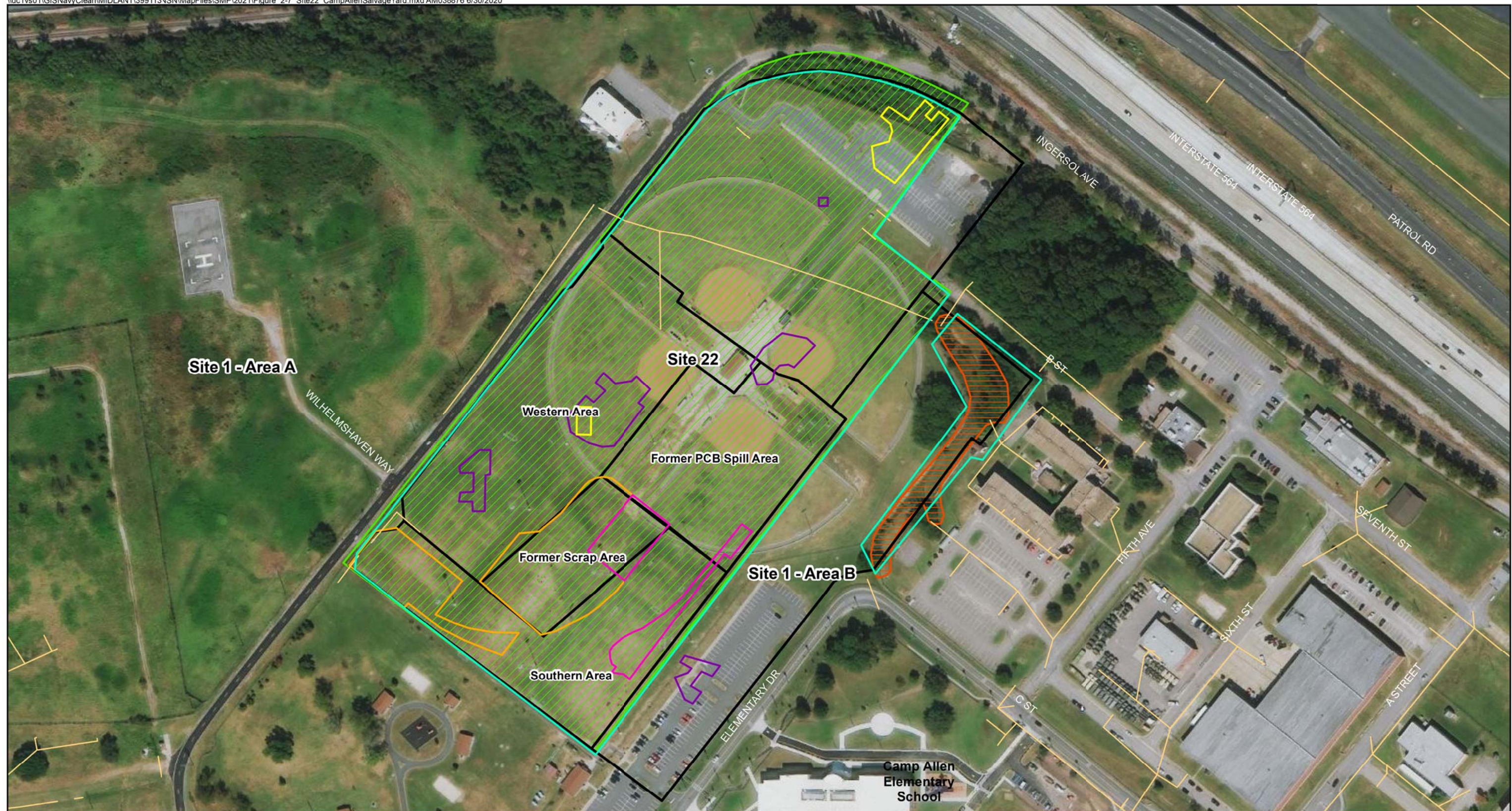


Figure 2-6
Site 20 - Building LP-20 Area
FY2021 Site Management Plan
Naval Station Norfolk
Norfolk, Virginia



Legend

- | | |
|---|----------------------------------|
| Storm Sewer Line | Sediment Cover Installed in 2003 |
| PCB Contaminated Soil Removed in 1998 | Soil Cover Installed in 2002 |
| PCB/Metals Contaminated Soil Removed in 2001 | Former Area |
| Metals 'Hot Spot' Soil Removed (0-4 Foot) in 2001 | Land Use Control Area (2020) |
| Metals 'Hot Spot' Soil Removed (0-1.5 Foot) in 2001 | |

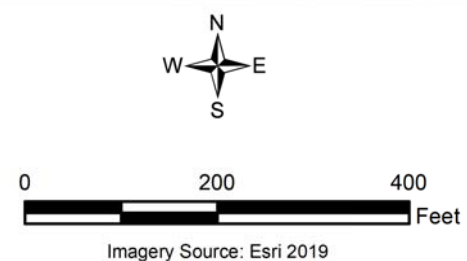
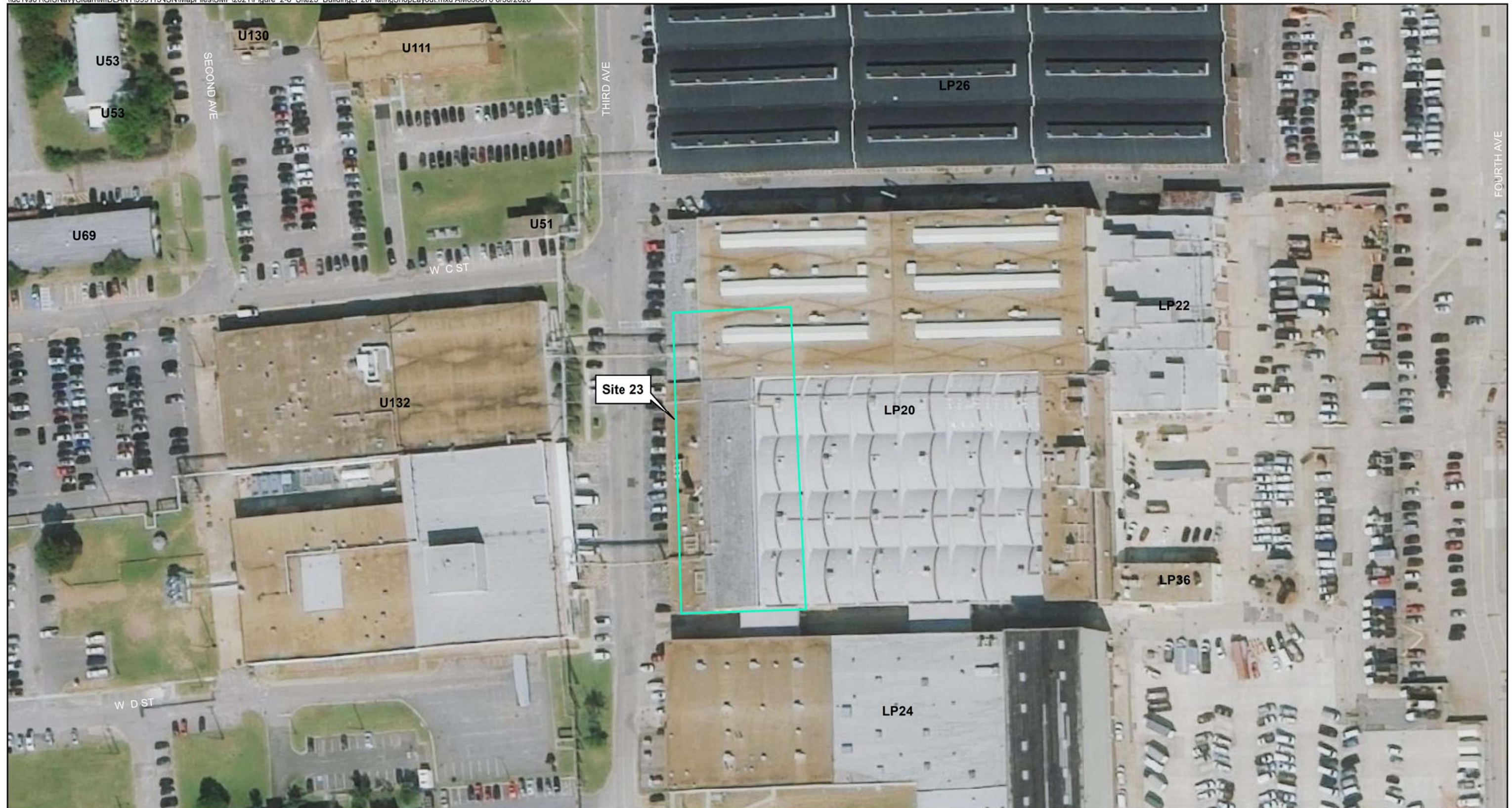


Figure 2-7
Site 22 - Camp Allen Salvage Yard
 FY2021 Site Management Plan
 Naval Station Norfolk
 Norfolk, Virginia



Legend
 Site 23 Land Use Control Area (2020)



Imagery Source: Esri 2019

Figure 2-8
Site 23 - Building LP-20 Plating Shop
FY2021 Site Management Plan
Naval Station Norfolk
Norfolk, Virginia



- Legend**
- Asphalt Cover
 - Bioretention Areas
 - Land Use Control Area (2020)

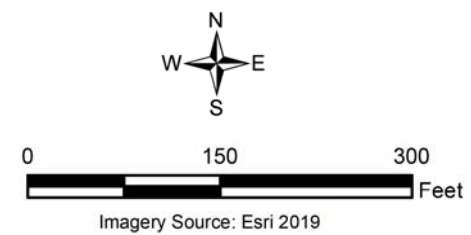


Figure 2-9
SWMU 14 - Satellite Accumulation Area Layout
FY2021 Site Management Plan
Naval Station Norfolk
Norfolk, Virginia

Site Management Plan Schedules

This section presents project-specific schedules for sites that are or potentially will be active in FY 2021 through 2025. Active and potentially active projects for FY 2021, for which site-specific schedules have been developed, are summarized in **Table 3-1**. Milestones for activities planned beyond FY 2021 are discussed under the individual sites. In addition to LTM, investigation activities planned for FY 2021 consist of the installation of a pilot-scale SBGR as an alternative remediation technology at Site 20, and the completion of a Remediation Optimization Investigation at Site 1.

3.1 Team Partnering at Naval Station Norfolk

In October 1996, NAVFAC Mid-Atlantic convened the environmental Partnering Team consisting of representatives from the Navy, USEPA, VDEQ, and Navy contractors. In addition, the Team created the Restoration Advisory Board to keep members of the community informed of Base ERP activities. The Team 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 scheduling assumes an ideal flow of work for sites that are addressed through the conventional cleanup approach. The scheduling does not account for how the streamlined oversight process may affect schedules and potentially affect the sequence of tasks as the Team 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.

3.2 Environmental Restoration Program Site Project Schedules

Project-specific schedules for ERP projects that are or potentially will be active during FYs 2021 to 2025 are presented in **Table 3-1**.

Table 3-1. Active Projects for Fiscal Years 2021 to 2025 (October 2020 to September 2025)

Active Projects for FY 2021	Estimated Milestone
Sites 1, 2, 3, 6, 18, and 20	
Site 1 Final Remedial Site 1 Remedial Action Optimization Evaluation SAP	3rd Quarter FY 2020
Site 1 Remedial Action Optimization Field Investigation	4th Quarter FY 2020
Site 1 Remedial Action Optimization Evaluation Draft Report	3rd Quarter FY 2021
Site 1 Remedial Action Optimization Evaluation Final Report	4th Quarter FY 2021
Site 1 Remedial Action Optimization Draft Pilot Test SAP	1st Quarter FY 2022
Site 1 Remedial Action Optimization Final Pilot Test SAP	1st Quarter FY 2022
Site 1 Groundwater Treatment Plant Assessment	4th Quarter FY 2020
Site 3, Site 18, Site 20 - 2019 annual LTM Draft Report	4th Quarter FY 2020
Site 3, Site 18, Site 20 - 2019 annual LTM Final Report	1st Quarter FY 2021
Site 1, Site 2, Site 3, Site 6, Site 18, Site 20 - Updated Draft SAP	1st Quarter FY 2021
Site 1, Site 2, Site 3, Site 6, Site 18, Site 20 - Updated Final SAP	1st Quarter FY 2021
Site 1, Site 3, Site 18, Site 20 - 2020 Annual LTM Sampling	2nd Quarter FY 2021
Site 1, Site 3, Site 18, Site 20 - 2020 Annual LTM Draft Report	3rd Quarter FY 2021

Table 3-1. Active Projects for Fiscal Years 2021 to 2025 (October 2020 to September 2025)

Active Projects for FY 2021	Estimated Milestone
Site 1, Site 3, Site 18, Site 20 - 2020 Annual LTM Final Report	1st Quarter FY 2022
Site 2, Site 3, Site 6, Site 18, Site 20 - 2021 Annual LTM Sampling	1st Quarter FY 2022
Site 2, Site 3, Site 6, Site 18, Site 20 - 2021 Annual LTM Draft Report	3rd Quarter FY 2022
Site 2, Site 3, Site 6, Site 18, Site 20 - 2021 Annual LTM Final Report	1st Quarter FY 2023
Site 1, Site 3, Site 18, Site 20 - 2022 Annual LTM Sampling	1st Quarter FY 2023
Site 1, Site 3, Site 18, Site 20 - 2022 Annual LTM Draft Report	2nd Quarter FY 2023
Site 1, Site 3, Site 18, Site 20 - 2022 Annual LTM Final Report	3 rd Quarter FY 2023
Site 20 - APU Performance Monitoring Draft SAP	4th Quarter FY 2020
Site 20 - APU Performance Monitoring Final SAP	4th Quarter FY 2020
Site 20 - Draft Vapor Intrusion Investigation Report	4th Quarter FY 2020
Site 20 - Final Vapor Intrusion Investigation Report	1st Quarter FY 2021
Site 20 SBGR Pilot Test Final Implementation Plan	4th Quarter FY 2020
Site 20 SBGR Pilot Test Final Construction Work Plan	4th Quarter FY 2020
Site 20 SBGR Installation	1st Quarter FY 2021
Site 20 Substrate Injection Draft SAP	1 st Quarter FY 2021
Site 20 Substrate Injection Final SAP	2 nd Quarter FY 2021
Site 20 SVE Performance Monitoring Draft SAP	3 rd Quarter FY 2021
Site 20 SVE Performance Monitoring Final SAP	3 rd Quarter FY 2021
Site 20 Substrate Injections	3 rd Quarter FY 2021
Site 20 SBGR Post-construction Draft Monitoring Report	3rd Quarter FY 2022
Site 20 SBGR Post-construction Final Monitoring Report	4th Quarter FY 2022
Site 20 Substrate Injection Draft Monitoring Report	4 th Quarter FY 2022
Site 20 Substrate Injection Final Monitoring Report	1 st Quarter FY 2023
Basewide	
FY 2021 Draft Site Management Plan	3rd Quarter FY 2020
FY 2021 Final Site Management Plan	4th Quarter FY 2020
FY 2022 Draft Site Management Plan	3rd Quarter FY 2021
FY 2022 Final Site Management Plan	4th Quarter FY 2021
FY 2023 Draft Site Management Plan	3rd Quarter FY 2022
FY 2023 Final Site Management Plan	4th Quarter FY 2022
Draft PA Tech Memo for PFAS Sites	3rd Quarter FY 2020
Final PA Tech Memo for PFAS Sites	4th Quarter FY 2020
Draft Basewide PFAS PA Report	1st Quarter FY 2021
Final Basewide PFAS PA Report	2nd Quarter FY 2021
Draft Basewide PFAS SI SAP, Phase I Sites	3rd Quarter FY 2021
Final Basewide PFAS SI SAP, Phase I Sites	4th Quarter FY 2021
Basewide PFAS SI Field Investigation for Phase I Sites	1st Quarter FY 2022
Basewide PFAS Draft SI Report for Phase I Sites	TBD
Final PFAS Draft SI Report for Phase I Sites	TBD

Table 3-1. Active Projects for Fiscal Years 2021 to 2025 (October 2020 to September 2025)

Active Projects for FY 2021	Estimated Milestone
Draft Community Involvement Plan	2nd Quarter FY 2021
Final Community Involvement Plan	3rd Quarter FY 2021
Draft Fifth Five-Year Review Report	3rd Quarter FY 2023
Final Fifth Five-Year Review Report	2nd Quarter FY 2024

Notes:

APU = air purifying unit

FY = fiscal year

LTM = long-term monitoring

PA = Preliminary Assessment

PFAS = per- and polyfluoroalkyl substances

SAP = Sampling and Analysis Plan

SBGR = subgrade biogeochemical reactor

SI = Site Investigation

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Appendix A

CERCLA Process Activities

CERCLA Process Activities

As discussed in Section 1 of the Site Management Plan for Naval Station Norfolk (NSN), NSN was listed on the United States Environmental Protection Agency (USEPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List on April 1, 1997. The Base is being investigated through the Installation Restoration Program (IRP). Because the Department of the Navy (Navy) structured the IRP to be consistent with the terminology and structure of the CERCLA program, the placement of NSN on the CERCLA National Priorities List has had a limited effect on the cleanup processes that were already established. The CERCLA cleanup process is described in this attachment. The IRP at NSN is being implemented in accordance with applicable federal and state environmental regulations and requirements.

The Federal Facility Agreement (FFA) developed for NSN by USEPA Region 3 and the Navy will assist the Navy in meeting the provisions of CERCLA, Resource Conservation and Recovery Act, 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 attachment.

CERCLA Process

CERCLA RI/FS Process

The CERCLA Remedial Investigation (RI)/Feasibility Study (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
- Risk Assessment
- FS
- Proposed Remedial Action Plan (PRAP)
- Record of Decision (ROD) or Decision Document

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 No Further Action (NFA) is required at a site, a no-action ROD would be signed and the site removed from the program.

The RI, risk assessment, 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 clean up 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 (NTCRAs).

For NTCRAs, an Engineering Evaluation and Cost Analysis (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 risk assessment results indicate that no further remedial action is required to protect human health and the environment.

An NTCRA was completed at Area B of the Camp Allen Landfill (CALF) in 1994; however, the NTCRA 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 cubic yards of petroleum-contaminated soil from the northwestern corner of the site to allow construction of a parking lot. In addition, a soil removal action was completed in the Naval Magazine 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 polychlorinated biphenyl-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 polychlorinated biphenyl-contaminated soil at the Camp Allen Salvage Yard, lead-contaminated sediment at the Naval Magazine Slag Pile, and metals and pesticide-contaminated sediment at the Construction Debris Landfill.

NTCRAs were completed at four sites in 2007 and 2008. These sites (along with the Site Management Plan section where details are provided) are the following:

- 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 2.2.1

Remedial Action Process

Remedial actions may be considered interim remedial actions (IRA) or final remedial actions. IRAs are implemented to provide temporary mitigation of human health risks or to mitigate the spread of contamination in the environment. Similar to removal actions, remedial actions may be implemented at any time during the RI/FS process. An IRA is implemented to attain applicable or relevant and appropriate requirements to the extent required by CERCLA or the National Contingency Plan. It is also consistent with and contributes to the efficient performance of a final remedial action taken at an area or operable unit (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 Feasibility Study is prepared rather than the more extensive FS. As with the removal action, an IRA may become the final remedial action if the risk assessment 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 Long-term Monitoring Plan and an Operation and Maintenance 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 Q-Area Drum Storage Yard. A groundwater extraction and treatment system and dual-phase vapor extraction system became operational at CALF in July 1997. An air sparge/soil vapor extraction (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 total petroleum hydrocarbons and chlorinated solvents in the groundwater started operations at the Q-Area Drum Storage Yard in Area of Concern (AOC) 2 and AOC 1 on August 18, 1998 and August 20, 1998, respectively.

Baseline monitoring, supplemental testing, and long-term monitoring are currently performed at all three sites (CH2M, 2007).

Treatability Studies

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

- 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 dual-phase vapor extraction technologies. Additionally, SVE and AS pilot-scale treatability studies were completed at the Q-Area Drum Storage Area and LP-20 site.

Federal Facility Agreement CERCLA Integration Process

Area of Concern 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 (SSP) as Site Screening Areas (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, an SSP Work Plan will be prepared outlining the activities necessary to determine whether there have been releases of hazardous substances, pollutants, contaminants, hazardous waste, or other hazardous constituents to the environment. After investigation activities have been performed, an SSP report will be prepared. The report provides the basis for a determination of one of the following:

- An RI/FS will 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.

Reference

CH2M. 2007. *Declaration Action Memorandum, Upper Reaches of Bousch Creek, Camp Allen Landfill (Site 1), Naval Station Norfolk, Norfolk, Virginia*. October.

Appendix B

Screening, Categorizing, and Prioritization of Sites at Naval Station Norfolk

Screening, Categorizing, and Prioritizing Sites at Naval Station Norfolk

Federal Facility Agreement

On February 18, 1999, the United States Environmental Protection Agency (USEPA) Region 3 and the Department of the Navy (Navy) entered into a Federal Facility Agreement (FFA) for Naval Station Norfolk (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 site screening areas (SSAs) and areas of concern (AOCs) for evaluation and determine whether Remedial Investigations (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 an SSA, poses a threat to public health or the environment, the other party will be notified. The parties will then have 45 days from the notification to discuss the site conditions and determine whether the site will be addressed under the FFA as an SSA.

Establishing a Site Screening Area

Any site that is established as an 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 will include a proposed time schedule for the submittal of an SSP Work Plan in the next draft Amended Site Management Plan (SMP). This schedule will be approved in accordance with Section XI of the FFA.

Site Screening Process

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

1. Upon conclusion of an SSP, the Navy will submit to the USEPA a draft SSP Report, which will provide the basis for determining one of the following:
 - RI/Feasibility Study (FS) will 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 whether the SSA will require an RI/FS.
3. For those SSAs that the USEPA and Navy agree do not warrant an RI/FS, the Navy will prepare a Decision Document that reflects that agreement. The agreement is to be signed by all the project managers.
4. For those SSAs that are to proceed with an RI/FS, operable units (OUs) will be established. A schedule for the submission of the RI/FS Work Plans will 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 follows:

1. A document evaluation will be undertaken to review existing documentation and assess 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 No Further Action (NFA).
3. For those AOCs that will not proceed to the SSP, the Navy will prepare, with USEPA assistance, a brief AOC closeout document. USEPA will provide a response to the Navy within 30 days of receipt of the supporting documentation.
4. Those AOCs that 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 SSAs, 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 used at NSN.

Relative Risk Ranking

The Department of Defense 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.”

The current 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 the 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 in the following paragraphs.

The primary factors considered in the relative risk methodology are human health and ecological risks associated with receptor 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 affect 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* (CH2M, 1999).

Aerial Photo Analysis

The September 1994 study by USEPA Photographic Interpretation Center of aerial photography identified 37 potential waste disposal areas at NSN (USEPA, 1994). 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 direct-push 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 risk assessments (RAs) for the following reasons:

- The data cannot be reproduced as is the case with well data.
- Metals data may not be representative because of 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 SSAs 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 as follows:

- Concentrations of detected chemicals were compared to the following current USEPA screening and regulatory screening criteria for each sample matrix: risk-based concentrations for residential and industrial soil, USEPA tap water risk-based concentrations and maximum contaminant levels for groundwater, and the USEPA Region 3 Biological Technical Assistance Group screening values for surface water and sediment. The solid waste management units (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 contaminant concentrations exceeding the comparison criteria were calculated using the detected concentrations from all samples collected during the Relative Risk Ranking 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.

References

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